## PROJECT MANUAL

#### **DOCUMENTS AND SPECIFICATIONS**

## **Guntersville Park Facility Improvements Phase 2**

#### City of Guntersville, Alabama

Leigh Dollar, Mayor
Sanchez Watkins, Councilman
Larry Wilson, Councilman
John Myers, Councilman
Carson Ray, Councilman
Donald Myers, Councilman
Rich Russell, Councilman
Randy Whitaker, Councilman

Barge NO.: 3710605 DATE: March 2023



# **Guntersville Park Facility Improvements Phase 2**



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Garett Younanian, PE

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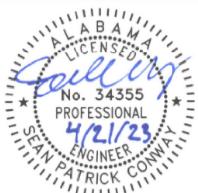
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Kerry Osborne, RA, AIA







Kerry Osborne Nate: 2023.04.21

Professional In Responsible Charge

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DIVISION 23: HEATING, VENTILATING AND AIR CONDITIONING

Daniel Gibbs, PE

No. 35844-E

PROFESSIONAL

Digitally signed by Daniel C Giops Inate 202 004.21

**DIVISION 26: ELECTRICAL** 

Nick Eaton, PE

No. 50120
PROFESSIONAL

WICHOLAS

## GUNTERSVILLE PARK FACILITY IMPROVEMENTS PHASE 2

#### **CITY OF GUNTERSVILLE, ALABAMA**

Sealed Bids for furnishing all materials, labor, tools, equipment and appurtenances necessary for the construction of the **Guntersville Park Facility Improvements - Phase 2** will be received at the City of Guntersville, Conference Room, 2<sup>nd</sup> Floor – City Hall, 341 Gunter Avenue, Guntersville, AL 35976 until 2:00 p.m., local time, on May 18, 2023, and then at said location publicly opened and read aloud.

A Pre-Bid Conference is scheduled for May 4, 2023 at 10:00 AM local time, at the Guntersville Parks and Recreation offices located at 1500 Sunset Drive, Guntersville, AL 35976. Bidder attendance is encouraged but not mandatory.

The work including furnishing all materials, equipment, and labor associated with the construction of two new softball fields, one open air pavilion, one concession/restroom building, splash pad equipment building, new parking, pedestrian walks, sports field lighting, landscaping, irrigation, Riverwalk extension, and a batting cage facility.

The project will be awarded as one contract.

The Instructions to Bidders, Bid, Contract Agreement, Drawings, Specifications and forms of Bid Bond, Performance Bond, Payment Bond and other Contract Documents may be examined at the following:

Guntersville Parks and Recreation Department 1500 Sunset Drive Guntersville, AL 35976 (256) 571-7590 Barge Design Solutions 200 Clinton Avenue, Suite 800 Huntsville, AL 35801 (256) 533-1561

Copies of Bidding Documents may be obtained from the Barge Design Solutions at the above address. Paper copies of the Bidding Documents may be obtained upon payment of a deposit of \$150.00 per set. Electronic (.pdf) copies can be obtained at no cost by contacting Garett Younanian by email at <a href="mailto:Garett.Younanian@bargedesign.com">Garett.Younanian@bargedesign.com</a>. The deposit shall be refunded in full to each prime contractor bidder upon return of the documents in reusable condition within 10 days after bid opening. Additional sets for prime contractor bidders, subcontractors, vendors, or dealers may be obtained upon payment of the same deposit. The deposit shall be refunded less the cost of printing, reproduction, handling, and distribution, upon return of the documents in reusable condition within 10 days after bid opening.

Advertisement for Bid

Each Bid must be accompanied by a Bid Bond, prepared on the forms attached to the Contract Documents or a Surety Company's Standard Bid Bond, duly executed by the Bidder as principal and having as surety thereon a surety company licensed to do business in the State of Alabama and being listed as a certified company in the latest issue of U.S. Treasury Circular 570. The Bid Bond must be in the amount of five percent of the Bid, but in no event more than \$10,000.

No bid may be withdrawn within 60 calendar days after the scheduled time for receipt of bids.

All bidders bidding in amounts exceeding that established by the State Licensing Board for General Contractors must be licensed under the provisions of Title 34, Chapter 8, Code of Alabama, 1975, and must show evidence of license before bidding or bid will not be received or considered by the Owner; the bidder shall show such evidence by clearly displaying its current license number on the outside of the sealed envelope in which the proposal is delivered. If subcontractor(s) are used, they must be in compliance with Alabama Contractor Licensing laws.

The Owner has pre-qualified Sports Field Specialty Subcontractors and Boardwalk Specialty Contractors for this project. The Bidding Documents contains provisions for additional companies to be considered, subject to meeting specified provisions. No proposal will be considered without the identification of a Pre-Qualified Sports Field Specialty Subcontractor and Boardwalk Specialty Subcontractor which will be used on the Project.

The successful Bidder for this Contract will be required to furnish a satisfactory Performance Bond and Payment Bond each in the amount of 100 percent of the Bid.

The Owner reserves the right to reject any or all Bids, to waive informalities and to re-advertise.

City of Guntersville, Alabama Betty Jones City Clerk

#### **ARTICLE 1 – DEFINED TERMS**

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
  - A. *Issuing Office* The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered. The issuing office for this Project is Barge Design Solutions, Inc., 200 Clinton Avenue Suite 800, Huntsville, AL 35801.

#### **ARTICLE 2 – COPIES OF BIDDING DOCUMENTS**

- 2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the advertisement or invitation to bid may be obtained from the Issuing Office, or its designated printing facility, as indicated in the Advertisement for Bids.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

#### **ARTICLE 3 – QUALIFICATIONS OF BIDDERS**

- 3.01 The minimum qualifications of a responsible Bidder include the following requirements:
  - A. The Bidder shall maintain a permanent place of business. This requirement applies to the Bidder where the Bidder is a division of a corporation, or where the Bidder is 50 percent or more owned by a person, corporation or firm.
  - B. The Bidder is licensed by the State Of Alabama to perform the work under this contract.
  - C. The Bidder shall demonstrate adequate construction experience and sufficient equipment resources to properly perform the work under and in conformance with the Contract Documents. This evaluation will be based upon a list of completed or active projects and a list of construction equipment available to the Bidder to perform the work. The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may reasonably request. The Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the Project contemplated therein.
  - D. The Bidder shall demonstrate financial resources of sufficient strength to meet the obligations incident to the performance of the work covered by these Contract

- Documents. The ability to obtain the required Performance and Payment Bonds will not alone demonstrate adequate financial capability.
- E. The Bidder shall demonstrate that he is familiar with the work covered by these Contract Documents.
- 3.02 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with the Bid written evidence such as previous experience, present commitments, and such other data as may be called for below.
  - A. Completion of Statement of Bidder's Qualifications, as included elsewhere in this Project Manual.
  - B. Bidder's Alabama contractor license number and classification.
- 3.03 To demonstrate Bidder's qualifications to perform the Work, within three days of Owner's request, Bidder shall submit written evidence such as financial data and such other data as may be requested by Owner.
- 3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.
- 3.05 A Bidder may be deemed as not responsible if:
  - A. Bidder fails to furnish adequate information for the Owner to determine if the Bidder is deemed to possess adequate construction experience and sufficient equipment resources or fails to provide such information in a timely manner.
  - B. Bidder fails to furnish information, evidence, and statements of the principal owner when the Bidder is owned 50 percent or more by another firm, corporation, or person.
  - C. Bidder is in arrears on any existing contracts, interested in any litigation against the Owner or has defaulted on a previous contract.
  - D. Bidder fails to have access to adequate equipment.
  - E. Bidder has uncompleted work which in the judgment of the Owner will hinder or prevent prompt completion of additional work, if awarded.
- 3.06 Acceptance of the Bidder's documentation and substantiation or Contract Award by the Owner does not relieve the Bidder of liability for non-performance as covered in the Contract Documents, nor will the Bidder be exempted from any other legal recourse the Owner may elect to pursue.

## ARTICLE 4 – EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

- 4.01 Subsurface and Physical Conditions
  - A. The Supplementary Conditions identify:

- 1. Those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site.
- 2. Those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
- B. Copies of reports and drawings referenced in Paragraph 4.01.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.02 of the General Conditions has been identified and established in Paragraph 4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

#### 4.02 Underground Facilities

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

#### 4.03 Hazardous Environmental Condition

- A. The Supplementary Conditions identify any reports and drawings known to Owner relating to a Hazardous Environmental Condition identified at the Site.
- B. Copies of reports and drawings referenced in Paragraph 4.03.A will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.06 of the General Conditions has been identified and established in Paragraph 4.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
- 4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 4.06 of the General Conditions.
- 4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition

- upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.
- 4.06 Reference is made to Article 7 of the Supplementary Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of contract documents (other than portions thereof related to price) for such other work.
- 4.07 It is the responsibility of each Bidder before submitting a Bid to:
  - A. examine and carefully study the Bidding Documents, and the other related data identified in the Bidding Documents;
  - B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
  - C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;
  - D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in Paragraph 4.02 of the Supplementary Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in the Paragraph 4.06 of the Supplementary Conditions as containing reliable "technical data";
  - E. consider the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs;
  - F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;
  - G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
  - H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder; and

- I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.
- 4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

#### ARTICLE 5 - PRE-BID CONFERENCE

5.01 A Pre-Bid Conference will be held if so indicated in the Advertisement for Bids. Oral statements may not be relied upon and will not be binding or legally effective.

#### **ARTICLE 6 – SITE AND OTHER AREAS**

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

#### ARTICLE 7 - INTERPRETATIONS AND ADDENDA

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed, delivered or otherwise issued to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Oral and other interpretations or clarifications will be without legal effect.
- 7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.
- 7.03 Questions and other inquiries shall be submitted to the Issuing office.

#### **ARTICLE 8 – BID SECURITY**

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five percent of Bidder's maximum Bid price but in no event more than \$10,000.00 and in the form of a Bid bond (on the form attached or on a surety company's standard bid bond form) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.

- 8.02 If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within ten days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.
- 8.03 Attorneys-in-Fact of other officers who sign bid bonds for a surety company must file with such bonds a certified copy of his power of attorney authorizing him to sign said bonds.

#### **ARTICLE 9 - CONTRACT TIMES**

9.01 The number of days within which, or the dates by which, the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

#### **ARTICLE 10 – LIQUIDATED DAMAGES**

10.01 Provisions for liquidated damages are set forth in the Agreement.

#### ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents. No substitution requests will be considered.

#### ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS AND OTHERS

- 12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute without an increase in the Bid.
- 12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

#### **ARTICLE 13 - PREPARATION OF BID**

- 13.01 The Bid Form is included with the Bidding Documents.
- 13.02 All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each Bid item and alternate item listed therein. In the case of optional alternatives, the words "No Bid," "No Change," or "Not Applicable" may be entered.
- 13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vicepresident or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown.
- 13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown.
- 13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.
- 13.06 A Bid by an individual shall show the Bidder's name and official address.
- 13.07 A Bid by a joint venture shall be executed by each joint venture in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.
- 13.08 All names shall be printed in ink below the signatures.
- 13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.10 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

#### ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

- 14.01 Lump Sum and Unit Prices
  - A. Bidders shall submit a bid on a lump sum or unit price basis, as indicated on the Bid schedule, for each item of Work listed in the Bid schedule.
  - B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

#### 14.02 Allowances

- A. For cash allowances the various other Bid prices shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 11.02.B of the General Conditions.
- 14.03 The Bid Form is to be completed and submitted with the Bid security along with the documents listed below. The Bidder shall submit one original of all documents in the envelope.
  - A. Bid Bond
  - B. Statement of Bidders Qualifications
  - C. Non-Collusion Affidavit of Prime Bidder
  - D. Alabama Immigration Law Bidders Certificate
  - E. Corporate Certificate
  - F. Contractor's License Certification
- 14.04 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in a sealed envelope which shall also contain the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to the place indicated in the Advertisement for Bids.
- 14.05 Each bid must be submitted in an opaque sealed envelope submittal designated as:

#### Bid for Guntersville Park Facility Improvements Phase II

The BID shall be addressed to:

City of Guntersville, City Clerk 341 Gunter Avenue Guntersville, Alabama 35976

A. The State of Alabama requires evidence of License before the BID is received or considered. The Contractors Name, Address, Alabama Contractors License Number, Expiration Date, and Classification shall be on the BID envelope.

Failure of any Bidder to furnish the required information void such bid and such bid shall not be considered.

#### **ARTICLE 15 – MODIFICATION AND WITHDRAWAL OF BID**

- 15.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.
- 15.02 A bid may be withdrawn after the time period stated in the Advertisement for Bids after the date of the opening of the bids, provided that the Bidder has not been notified within said time period that his bid has been accepted.

#### **ARTICLE 16 – OPENING OF BIDS**

16.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

#### ARTICLE 17 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Advertisement for Bids, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

#### ARTICLE 18 - EVALUATION OF BIDS AND AWARD OF CONTRACT

- 18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.
- 18.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.
- 18.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- 18.04 A bid may be declared by the Owner to be non-responsive for, but not limited to, any of the following reasons:
  - A. Bid contains blanks, Proposal is not complete or required accompanying documents, certifications, and statements are not included.

- B. Bid contains modifications or alterations of the Bid Form or other Contract Documents.
- C. Bid is a qualified or conditional bid.
- D. Bid contains unrealistic data, erroneous data, inaccurate data, or data that cannot be documented or substantiated.
- 18.05 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.
- 18.06 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work in accordance with the Contract Documents.
- 18.07 The Contracts will be awarded to the responsive, responsible Bidders submitting the lowest Bid complying with the conditions of the Contract Documents. Award will be made on the basis of the prices given in the Bid.

#### ARTICLE 19 - CONTRACT SECURITY AND INSURANCE

19.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

#### **ARTICLE 20 – SIGNING OF AGREEMENT**

- 20.01 When Owner or Engineer issues a Notice of Award to the Successful Bidder, the Notice of Award will be accompanied by the required number of unsigned counterparts of the Agreement along with the other Contract Documents, which are identified in the Agreement as attached thereto. Within ten days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within ten days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.
- 20.02 Upon failure of the Bidder to execute the required bonds or to sign the required contract within ten days after the contract is awarded, he will be considered to have abandoned his proposal and the Owner may annul the award. By reason of the uncertainty of market prices of materials and labor, and it being impracticable and extremely difficult to fix the amount of damages to which the Owner would be put by reason of said Bidder's failure to execute said bonds and contract within ten days, the bid security accompanying the proposal shall be the agreed amount of damages which the Owner will suffer by reason

of such failure on the part of the Bidder and shall thereupon immediately be forfeited to the Owner. The filing of a proposal will be considered as an acceptance of this provision.

#### **ARTICLE 21 – DELETED**

#### **ARTICLE 22 - RETAINAGE**

22.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Agreement.

**ARTICLE 23 - DELETED** 

**ARTICLE 24 – DELETED** 

**ARTICLE 25 – DELETED** 

**ARTICLE 26 – DELETED** 

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**END OF SECTION** 

## Supplementary Instructions to Bidders - Sports Field Contractors Minimum Pre-Qualifications

#### 1.1 General

- A. Pre-Qualification of Sports Field Contractors (SFC) will be at the discretion of the Owner based on the information submitted and interviews of owners of previous projects completed by the SFC, financial stability, and equipment available to accomplish the task, experience of labor force and any other pertinent information the Owner requires to determine pre- qualified sports field contractors.
- B. Required scope of work by the SFC on this project shall include grading of subgrade to one-half inch of specified elevations, installation of underground irrigation systems, placement of topsoil in the outfields, soil amendments, finish grading of the sports fields using laser grading technology to one-quarter inch of specified elevations, installation of infield material and sodding of the fields. A pre-qualified SFC must perform this work with their own forces. Irrigation installation can be subcontracted but must be performed under the supervision of the SFC. Placement of topsoil in the outfields can be accomplished by the general or earthwork contractor under the supervision of the SFC to ensure the proper specified depth of topsoil.
- C. The Owner is pre-qualifying SFC's in order to identify the pre-qualified firms in bid documents for the Project. General Contractors bidding on the project must use one of the pre-qualified SFC's listed in the bid documents. Bidders shall identify the SFC they will use in their bid on the Bid Form. Failure to identify a pre-qualified SFC may result in the bid being deemed non-responsive and therefore rejected.

#### 1.2 Pre-Qualified Sports Field Contractors

- A. The following Sports Field Contractors have been deemed pre-qualified for this Project:
  - 1. Carolina Green Corp.,10108 Indian Trail, Fairview Road, Indian Trail, NC, 28079 Contact: Chad Price, cprice@cgcfields.com (866) 753-1707
  - 2. Sports Turf Company, 1487 Black Dirt Road, Whitesburg, GA, 30185 Contact: Todd Wiggins, twiggins@sportsturf.net (770) 832-8691
  - 3. Athletic Fields, Inc., 54 Brown Farm Road SW, Cartersville, GA 30120 Contact: (770) 382-7284
  - Sports Fields, Inc., 3760 Sixes Road, Canton, GA 30114
     Contact: Chris Carnahan, ccarnahan@fields-inc.com (678) 710-8585
  - 5. Sports Turf Solutions, 606 St. Blaise Road, Gallatin, TN 37066
    Contact: Ryan Moriarity, ryan@sportsturfconstruction.com (615) 566-9799
  - 6. Baseline Sports Construction, 3600 Henson Road, Knoxville, TN 37921, Contact: Steve Clift, steve@baselinellc.com (800) 205-9521.
  - 7. Eagle Golf & Athletics, Inc., 2143 Arlington Blvd., Ste 4, Florence, AL 35630 Contact: Bob Chamlee, bchamlee@egaainc.com (256)-765-0050
  - 8. Warner's Athletic Construction Co., 570 Huntley Industrial Blvd., Smyrna, TN 37167 Contact: (615) 459-6993
  - 9. Precision Turf LLC, 3276 Buford Dr., Ste 104 #351, Buford, GA 30519 Contact: Jonathan Holland, jonathan@ptuff.com (770) 921-1925

#### 1.3 Requests for Pre-Qualification

- A. Sports Field Contractors which are not identified above may submit request for consideration as a Pre-Qualified Sports Field Contractor in accordance with the following provisions.
- B. Only SFC's meeting all of the following minimum qualifications will be considered:
  - 1. The SFC shall demonstrate that they have experience with multiple projects similar in scope to this project that have been completed within the last three consecutive years. This project includes two natural turf baseball/softball fields. Said project(s) shall be of similar scope and character with the work to be performed and have been performed by and only by the actual SFC that is submitting their qualifications. Further, prior work performed as a subcontractor involving only part of direct field construction on such previous projects shall not be considered. For example, contractors whose primary experience only involves the installation of sod on athletic fields shall not be considered as SFC's.
  - 2. SFC should have on its staff a Certified Field Builder (CFB) certified by ASBA.
  - 3. The SFC shall provide an on-site construction superintendent having at least three years' experience constructing athletic fields using laser grading systems and with the installation of synthetic turf fields.
  - 4. The SFC must have experience with the installation natural turf baseball/softball fields with imported infield mix. The SFC must have demonstrated and successful experience with the installation of at least 10 natural turf baseball/softball fields over the last three years that included the SFC's scope of work.
  - 5. The SFC must perform all required work with their own staff supervision and employees, using company equipment either owned or leased without the subcontracting of any of the said required work, except the SFC may be allowed to subcontract 1) irrigation, 2) grow-in maintenance (if required), as long as the SFC directly controls and supervises the subcontractor(s).
  - 6. SFC shall have experience with automatically controlled laser guided grading equipment, specifically a dual slope hydraulically actuated soil plane adjustable to 1/100 of a foot. Equipment shall be pulled with a high flotation tractor with a gross weight of less than 15,000 lbs. Equipment must be made available for inspection by the Owner if requested. The contractor shall also use other specialized sports field equipment such as tractors, disc harrows, power rakes, tillers, infield groomers and drags in construction of athletic fields.
  - 7. The SFC must demonstrate the ability to accomplish the work in accordance with the Owner's schedule as evidenced by their current and projected workload and the availability of equipment and resources to accomplish the work.
- C. The Owner may make minor exceptions to the minimum qualifications if deemed in the Owner's best interests to do so.
- D. The following information must be submitted in order to be considered as pre-qualified as an SFC:
  - 1. A completed copy of the attached "Statement of Qualifications".
  - 2. The following information for each of the projects required under Item 1 and 4 in the minimum qualifications set forth above:

Supplemental Instructions to Bidders – Sports Field Contractors Pre-Qualifications

Project Name and Location Project Description Owner's Name Owner's Complete Address

Owner's Telephone Area Code and Number

Owner's Current Contact Person

- 3. A listing of laser technology and equipment plus other specialized sports field construction equipment owned and/or leased.
- 4. Resumes or other evidence of the experience of the principals of the firm and for the project superintendent proposed for this project.
- 5. Any other information concerning the SFC that evidences your ability to meet the minimum qualifications necessary to be qualified for the project.
- E. The decision on whether an SFC is qualified rests solely with the Owner.
- F. Requests for approval of a SFC that is not already pre-qualified must be received by the A/E at the address below a minimum of 15 calendar days prior to the date of receipt of bids in order to be considered. Any request received after this date will not be considered. If an SFC submits qualifications and is deemed prequalified, all prime bidders will be notified of such by Addendum.
- G. Questions may be directed to and submittals may be emailed to:

John Brown Sr Landscape Architect Barge Design Solutions, Inc. john.brown@bargedesign.com Supplementary Instructions to Bidders - Sports Field Contractors Pre-Qualifications

## STATEMENT OF QUALIFICATIONS SPORTS FIELD CONTRACTOR

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information desired to demonstrate their qualifications.

1.	Name of Spo	rts Field Contractor's (	Company:	
2. addr		main office address,	phone and fax, email and (if available) w	veb site
3.	When organi	zed:		
4.	If a Corporati	on, where incorporate	ł:	
5. firm	How many ye or trade name?	ears have you been en	gaged in the contracting business under your	present
6. amo		`	ese, showing the name of the project, the se anticipated dates of completion):	Owner,
7.	Provide the	company's gross reve	nues for sports field construction only for t	the nast
		rmation will remain co		ле разі
	2022	2021	2020	
8.	General desc	cription of work perforn	ed by your company:	

00 21 14 - 5
Supplemental Instructions to Bidders – Sports Field Contractors Pre-Qualifications

9.	Have you ever failed to co	omplete any w	ork awarded to you? If s	so, where and why.
10.	Have you ever defaulted	on a contract?	If so, where and why.	
	dersigned hereby authorization requested in verificat			
Dated	at	this	day of	, 20
Sports	Field Contractor:			
Compa	any Name:			
By (Sig	gnature):			
Printed	Name:			
Title: _				

**END OF DOCUMENT** 

#### **GUNTERSVILLE PARK FACILITY IMPROVEMENTS PHASE 2**

Δ	RT	ICI	F 1	- RID	RECIP	IFNT
_		IVL		_ 010	NLGIE	

1.01 This Bid is submitted to:

City of Guntersville 341 Gunter Avenue Guntersville, AL 35976

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

#### ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for period of time after the Bid opening as stated in the Advertisement for Bids, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

#### **ARTICLE 3 – BIDDER'S REPRESENTATIONS**

- 3.01 In submitting this Bid, Bidder represents that:
  - A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

Addendum No.	Addendum Date

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

- C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.
- D. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs.
- E. Based on the information and observations referred to in Paragraph 3.01.D above, Bidder does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- F. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- G. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.
- H. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- I. Where this Bid Form contains the provision for a bid based on a lump sum price, the Bidder shall be responsible for having prepared its own estimate of the quantities necessary for the satisfactory completion of the Work specified in these Contract Documents and for having based the lump sum price bid on its estimate of quantities.

#### ARTICLE 4 - BIDDER'S CERTIFICATION

#### 4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
  - "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
  - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
  - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
  - 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

#### **ARTICLE 5 – BASIS OF BID**

#### 5.01 LUMP SUM BID

The Bidder agrees to furnish all plant, labor, materials, equipment, and incidentals necessary for the construction, testing, and placing into operation of the Guntersville Park Facility Improvements Phase II, all in accordance with the drawings and specifications, for the lump sum amount shown below:

TOTAL AMOUNT OF BID \$	(Figures)
(Words)	

The above lump sum price shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for.

#### **ARTICLE 6 – TIME OF COMPLETION**

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

#### ARTICLE 7 - ATTACHMENTS TO THIS BID

- 7.01 The following documents are to be submitted with bid form and are a condition of this Bid:
  - A. Bid Bond
  - B. Statement of Bidders Qualifications
  - C. Non-Collusion Affidavit of Prime Bidder
  - D. Alabama Immigration Law Bidders Certificate
  - E. Corporate Certificate
  - F. Contractor License Certificate

#### **ARTICLE 8 – DEFINED TERMS**

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

#### **ARTICLE 9 – BID DATA**

9.01 The Bidder shall designate below the one pre-qualified Sports Field Contractor to perform the specialty work if awarded the work with the understanding that no changes or substitutions will be considered for this contract unless directed by the Owner. The Bidder understands that if this information is not provided, then the Owner reserves the right to determine the Bidder non-responsive and reject the Bid.

Sports Field Contractor:

#### **ARTICLE 10 – BID SUBMITTAL**

10.01 This Bid submitted by: An Individual Name (typed or printed): (SEAL) (Individual's signature) Doing business as: Attest: (Notary) Name (typed or printed): A Partnership Partnership Name: (SEAL) (Signature of general partner – attach evidence of authority to sign) Name (typed or printed): Attest: \_\_ (Signature of another Partner) Name (typed or printed): A Corporation Corporation Name: (SEAL) State of Incorporation: Type (General Business, Professional, Service, Limited Liability): By: (Signature) Name (typed or printed): (CORPORATE SEAL) (Signature of Corporate Secretary)

Name (typed or printed):

Λ .	1 - : - 4	\ / 4.	
$A \cup$	IOINT	Ventu	ıre

	Name of Joint Venturer:	_
	First Joint Venturer Name:	_ (SEAL)
	Ву:	_
	(Signature of first joint venture partner)	
	Name (typed or printed):	_
	Title:	_
	Second Joint Venturer Name:	_ (SEAL)
	By: (Signature of second joint venture partner)	_
	Name (typed or printed):	_
	Title:	_
	(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)	
All Bio	dders shall complete the following:	
	Bidder's Business address:	_
		_
	Phone:Facsimile:	
	Primary Contact:	
	Primary Contact E-mail:	
	Submitted on, 20	
	State Contractor License No	
	Current bid limit and type of work	

Bid Form

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**END OF SECTION** 

BIDDER	(Name and Address):		
SURETY	(Name, and Address of Principal Place of Busi	ness):	
OWNER	R (Name and Address):		
	Due Date: scription ( <i>Project Name— Include Location</i> ):		
BOND			
Dat			¢
Dat Per Surety a this Bid	te:  nal sum (Words)  and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of		nt, or representative.
Dat Per Surety a this Bid <b>BIDDER</b>	te:  nal sum (Words)  and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of	ficer, age SURETY	(Figures) ct to the terms set forth below, do each cause nt, or representative.
Dat Per Surety a this Bid <b>BIDDER</b> Bidder's	te:  nal sum (Words)  and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of (Seal)	ficer, age SURETY	(Figures) ct to the terms set forth below, do each cause nt, or representative. (Seal)
Dat Per Surety a this Bid BIDDER	te:  nal sum (Words)  and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of (Seal)	SURETY Surety's	(Figures) ct to the terms set forth below, do each cause nt, or representative. (Seal)
Dat Per Surety a this Bid <b>BIDDER</b> Bidder's	te: nal sum (Words) and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of  (Seal) S Name and Corporate Seal	SURETY Surety's	(Figures) ct to the terms set forth below, do each cause nt, or representative (Seal) s Name and Corporate Seal
Dat Per Surety a this Bid <b>BIDDER</b> Bidder's	te: nal sum (Words) and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of (Seal) S Name and Corporate Seal Signature	SURETY Surety's	(Figures) ct to the terms set forth below, do each cause nt, or representative.  (Seal) S Name and Corporate Seal  Signature (Attach Power of Attorney)
Dat Per Surety a this Bid <b>BIDDER</b> Bidder's	te: nal sum (Words) and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of (Seal) s Name and Corporate Seal  Signature  Print Name	Surety's By:	(Figures) ct to the terms set forth below, do each cause nt, or representative.
Dat Per Surety a this Bid <b>BIDDER</b> Bidder's	te: nal sum (Words) and Bidder, intending to be legally bound here Bond to be duly executed by an authorized of (Seal) s Name and Corporate Seal  Signature  Print Name	SURETY Surety's	(Figures) ct to the terms set forth below, do each cause nt, or representative.

Note: Addresses are to be used for giving any required notice.

Provide execution by any additional parties, such as joint venturers, if necessary.

- 1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
- 2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
- 3. This obligation shall be null and void if:
  - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
  - 3.2 All Bids are rejected by Owner, or
  - Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
- 4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
- 5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
- 6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
- 7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
- 8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
- 9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
- 10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this

Bid Bond

Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

## Statement of Bidder's Qualifications

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information desired. Attach all additional sheets to this statement. (Sample "Project Information Form" contained at the end of this Section.)

1.	Name of Bidder:		
2.	Permanent main office address and p	phone number:	
3.	When organized:		
4.	If a Corporation, where incorporated:	:	
5.	How many years have you been engaged in the contracting business under your present firm or trade name?		
6.	Contracts on hand. (Complete a "Pro	oject Information Form", for each Co	ontract on hand.)
7.	General description of type of work p	erformed by your company:	
8.	Have you ever failed to complete any	y work awarded to you? If so, where	e and why?
9.	Have you ever defaulted on a contract	ct? If so, where and why?	
10.	Attach a list of the most important p similar in scope to this Project. (C listed.)		
11.	Names, background and experience officers:	of the principal members of your o	organization, including
	Name	Position	Years Experience

00 45 13 - 2 Statement of Bidder's Qualifications

Owner in verification of the recitals comprising this
am of the Bidder, and that statements contained therein are true and correct.
(name signed)
(name printed or typed)
f, 20
(name signed)
(name printed or typed)
(Date) (SEAL)

# 00 45 13 - 3 Statement of Bidder's Qualifications

# Project Information Form

Proje	ct Title:
Proje	ct Description:
Majo	Subcontractors:
Majo	Suppliers:
Proje	ct Owner:
-	Owner Name:
-	Contact Person:
-	Phone Number:
Engi	eer/Construction Manager:
_	Company Name:
_	Contact Person:
-	Phone Number:
Cont	act Amount:
_	Initial:
-	Final:
Cont	act Time
-	Initial:
-	Final:
_	Completion Date:

**END OF SECTION** 

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All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information desired. Bidder should have completed construction of a minimum of three (3) projects of similar size and scope within the past five (5) years and submit reference contacts on the enclosed form. The boardwalk/bridge contractor must have completed at least three (3) top down construction projects of similar size and scope with the past three (3) years. Documented top down construction experience is required for bid consideration. Contractor bids without documented top down construction experience will not be considered. The Contractor will identify on the Reference Form, by name, the Superintendent for each project. The Superintendent assigned to this project should have directed at least one of the three references.

1.	Name of Boardwalk Contractor's Company:		
2.	Permanent main office address, phone and fax, email and (if available) web site address:		
3.	When organized:		
4.	If a Corporation, where incorporated:		
5.	How many years have you been engaged in the contracting business under your present firm or trade name?		
6.	. Contracts on hand: (Schedule these, showing amount of each contract and the appropriate anticipated dates of completion):		
7.	. General description of work performed by your company:		
8.	. Have you ever failed to complete any work awarded to you? If so, where and why.		
9.	Have you ever defaulted on a contract? If so, where and why.		
10.	The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested in verification of the recitals comprising this Statement of Qualifications – SFC.		
Da	ted at, 20		
Во	ardwalk Contractor:		

## Statement of Qualificatoins – Sports field Contractor

Company Name:		
By (Signature):		
by (olgilatare)		
Printed Name:	 	
Title:		

**END OF DOCUMENT** 

# Non-Collusion Affidavit of Prime Bidder

STATE OF	COUNTY OF
I,, being first du	uly sworn, deposes and says that:
He or she is	
Owner, Partner, Officer, F	Representative or Agent) _, the Bidder that has submitted the attached Bid;
He or she is fully informed respecting the pertinent circumstances respecting such Bio	preparation and contents of the attached Bid and of all ;
Such Bid is genuine and is not a collusive or	sham Bid;
employees or parties in interest, includin connived or agreed, directly or indirectly wit or sham Bid in connection with the Contract refrain from bidding in connection with such sought by agreement or collusion or community person to fix the price or prices in the attact profit or cost element of the Bid price or the collusion, conspiracy, connivance or un Guntersville or any person interested in the	
·	d Bid are fair and proper and are not tainted by any ful agreement on the part of the Bidder or any of its s, or parties in interest, including this Affiant.
BIDDER:	
By:	
	(name signed)
Title:	(name printed or typed)
Subscribed and sworn to me this day of	, 20
NOTART OBLIC.	(name signed)
	(name printed or typed)
Commission Expires:	
	O OF SECTION (SEAL)

	360001 00 <del>4</del> 3 33
	Alabama Immigration Law Certifications
STATE OF	COUNTY OF
This contract and the Bidder/Contractor are Alabama 1975, including its provisions relate	subject to the provisions of Section 31-13-9, Code of ed to subcontractors.
The award of the contract is conditioned employment or continue to employ an unaut	d on the Contractor not knowingly employ, hire for horized alien within the State of Alabama.
Bidder is enrolled in the E-Verify program. So A copy of the Memorandum of Understand	he Bidder providing documentation establishing that the uch documentation shall be attached to this Certification. ding (MOU) entered into between the Bidder and the E-Verify system will suffice as sufficient documentation
	Contractor shall participate in the E-Verify program and to be verified according to the applicable federal rules
will not violate federal immigration law or lemploy an unauthorized alien within the Stat	ties affirm, for the duration of the agreement, that they knowingly employ, hire for employment or continue to e of Alabama. Furthermore, a contracting party found to ned in breach of the agreement and shall be responsible
BIDDER:	
	(name signed)
Title:	(name printed or typed)
Subscribed and sworn to me this day o	f, 20
NOTART PUBLIC:	(name signed)
	(name printed or typed)

**END OF SECTION** 

Commission Expires:

04/21/2023 37106-05

(SEAL)

# Contractor's License Certification

Bidder/Contractor's Name:	
Alabama Contractor's License Number:	
Alabama Contractor's License Classification	::
Alabama Contractor's License Bid Limit:	
Expiration Date of License:	
I certify that the above information is true ar to the Bid for this Project.	nd correct and that the classification noted is applicable
BIDDER:	
Ву:	
	(name signed)
	(name printed or typed)
Title:	
Date:	

**END OF SECTION** 

Agreement

THIS AGREEMENT is by and between City of Guntersville, Alabama ("Owner") and ("Contractor")

Owner and Contractor agree as follows:

#### **ARTICLE 1 – WORK**

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Guntersville Park Facility Improvements Phase II

#### **ARTICLE 2 – THE PROJECT**

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

Guntersville Park Facility Improvements Phase II

#### **ARTICLE 3 – ENGINEER**

3.01 The Project has been designed by Barge Design Solutions, Inc. (Engineer), which is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

#### **ARTICLE 4 – CONTRACT TIMES**

- 4.01 Time of the Essence
  - A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.
- 4.02 Days to Achieve Substantial Completion and Final Payment
  - A. The Work will be substantially completed within 300 consecutive calendar days after the date when the Contract Times commence to run as provided in Paragraph 2.03 of the General Conditions and completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within 330 consecutive calendar days after the date when the Contract Times commence to run.
- 4.03 Liquidated Damages
  - A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding

the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner \$500.00 for each day that expires after the time specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner \$500.00 for each day that expires after the time specified in Paragraph 4.02 above for completion and readiness for final payment until the Work is completed and ready for final payment.

#### **ARTICLE 5 - CONTRACT PRICE**

- 5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A below:
  - A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

#### ARTICLE 6 – PAYMENT PROCEDURES

- 6.01 Submittal and Processing of Payments
  - A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.
- 6.02 Progress Payments; Retainage
  - A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 25<sup>th</sup> day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.
    - 1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions.
      - a. 95 percent of Work completed (with the balance being retainage).; and
      - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
      - c. If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain

satisfactory to Owner and Engineer, there will be no additional retainage.

#### 6.03 Final Payment

A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07.

#### **ARTICLE 7 – INTEREST**

7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate of one half percent per annum.

#### **ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS**

- 8.01 In order to induce Owner to enter into this Agreement, Contractor makes the following representations:
  - A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
  - B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
  - C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
  - D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified in Paragraph SC-4.02 of the Supplementary Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph SC-4.06 of the Supplementary Conditions as containing reliable "technical data."
  - E. Contractor has considered the information known to Contractor; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) Contractor's safety precautions and programs.
  - F. Based on the information and observations referred to in Paragraph 8.01.E above, Contractor does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract

Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

#### **ARTICLE 9 – CONTRACT DOCUMENTS**

#### 9.01 Contents

- A. The Contract Documents consist of the following:
  - 1. This Agreement
  - 2. Performance bond
  - 3. Payment bond
  - 4. General Conditions
  - 5. Supplementary Conditions
  - 6. Specifications as listed in the table of contents of the Project Manual.
  - 7. Drawings as listed on the Drawing Index, with each sheet bearing the following general title: Guntersville Park Facility Improvements Phase II
  - 8. Addenda (numbers \_\_\_\_\_ to \_\_\_\_, inclusive), incorporated herein.
  - 9. Exhibits to this Agreement (enumerated as follows):
    - a. Contractor's Bid as shown in Section 00 41 00 of this Project Manual.
  - 10. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    - a. Notice to Proceed.
    - b. Work Change Directives.
    - c. Change Orders.
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

#### **ARTICLE 10 - MISCELLANEOUS**

#### 10.01 Terms

A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

### 10.02 Assignment of Contract

A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

### 10.03 Successors and Assigns

A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

#### 10.04 Severability

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

### 10.05 Contractor's Certifications

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:
  - "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
  - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of

Aareement

- Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
- 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
- 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

	tractor have signed this Agreement. Counterparts or. All portions of the Contract Documents have been Contractor or on their behalf.
This Agreement will be effective on day Effective Date of the Agreement).	of, 20, (which is the
OWNER: City of Guntersville, Alabama	CONTRACTOR
By:	By:
Title:	Title:  (If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest:	Attest:
Title:	Title:
Address for giving notices:	Address for giving notices:

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> American Council of Engineering Companies 1015 15th Street N.W., Washington, DC 20005 (202) 347-7474 www.acec.org

American Society of Civil Engineers 1801 Alexander Bell Drive, Reston, VA 20191-4400 (800) 548-2723 www.asce.org

Associated General Contractors of America 2300 Wilson Boulevard, Suite 400, Arlington, VA 22201-3308 (703) 548-3118 www.agc.org

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CONTRACTOR (name and address):	SURETY (name and address of principal business):	place of
OWNER (name and address): City of Guntersville 341 Gunter Avenue Guntersville, Alabama 35976		
CONSTRUCTION CONTRACT  Effective Date of the Agreement:  Amount:  Description: Guntersville Park Facility Improver		
BOND Bond Number: Date (not earlier than the Effective Date of the Agreeme Amount:	ent of the Construction Contract):	
Surety and Contractor, intending to be legally boul cause this Performance Bond to be duly executed CONTRACTOR AS PRINCIPAL		
(seal) Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal	(seal)
By:	By:	
Signature	Signature (attach power of attorney)	
Print Name	Print Name	
Title	Title	
Attest: Signature	Attest:Signature	
Title	Title	
Notes: (1) Provide supplemental execution by a		

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- 1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
- 2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond.
- 3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after Owner terminates for cause in accordance with General Conditions Paragraph 15.02.
- 4. Failure on the part of the Owner to comply with the notice requirement in General Conditions Paragraph 15.02 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
- 5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take the following action:
  - 5.1 Waive its right to perform and complete, to arrange for completion, or to obtain a new contractor, and with reasonable promptness under the circumstances:
    - 5.1.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
    - 5.1.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
- 6. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
  - 6.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract:
  - 6.2 additional legal, design professional, and delay costs resulting from the Contractor's Default; and
  - 6.3 liquidated damages caused by delayed performance or non-performance of the Contractor.
- 7. The Surety's liability is limited to the amount of this Bond.
- 8. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

- 9. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
- 10. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.
- 11. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.
- 12. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

#### 13. Definitions

- 13.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
- 13.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
- 13.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
- 13.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 13.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

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American Society of Civil Engineers 1801 Alexander Bell Drive, Reston, VA 20191-4400 (800) 548-2723 www.asce.org

Associated General Contractors of America 2300 Wilson Boulevard, Suite 400, Arlington, VA 22201-3308 (703) 548-3118 www.agc.org

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CONTRACTOR (name and address):	SURETY (name and address of principal place of		
	business):		
OWNER (name and address):			
City of Guntersville 341 Gunter Avenue Guntersville, Alabama 35976			
CONSTRUCTION CONTRACT  Effective Date of the Agreement:  Amount:  Description (name and location):  Gunters	sville Park Facility Improvements Phase II		
BOND  Bond Number:  Date (not earlier than the Effective Date of the Agreement of the Construction Contract):  Amount:			
	y bound hereby, subject to the terms set forth below, do secuted by an authorized officer, agent, or representative.  SURETY		
(e	(502)		
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal		
Ву:	By:		
Signature	Signature (attach power of attorney)		
Print Name	Print Name		
Title	Title		
Attest:	Attest:		
Signature	Signature		
Title	Title		
	by any additional parties, such as joint venturers. (2) Any Owner, or other party shall be considered plural where		

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- The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
- 2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
- 3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
- 4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
- 5. The Surety's obligations to a Claimant under this Bond shall arise after the following:
  - 5.1 Claimants who do not have a direct contract with the Contractor,
    - 5.1.1 have furnished a written notice of nonpayment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
    - 5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).
  - 5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

- If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
- 7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
  - 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
  - 7.2 Pay or arrange for payment of any undisputed amounts.
  - 7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
- 8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.
- 9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
- 10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

- 11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
- 12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
- 13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.
- 14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
- 15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

#### 16. **Definitions**

- 16.1 **Claim:** A written statement by the Claimant including at a minimum:
  - 1. The name of the Claimant;
  - The name of the person for whom the labor was done, or materials or equipment furnished:
  - A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
  - A brief description of the labor, materials, or equipment furnished;
  - The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

- 6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
- 7. The total amount of previous payments received by the Claimant; and
- 8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
- 16.2 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor. materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
- 16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
- 16.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 16.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.
- 17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

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# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

#### **ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE**

and

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#### **ARTICLE 1 – DEFINITIONS AND TERMINOLOGY**

#### 1.01 Defined Terms

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
  - 1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
  - 2. Agreement—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
  - Application for Payment—The form acceptable to Engineer which is to be used by Contractor
    during the course of the Work in requesting progress or final payments and which is to be
    accompanied by such supporting documentation as is required by the Contract Documents.
  - 4. Asbestos—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
  - 5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
  - 6. *Bidder*—The individual or entity who submits a Bid directly to Owner.
  - 7. Bidding Documents—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
  - 8. Bidding Requirements—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
  - Change Order—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
  - 10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
  - 11. Contract—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
  - 12. Contract Documents—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

General Conditions

- 13. Contract Price—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
- 14. Contract Times—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
- 15. Contractor—The individual or entity with whom Owner has entered into the Agreement.
- 16. Cost of the Work—See Paragraph 11.01 for definition.
- 16.1 Designer The individual or entity named as such in the Agreement, if a different person or entity from Engineer.
- 17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined. The term Drawings shall be considered synonymous with the term Plans.
- 18. Effective Date of the Agreement—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
- 19. Engineer—The individual or entity named as such in the Agreement.
- 20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
- 21. General Requirements—Sections of Division 01 of the Specifications. The General Requirements are applicable to all Sections of the Specifications and to the entire Work.
- 22. Hazardous Environmental Condition—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
- 23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
- 24. Laws and Regulations; Laws or Regulations—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
- 25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
- 25.1 Liquidated Damages amounts shall be as stipulated in the Agreement. Liquidated damages shall apply to the Contract Times for the Project. Liquidated Damages shall be both additive and cumulative. Liquidated Damages shall end upon Substantial Completion, Completion of the Work associated with each Milestone Date, and upon final completion of

**General Conditions** 

the Work. Liquidated damages are not a penalty, but constitute liquidated damages for loss to the Owner because of increases in expenses for administration, legal counsel, accounting, engineering, construction supervision, inspection, and any other expenses incurred directly as a result of the delay of the Contractor in completing the work. This provision for liquidated damages shall be effective between the parties ipso facto without necessity for demand or putting in default by any notice or other means than by the terms of these Contract Documents, the Contractor hereby waiving any such other notice of default and acknowledging that the Contractor shall be deemed to be in default by the mere act of his failure to complete the work within the Contract Time, or within any valid extension of such time hereunder.

- 26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
- 27. Notice of Award—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
- 28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
- 29. Owner—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed. The Owner may designate an authorized representative to exercise the authority, in whole or in part, identified in these contract Documents, with such designation being identified in the Supplementary Conditions.
- 30. *PCBs*—Polychlorinated biphenyls.
- 31. Petroleum—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
- 32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
- 33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
- 34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in its table(s) of contents.
- 35. Radioactive Material—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
- 36. Resident Project Representative—The authorized representative of Engineer who may be assigned to the Site or any part thereof.

General Conditions

- 37. Samples—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
- 38. Schedule of Submittals—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
- 39. Schedule of Values—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
- 40. Shop Drawings—All drawings, diagrams, illustrations, brochures, schedules, specified design related submittals, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work that will be fabricated or installed. Shop drawings may also mean detail drawings, working drawings, construction drawings, and engineering data.
- 41. Site—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
- 42. Specifications—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
- 43. Subcontractor—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
- 44. Substantial Completion—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents to provide the following: (i) the Owner full time, uninterrupted, continuous operation of the work; and (ii) all required functional, performance, and operational or startup testing has been successfully demonstrated for all components, devices, equipment, and systems to the satisfaction of the Engineer in accordance with the requirements of the Specifications; and (iii) all required inspections and other work necessary for the Engineer to certify "substantially complete" have been completed. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
- 44.1 Submittals All administrative documents, Shop Drawings, Samples, product data, manufacturer's literature, quality control documents, design related documents, record documents, contract close-out documents, and/or any other specified document prepared or assembled by or for Contractor and submitted by Contractor to the Owner and/or Engineer.
- 45. Successful Bidder—The Bidder submitting a responsive Bid to whom Owner makes an award.
- 46. Supplementary Conditions—That part of the Contract Documents which amends or supplements these General Conditions.

- 47. Supplier—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
- 48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
- 49. *Unit Price Work*—Work to be paid for on the basis of unit prices.
- 50. Work—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, materials, tools, equipment, incidentals, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
- 51. Work Change Directive—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

## 1.02 Terminology

- A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. Intent of Certain Terms or Adjectives:
  - 1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.
  - 2. Where the word "similar" occurs in the Contract Document, it shall have a general meaning and not be interpreted as being identical, and all details shall be worked out in relation to their location and their connection with other parts of the Work.

# C. Day:

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

#### D. Defective:

- 1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:
  - a. does not conform to the Contract Documents; or
  - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
  - c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

## E. Furnish, Install, Perform, Provide:

- 1, The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
- 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
- 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
- 4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

## **ARTICLE 2 - PRELIMINARY MATTERS**

# 2.01 Delivery of Bonds and Evidence of Insurance

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. Evidence of Insurance: Before any Work at the Site is started, Contractor shall deliver to the Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which Owner or any additional insured

may reasonably request) which Contractor is required to purchase and maintain in accordance with Article 5.

## 2.02 Copies of Documents

A. Owner will furnish to Contractor up to four printed or hard copies of the Contract Documents and one counterpart of the executed Contract Agreement. Additional copies will be furnished upon request at the cost of reproduction.

#### 2.03 Commencement of Contract Times: Notice to Proceed

A. Contract Times will commence to run on the date established in the Notice to Proceed. A Notice to Proceed may be given at any time within 60 days after the Effective Date of the Agreement.

# 2.04 Starting the Work

A. Contractor may start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

# 2.05 Before Starting Construction

- A. *Preliminary Schedules:* Within 10 days after the Commencement of the Contract Time (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
  - a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
  - 2. a preliminary Schedule of Submittals which indicates each required Submittal and the dates for submitting, time for reviewing and processing each Submittal (periodic Submittals may be listed by a common monthly date); and
- 3. a preliminary Schedule of Values for all of the Work in a format acceptable to the Engineer and in accordance with the requirements specified in the General Requirements. 2.06 *Preconstruction Conference; Designation of Authorized Representatives* 
  - A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.
  - B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

#### 2.07 Initial Acceptance of Schedules

- A. Not more than ten days after the preconstruction conference, a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
  - 1. The Progress Schedule will be acceptable to Engineer as being the Contractor's schedule for the orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor. The Progress Schedule may subsequently be adjusted in accordance with Paragraph 6.04 and applicable provisions of the General Requirements.
  - Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals. The Schedule of Submittals may subsequently be adjusted in accordance with Paragraph 6.04 and applicable provisions of the General Requirements.
  - 3. Contractor's Schedule of Values will be acceptable to the Engineer as to form and substance if it is provided in accordance with the General Requirements..

# ARTICLE 3 - CONTRACT DOCUMENTS; INTENT, AMENDING, REUSE

#### 3.01 Intent

- A. The individual components of the Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.
- D. Each and every clause or other provision required by law to be inserted in these Contract Documents shall be deemed to be inserted herein, and they shall be read and enforced as though it were included herein, and if through mistake or otherwise, any such provision is not inserted, or if not correctly inserted, then upon the application of either party, the Contract Documents shall forthwith be amended to make such insertion.
- E. "Imperative" or "Command" type language is used in the Contract Documents. This command language refers to and is directed to the Contractor.
- F. Emphasis, such as italics, underlining, bold text or quotes, may have been used throughout the Contract Documents. Use of emphasis shall not change the meaning of the term emphasized.

## 3.02 Reference Standards

# A. Standards, Specifications, Codes, Laws, and Regulations

- Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
- 2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.
- 3. All sections of governing standard specifications relating to measurement and payment shall not apply to the work specified herein.

## 3.03 Reporting and Resolving Discrepancies

## A. Reporting Discrepancies:

- 1. Contractor's Review of Contract Documents Before Starting Work: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
- 2. Contractor's Review of Contract Documents During Performance of Work: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
- 3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge or reasonably should have known thereof.

## B. Resolving Discrepancies:

 Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

- a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).
- 2. In resolving inconsistencies within the Contract Documents, precedence shall be given in the following descending order:
  - a. Change Orders, with latest Change Order taking precedent over preceding Change Orders
  - b. Work Change Directives
  - c. Field Orders
  - d. Engineer's written interpretations and clarifications
  - e. Notice to Proceed
  - f. Addenda
  - g. Contract Agreement
  - h. Supplementary Conditions
  - i. General Conditions
  - Specifications
  - k. Drawings
    - 1. Schedules on Drawings
    - 2. Notes on Drawings
    - 3. Details on Drawings
    - 4. Large Scale Drawings
    - 5. Small Scale Drawings
    - 6. Dimensions given as Figures
    - 7. Scaled Dimensions
  - I. Bidding Requirements
- 3.04 Amending and Supplementing Contract Documents

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:
  - 1. A Field Order; or
  - 2. Engineer's written interpretation or clarification.

## 3.05 Reuse of Documents

- A. Contractor and any Subcontractor or Supplier shall not:
  - have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or
  - reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

#### 3.06 Electronic Data

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

## 3.07 Contract Times

- A. All Contract Times and time limits stated in the Contract Documents are of the essence of the Agreement.
- B. The Contractor shall proceed with the Work at a rate of progress which will ensure completion within the Contract Times.
- C. It is expressly understood and agreed by and between the Contractor and the Owner, that the Contract Times for the Work described herein are reasonable time, taking into consideration the average climatic and economic conditions, and other factors prevailing in the locality of the Work.
- D. If the Contractor shall fail to perform the Work required within the Contract Times, or extended Contract Times if authorized by Change Order, then the Contractor shall pay to the Owner the full amount of liquidated damages specified in the Contract Documents for each calendar day that the Contractor shall be in default after the Contract Times stipulated in the Contract Documents.

# ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

# 4.01 Availability of Lands

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

#### 4.02 Subsurface and Physical Conditions

- A. Reports and Drawings: The Supplementary Conditions identify:
  - 1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that have been utilized by the Engineer in preparing the Contract Documents; and
  - those drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities that have been utilized by the Engineer in preparing the Contract Documents).
- B. Limited Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary

Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

- the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
- other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
- 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

# 4.03 Differing Subsurface or Physical Conditions

- A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:
  - 1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
  - 2. is of such a nature as to require a change in the Contract Documents; or
  - 3. differs materially from that shown or indicated in the Contract Documents; or
  - is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

- B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.
- C. Possible Price and Times Adjustments:
  - The Contract Price or the Contract Times, or both, may be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
    - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

- b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
- 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
  - a. Contractor knew or should have known of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
  - the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or
  - c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
- 3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

## 4.04 Underground Facilities

- A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
  - 1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
  - the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
    - a. reviewing and checking all such information and data;
    - b. locating all Underground Facilities shown or indicated in the Contract Documents;
    - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
    - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.
- B. Not Shown or Indicated:

- 1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- 2. If Engineer concludes that a change in the Contract Documents is required, a Field Order, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment may be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.
- D. The dimensions and descriptions given on the Drawings for adjacent work by others, if any, (including any existing facilities or utilities previously constructed for Owner) are based on the design drawings and not as-built drawings. Prior to commencing the Work, the Contractor shall verify all as-built conditions and information whenever existing facilities or utilities may impact the Work. Failure of Contractor to so verify all as-built conditions prior to commencing the Work shall bar Contractor from later seeking additional compensation for conflicts with existing facilities or utilities.
- E. Prior to the construction or installation of any proposed facility or pipeline, the Contractor shall expose all existing utilities true to their vertical and horizontal location, within the vicinity of the Work. In order to avoid conflicts between existing and proposed facilities or utilities, the Contractor shall either relocate the existing or proposed utility on a temporary or permanent basis, or shall take whatever means necessary to protect the existing facilities or utilities during the installation of proposed utilities, as approved by the Engineer. No additional payment will be made for the relocation of existing utilities or for any work associated with the protection of existing facilities or utilities.4.05 Reference Points
  - A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.
  - B. Engineer may check the lines, elevations, and reference marks set by Contractor, and Contractor shall correct any errors disclosed by such check. Such a check shall not be considered as approval of Contractor's work and shall not relieve Contractor of the responsibility for accurate

construction of the entire Work. Contractor shall furnish personnel to assist Engineer in checking lines and grades.

- C. The Contractor shall review the Contract Documents and the Project site to determine the presence and location of any property or rights-of-way monuments or markers, and to assess the possibility of disruption to these monuments or markers. It will be the Contractor's responsibility to flag, erect guard post, or provide offset references for the protection or the re-monumentation of these property or rights-of-way monuments or markers. In the event these monuments or markers are covered over or disturbed, it will be the Contractor's responsibility to employ a surveyor licensed in the state of that the Project is located to re-establish those monuments or markers of property or rights-of-way, which were present prior to Work on the Project.
- D. It shall be the Contractor's responsibility to verify all reference points shown on the Contract Documents prior to beginning Work on the site. This verification shall be conducted by professionally qualified personnel in a manner which will verify the accuracy of the information shown in the Contract Documents. On projects which involve the connection to, or additions to existing structures, the elevations of these existing structures shall also be verified. Any findings which differ from those shown on the Contract Documents shall be submitted in writing to the Engineer for resolution.
- E. Additional surveys necessary for the construction staking shall be performed by the Contractor, the cost of which shall be incorporated into the appropriate items of Work. On projects in which payment is classified by depth of cut, the construction staking shall be performed in a manner that will allow for the determination of cut classification.

#### 4.06 Hazardous Environmental Condition at Site

- A. Reports and Drawings: The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. Limited Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
  - the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
  - 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
  - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified

in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.
- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may issue a Work Change Directive or Change Order as appropriate regarding said condition. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution

costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

#### ARTICLE 5 - BONDS AND INSURANCE

## 5.01 Performance, Payment, and Other Bonds

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment is made by the Owner or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

#### 5.02 Licensed Sureties and Insurers

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as provided below:
  - 1. Surety shall be in good standing with the agency having jurisdiction over sureties and insurance companies for the state in which the Project is located.
  - 2. Surety and Insurers must have an A.M. Best Financial Strength Rating of A or higher, with a Financial Size Category of X or higher.

- 3. The surety shall have an underwriting limitation in Circular 570 in excess of the Contract Amount.
- 4. No surety will be accepted who is now in default or delinquent on any bond.

#### 5.03 Certificates of Insurance

- A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
- B. Deleted.
- C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

#### 5.04 Contractor's Insurance

- A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
  - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
  - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
  - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
  - claims for damages insured by available personal injury liability coverage which are sustained:
    - a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
    - b. by any other person for any other reason;

- 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
- 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:
  - with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
  - include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
  - 3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
  - 4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
  - remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
  - 6. include completed operations coverage:
    - a. Such insurance shall remain in effect for two years after final payment.
    - b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

## 5.05 Owner's Liability Insurance

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

## 5.06 Property Insurance

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof. This insurance shall:
  - include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;
  - 2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
  - 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
  - cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
  - 5. allow for partial utilization of the Work by Owner;
  - 6. include testing and startup; and
  - be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

## 5.07 Waiver of Rights

A. Owner and Contractor intend that all policies purchased in accordance with Paragraphs 5.04 and 5.06 by Contractor will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. None of the above waivers shall

extend to the rights that any party making such waiver may have to the proceeds of insurance held by Contractor as trustee or otherwise payable under any policy so issued.

# 5.08 Receipt and Application of Insurance Proceeds

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner shall adjust and settle the loss with the insurers.

#### 5.09 Acceptance of Bonds and Insurance; Option to Replace

A. If Owner has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by Contractor in accordance with this Article 5 on the basis of its not complying with the Contract Documents, Owner will notify Contractor in writing thereof within 10 days of the date of delivery of such certificate to Owner in accordance with Paragraph 2.01. Contractor shall provide such additional information in respect of insurance provided by Contractor as Owner may reasonably request.

# 5.10 Partial Utilization, Acknowledgment of Property Insurer

A. If Owner chooses to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

#### **ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES**

# 6.01 Supervision and Superintendence

A. Contractor shall supervise, provide quality control, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Any method of work suggested by the Owner or Engineer, but not specified, shall be used at the risk and responsibility of the Contractor; and the Owner and Engineer will assume no responsibility therefore. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or

procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

- B. At all times during the progress of the Work, Contractor shall assign a competent superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances. Contractor shall also designate, in writing, a representative, hereinafter referred to as Project Manager, assigned to the Project on a full-time basis during execution of the Work who shall have the authority to act on behalf of Contractor, including executing the orders or directions of the Engineer without delay. This Superintendent and/or Project Manager shall have full authority to promptly supply products, tools, plant equipment, and labor as may be required to diligently prosecute the Work. All communications given to or received from the Superintendent and/or the Project Manager shall be binding on Contractor.
- C. If at any time during the Project the Superintendent or Project Manager leaves the Project site while Work is in progress, Engineer shall be notified and provided with the name of Contractor's representative having responsible charge.
- D. Contractor shall also designate the person responsible for Contractor's quality control while Work is in progress. Engineer shall be notified in writing prior to any change in quality control representative assignment.
- E. Prior to the Commencement of the Contract Time, Contractor shall furnish to the Owner and Engineer the names, resumes, 24 hour contact information and other relevant information associated with the Project Manager and the Superintendent that are to be assigned to this project. The Project Manager and Superintendent must be acceptable to the Owner and Engineer.

#### 6.02 Labor; Working Hours

- A. Contractor shall provide competent, skilled, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site. Contractor shall, upon demand from the Engineer, immediately remove any manager, superintendent, foreman or workman whom the Engineer or Owner may consider incompetent or undesirable.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.
- C. Regular working hours may be Monday through Friday, excluding holidays, occurring between the hours of 7:00 AM and 7:00 PM, unless restricted otherwise. Contractor shall establish regular scheduled work times, e.g., four 10-hour days, five 8-hour days, or five 10-hour days within the hours and days allowed above. Approval for specific work outside regular scheduled work times shall be requested no less than 48 hours prior to the requested work period. Contractor shall request approval of changes in regular scheduled work times no less than one week prior to the desired change. Occasional unscheduled overtime on weekdays may be permitted provided reasonable notice is given to Engineer. Night work will not be established as a regular procedure, excluding emergencies, except with written permission. Such permission, if granted, shall be upon such terms and conditions deemed appropriate in the Engineer's sole discretion.

- D. Contractor shall pay all extra costs incurred by the Owner associated with work, outside of normal working hours, including additional support services, inspection services, testing services, utilities or other applicable costs. The cost associated with the Owner's inspection overtime will be the amounts as provided in the Supplementary Conditions per hour per individual, depending upon individuals assigned to the Project, the type of work being inspected, and the date of the invoice; i.e., allowing for salary escalation. Contractor will not be responsible for extra costs associated with inspection overtime for work in excess of 40 hours per week when such overtime work is explicitly required by the Contract Documents.
- E. Except in the case of emergencies or other unusual circumstances, no work shall be permitted on the project on Sunday.
- F. The Engineer will determine to what extent extraordinary onsite personnel work is required during Contractor's overtime work or working hours outside regular scheduled work hours.
- G. During unfavorable weather, wet ground, or other unsuitable construction conditions, the Contractor shall confine his operations to work which will not be affected adversely thereby. No portion of the work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by the Contractor to perform the work in a proper and satisfactory manner.

## 6.03 Services, Materials, and Equipment

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, quality control, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified, and shall be of good quality, new and unused, except as otherwise provided in the Contract Documents and shall be installed in an undamaged condition. All products provided on this Project shall be products currently manufactured by the manufacturer, i.e., products shall not be discontinued or out-of-date products nor shall they be of the last production run of the product. Contractor shall incorporate the previous sentence in any contract or agreement between Contractor and subcontractor or supplier supplying products provided on this Project. All special warranties and guarantees required by the Contract Documents shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.
- D. Without limiting the responsibility or liability of the Contractor pursuant to this agreement, all warranties given by manufacturers on materials or equipment incorporated in the work are hereby assigned by the Contractor to the Owner. Such assignment shall be effective upon completion of Contractor's warranty period. If requested, the Contractor shall execute formal assignments of said manufacturer's warranties to the Owner. All such warranties shall be directly enforceable by the Owner. Such assignment shall in no way affect the Contractor's responsibilities and duties during the warranty period.

- E. Wherever a stock size of manufactured item or piece of equipment is specified by its nominal size, it shall be the responsibility of the Contractor to determine the actual space requirements for setting and for entrance to the setting space and to make all necessary allowances and adjustments therefor in his work without additional cost to the Owner.
- F. Equipment and Construction Plant. All equipment and construction plant shall be suitable to produce the quality of work and materials required for the satisfactory completion of the work within the Contract Time and shall be satisfactory to the Engineer. The Contractor shall provide adequate and suitable equipment and construction plant to meet the requirements of the work as specified in these Contract Documents. The Contractor shall remove unsuitable equipment from the site of the work when ordered to do so by the Engineer. The Contractor shall obtain written permission from the Owner prior to constructing temporary buildings or other structures on land owned or leased by the Owner. If permission is granted, said buildings or other structures shall comply with all applicable regulations regarding their construction and maintenance and shall be satisfactory to the Owner.

## 6.04 Progress Schedule

- A. Contractor shall provide all resources, labor, materials, equipment, services, etc. necessary to adhere to the Progress Schedule established in accordance with Paragraph 2.07 and the General Requirements as it may be adjusted from time to time as provided below.
  - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07 and the General Requirements) an updated Progress Schedule and an updated Schedule of Submittals with each partial payment request, but no less than monthly. Contractor's failure to provide acceptable updated Progress Schedule and Schedule of Submittals will delay processing of the pay request until receipt of the acceptable updated Progress Schedule and/or an updated Schedule of Submittals. Such updates and adjustments shall comply with any provisions of the General Requirements applicable thereto.
  - Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.
  - 3. Number of anticipated days associated with weather conditions, as defined in the General Requirements, shall be included on the critical path of Project Schedule.
- B. The Contractor shall implement the detailed schedule of activities to the fullest extent possible between Project Coordination Meetings.
- C. The Contractor shall prepare its daily report by 10:00 a.m. of the day following the report date. This daily report will contain, as a minimum, the weather conditions; number of workers by craft, including supervision and management personnel on site; active and inactive equipment on site; work accomplished by schedule activity item; problems; and visitors to the jobsite.
- D. If a current activity or series of activities on the overall project schedule is behind schedule and if the late status is not due to an excusable delay for which a time extension would be forthcoming, the Contractor shall attempt to reschedule the activity to be consistent with the overall Project schedule so as not to delay any of the Contract milestones. The Contractor agrees that:

- 1. The Contractor shall attempt to expedite the activity completion so as to have it agree with the overall progress schedule. Such measures as the Contractor may choose shall be made explicit during the Project Coordination Meeting.
- 2. If, within two weeks of identification of such behind-schedule activity, the Contractor is not successful in restoring the activity to an on schedule status, the Contractor shall:
  - a. Carry out the activity with the scheduled crew on an overtime basis until the activity is complete or back on schedule.
  - b. Increase the crew size or add shifts so the activity can be completed as scheduled.
  - c. Commit to overtime or increased crew sizes for subsequent activities, or some combination of the above as deemed suitable by the Engineer.
- 3. These actions shall be taken at no increase in the Contract amount.
- E. The Contractor shall maintain a current copy of all construction schedules on prominent display in the Contractor's field office at the Project site.
- F. The Contractor shall cooperate with the Owner and Engineer in all aspects of the Project scheduling system. Failure to implement the Project scheduling system or to provide specified schedules, diagrams and reports, or to implement actions to re-establish progress consistent with the overall progress schedule may be causes for withholding of payment.
- G. If the Progress Schedule reflects a completion date prior to the completion date established by the Agreement, this shall afford no basis to claim for delay should Contractor not complete the Work prior to the projected completion date. Instead, all "float" between the completion date in Contractor's schedule and the completion date established in the Agreement shall belong to and is available to the Contractor and the Owner.
- 6.05 Substitutes and "Or-Equals"
  - A. See General Requirements.
- 6.06 Concerning Subcontractors, Suppliers, and Others
  - A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Acceptance of any Subcontractor, other person or organization by Owner shall not constitute a waiver of any right of Owner to reject defective Work. Contractor shall not be required to employ any Subcontractor, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.
  - B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other

individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
  - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
  - shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade. Such arrangement shall not operate to make the Engineer or the Owner an arbitrator to establish subcontract limits between Contractor and Subcontractor.
- G. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- H. Owner or Engineer may furnish to any Subcontractor, Supplier or other person or organization, to the extent practicable, information about amounts paid on their behalf to Contractor in accordance with Contractor's Applications for Payment.
- Specialty Subcontractors: Contractor shall utilize the services of Specialty Subcontractors on those parts of the Work which is declared as specialty work in Specifications and which, under normal contracting practices, is best performed by Specialty Subcontractors, as required by the Engineer in Engineer's sole discretion, at no additional cost to the Owner. If Contractor desires to self-perform specialty work, Contractor shall submit a request to the Owner, accompanied by evidence that Contractor's own organization has successfully performed the type of work in question, is presently competent to perform the type of work, and the performance of the work by Specialty Subcontractors will result in materially increased costs or inordinate delays.
- J. The Contractor shall perform a minimum of 20 percent of the onsite labor with its own employees.

## 6.07 Patent Fees and Royalties

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents

#### 6.08 Permits

A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction, temporary permits and licenses, necessary and incidental to the due and lawful prosecution of the work, including all permits on any part of the Work as required by law in connection with the Work. Owner will assist Contractor, when required by the permitting agency , in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

## 6.09 Laws and Regulations

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work.

However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times, or both. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.
- D. It is understood and agreed that the Contractor shall be familiar with and shall observe and comply with, all Federal, State, County, and local laws, codes, ordinances, regulations, orders, and decrees, including air and water pollution and noise abatement regulations, existing, or enacted subsequent to the execution of the Contract, that in any manner affect those engaged or employed in the work, or the materials or equipment used in the work, or which in any way affect the conduct of the work. The Contractor shall strictly observe all applicable laws and regulations as to public safety, health and sanitation. No pleas of misunderstanding or ignorance on the part of the Contractor will in any way serve to modify or mitigate the provisions of these Contract Documents. The Contractor and his Surety shall indemnify and save harmless the Owner and the Engineer and all their officers, agents, and servants against any claim or liability arising from, or based on the violation of, any such law, code, ordinance, regulation, order or decree, whether by himself, his agents or his employees.
- F. Where professional engineering and/or architectural services are required in connection with any of the components required by the Contract, all Bidders and component suppliers must make certain that there is full compliance with all applicable laws of the state in which the Project is located and any other state governing professional engineering and/or architecture. The Owner and Engineer do not warrant that any entity listed as an acceptable manufacturer is or will be in compliance with such laws.
- G. Any fines levied against the Owner for failure of Contractor to properly maintain required NPDES erosion and sediment control measures or any other related requirements will be deducted as set-offs from payments due Contractor.

## 6.10 Taxes

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

#### 6.11 Use of Site and Other Areas

- A. Limitation on Use of Site and Other Areas:
  - Contractor shall confine construction equipment, the storage of materials and equipment, and
    the operations of workers to the Site and other areas permitted by Laws and Regulations, and
    shall not unreasonably encumber the Site and other areas with construction equipment or
    other materials or equipment. Contractor shall assume full responsibility for any damage to
    any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas
    resulting from the performance of the Work.

- 2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
- 3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.
- B. Removal of Debris During Performance of the Work: During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. Loading Structures: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

#### 6.12 Record Documents

A. Contractor shall maintain in a safe place at the Site Record Documents as specified in the General Requirements. Upon completion of the Work, these record documents, Samples, and Shop Drawings shall be delivered to Engineer for Owner.

## 6.13 Safety and Protection

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all precautions for the safety of, and shall provide the protection to prevent pollution of or damage, injury or loss to:
  - 1. all persons on the Site or who may be affected by the Work;
  - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

- other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. The property, improvements or facilities at the site shall be replaced or restored to a condition as good as when Contractor entered upon the Site. In case of failure on the part of Contractor to restore such property, or make good such damages or injury, the Owner may, after 48 hours written notice, or sooner in the case of an emergency, proceed to repair, rebuild, or otherwise restore such property, improvements or facilities as may be deemed necessary. The cost thereof will be deducted from any monies due or which may become due Contractor under this Contract.
- H. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.l. The Contractor shall give due notice to any controlling person, department, or public service company, prior to adjusting items to grade and shall be held strictly liable to the Owner if any such items are disturbed, damaged or covered up during the course of the work.
- J. Fire hydrants on or adjacent to the work shall be kept accessible to the fire-fighting apparatus at all times, and no material or obstruction shall be placed within 10 feet of any hydrant. Adjacent

premises must be given access, as far as practicable, and obstruction of sewer inlets, gutters and ditches will not be permitted.

## K. Public Safety and Convenience

- The Contractor shall conduct his operations in a manner that will offer the least possible obstruction and inconvenience to the public and he shall not have under construction an amount of work greater than he can prosecute properly with due regard to the rights of the public.
- Construction operations shall be conducted in a manner that will cause as little inconvenience
  as possible to abutting property owners. Convenient access to driveways, houses, buildings
  or other facilities in the vicinity of the work shall be maintained and temporary access facilities
  for public roadways shall be provided and maintained in satisfactory condition.

#### 6.14 Safety Representative

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

# 6.15 Hazard Communication Programs

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.
- B. The Contractor shall erect and properly maintain at all times, as required by the conditions and progress of the work, all necessary safeguards, including sufficient lights and danger signals on or near the work; it shall erect suitable railings, barricades, covers, or other protective devices about unfinished work, open trenches, holes, embankments or other hazards and obstructions; where hazards to workmen or the public exist. The Contractor shall provide, at all times, all necessary watchmen on the project, for the safety of employees, delivery personnel, and the general public, and to diligently guard and protect all work and materials, including Owner-furnished equipment. Construction equipment shall be suitably night-marked and lighted as necessary for safety considerations.

## 6.16 Emergencies

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

# 6.17 Shop Drawings, Samples and Other Submittals

A. Contractor shall submit Submittals to Engineer for review and approval in accordance with the accepted or adjusted Schedule of Submittals (as required by Paragraph 2.07). Each submittal shall be identified as Engineer may require.

# 1. Shop Drawings:

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

# 2. Samples:

- a. Submit number of Samples specified in the Specifications.
- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.
- B. Where any Submittal is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

#### C. Submittal Procedures:

- 1. Before submitting each Shop Drawing or Sample, Contractor shall have:
  - a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
  - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
  - determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
  - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- Each Shop Drawing and Sample submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
- 3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract

Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

# D. Engineer's Review:

- 1. Engineer will return as incomplete or will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval or disapproval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
- 2. Engineer's review and approval or disapproval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- 3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written Field Order thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.
- 4. Review by the Owner or Engineer of any plan or method of work proposed by the Contractor shall not relieve the Contractor of any responsibility therefor, and such review shall not be considered as an assumption of any risk or liability by the Owner or Engineer, or any officer, agent, or employee thereof. The Contractor shall have no claim on account of the failure or inefficiency of any plan or method so reviewed.

#### E. Resubmittal Procedures:

- 1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
- F. Excessive Submittal Resubmission: Engineer will record time required by Engineer for excessive Submittal review occasioned by Contractor's resubmission, in excess of two resubmissions of any required Submittal, caused by unverified, unchecked or unreviewed, incomplete, inaccurate or erroneous, or nonconforming Submittals. Upon receipt of Engineer's accounting of time and costs, Contractor will reimburse Owner for the charges of Engineer's review for excessive resubmissions through set-offs from the recommended Owner payments to Contractor as established in Paragraph 14.02.D. of these General Conditions.
- G. In the event that Contractor provided a submittal for a previously approved item, whether such is as a substitution or in addition to the previously approved item, Contractor shall reimburse

Owner for Engineer's charges for such time as may be required to perform all reviews of the substitute item, unless the change is specifically requested by the Owner.

## 6.18 Continuing the Work

A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

## 6.19 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  - 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
  - normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
  - 1. observations by Engineer;
  - 2. recommendation by Engineer or payment by Owner of any progress or final payment;
  - 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
  - 4. use or occupancy of the Work or any part thereof by Owner;
  - 5. any review and approval of a Submittal or the issuance of a notice of acceptability by Engineer;
  - 6. any inspection, test, or approval by others; or
  - 7. any correction of defective Work by Owner.

## 6.20 Indemnification and Liability

A. It is understood and agreed that the Contractor shall be deemed and considered an independent contractor in respect to the work covered by these Contract Documents, and shall assume all

risks and responsibility for casualties of every description in connection with the work, except that he shall not be held liable or responsible for delays or damage to work caused by acts of God, acts of public enemy, quarantine restrictions, general strikes throughout the trade, or freight embargoes not caused or participated in by the Contractor. The Contractor shall have charge and control of the entire work until completion and final acceptance of the work by the Owner. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity.

- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
  - 1. the negligent preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  - 2. negligently giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.
- D. Contractor, Subcontractors, Suppliers and others on the Project, or their sureties, shall maintain no direct action against the Engineer, their officers, employees, affiliated corporations, consultants, and subcontractors, for any claim arising out of, in connection with, or resulting from the engineering services performed. Only the Owner will be the beneficiary of any undertaking by the Engineer.
- E. Defense of Suits: In case any action in court is brought against the Owner or the Engineer, or any officer, agent or employee of any of them, for the failure, omission, or neglect of the Contractor to perform any of the covenants, acts, matters, or things by this contract undertaken; or for injury or damage caused by the alleged negligence of the Contractor or his subcontractors or his or their agents, or in connection with any claim based on lawful demands of subcontractors,

workmen, material-men, or suppliers, the Contractor shall indemnify, defend and save harmless the Owner and the Engineer and their officers, agents and employees, from all losses, damages, costs, expenses (including attorneys' fees), judgments, or decrees arising out of such action.

# 6.21 Delegation of Professional Design Services

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed 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 Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

#### 6.22 Project Coordination Meetings

A. The Contractor shall participate in Project Coordination Meetings to be held on the site monthly, or more often if conditions warrant, to establish the current state of completion and revise the schedule as necessary. The Project Coordination Meeting will be conducted by the Owner and/or the Engineer.

# ARTICLE 7 - OTHER WORK AT THE SITE

#### 7.01 Related Work at Site

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

- 1. written notice thereof will be given to Contractor prior to starting any such other work; and
- 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times or both that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

#### 7.02 Coordination

- A. If Owner contracts with others for the performance of other work on the Site, the following will be set forth in Supplementary Conditions:
  - 1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
  - 2. the specific matters to be covered by such authority and responsibility will be itemized; and
  - 3. the extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination with other contractors.

# 7.03 Legal Relationships

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

#### 7.04 Claims Between Contractors

- A. Should Contractor cause damage to the work or property of any separate contractor at the site, or should any claim arising out of Contractor's performance of the work at the site be made by any separate contractor against Contractor, Owner, Engineer, or any other person, Contractor shall promptly attempt to settle with such other contractor by agreement, or to otherwise resolve the dispute by mediation, arbitration, or at law.
- B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold Owner, Engineer, and the officers, directors, employees, agents, and other consultants of each and any of them harmless from and against all claims, costs, losses and damages, (including, but not limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising directly, indirectly or consequentially out of or resulting from any action, legal or equitable, brought by any separate contractor against Owner, Engineer, or the officers, directors, employees, agents, and other consultants of each and any of them to the extent based on a claim arising out of Contractor's performance of the Work. Should a separate contractor cause damage to the Work or property of Contractor or should the performance of work by any separate contractor at the site give rise to any other claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or the officers, directors, employees, agents, and other consultants of each and any of them or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any mediator or arbitrator which seeks to impose liability on or to recover damages from Owner, Engineer, or the officers, directors, employees, agents, or other consultants of each and any of them on account of any such damage or claim.
- C. If Contractor is delayed at any time in performing or furnishing Work by any act or neglect of a separate contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable hereto, Contractor may make a claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, and/or Engineer and the officers, directors, employees, agents, or other consultants of each and any of them for any delay, disruption, interference or hindrance caused by any separate contractor. This Paragraph does not prevent recovery from Owner, Engineer, and/or Designer for activities that are their respective responsibilities.

## **ARTICLE 8 – OWNER'S RESPONSIBILITIES**

## 8.01 Communications to Contractor

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

## 8.02 Replacement of Engineer

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer whose status under the Contract Documents shall be that of the former Engineer.

#### 8.03 Furnish Data

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

## 8.04 Pay When Due

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

## 8.05 Lands and Easements; Reports and Tests

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

#### 8.06 Insurance

A. Owner shall not have any responsibilities with respect to purchasing and maintaining liability and property insurance.

# 8.07 Change Orders

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

## 8.08 Inspections, Tests, and Approvals

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

#### 8.09 Limitations on Owner's Responsibilities

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

#### 8.10 Undisclosed Hazardous Environmental Condition

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

## 8.11 Evidence of Financial Arrangements

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

## 8.12 Compliance with Safety Program

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

#### ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

# 9.01 Owner's Representative

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

#### 9.02 Visits to Site

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

# 9.03 Project Representative

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work, but will not be on-site at all hours the Work is in progress. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

#### 9.04 Authorized Variations in Work

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and

are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefore as provided in Paragraph 10.05.

# 9.05 Rejecting Defective Work

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

# 9.06 Shop Drawings, Change Orders and Payments

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

#### 9.07 Determinations for Unit Price Work

A. Engineer will have authority to determine the actual quantities and classifications of Unit Price Work performed by Contractor. If Engineer exercises such authority, Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

# 9.08 Decisions on Requirements of Contract Documents and Acceptability of Work

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and initial judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

# 9.09 Limitations on Engineer's Authority and Responsibilities

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents, except that Owner shall determine whether bonds, certificates of insurance and release of liens comply with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

# 9.10 Compliance with Safety Program

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

# ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

# 10.01 Authorized Changes in the Work

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
  - Owner may, in anticipation of possibly ordering an addition, deletion or revision to the Work, request Contractor to prepare a proposal of cost and times to perform Owner's contemplated changes in the Work. Contractor's written proposal shall be transmitted to the Engineer promptly, but not later than fourteen days after Contractor's receipt of Owner's written request and shall remain a firm offer for a period not less than sixty days after receipt by Engineer.
  - Contractor is not authorized to proceed on an Owner contemplated change in the Work prior to Contractor's receipt of a Change Order (or Work Change Directive) incorporating such change into the Work.
  - 3. Owner's request for proposal or Contractor's failure to submit such proposal within the required time period will not justify a claim for an adjustment in Contract Price or Contract Time (or Milestones).
  - 4. The Owner shall not be liable to the Contractor for any costs associated with the preparation of proposal associated with the Owner's contemplated changes in the Work.
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

# 10.02 Unauthorized Changes in the Work

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

# 10.03 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
  - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

- changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
- 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.
- B. In signing a Change Order, the Owner and Contractor acknowledge and agree that:
  - 1. The stipulated compensation (Contract Price or Contract Time, or both) set forth in the Change Order includes payment for:
    - a. the Cost of the Work covered by the Change Order,
    - b. Contractor's fee for overhead and profit,
    - c. interruption of Progress Schedules,
    - d. delay and impact, including cumulative impact, on other work under the Contract Documents, and
    - e. extended home office and jobsite overhead;
  - 2. the Change Order constitutes full mutual accord and satisfaction for the change to the Work;
  - 3. No reservation of rights to pursue subsequent claims on the Change Order will be made by either party; and
  - 4. No subsequent claim or amendment of the Contract Documents will arise out of or as a result of the Change Order.

# 10.04 Notification to Surety

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

#### 10.05 Claims and Disputes

- A. Engineer's Decision Required: All Claims and disputes, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. Notice: Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 10 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with written supporting data shall be delivered to the Engineer and the other party to the Contract within 20 days (and monthly thereafter for continuing events) after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).
- C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
  - 1. deny the Claim in whole or in part;
  - 2. approve the Claim; or
  - 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

# ARTICLE 11 - COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

#### 11.01 Cost of the Work

A. Costs Included: The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of

the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

- 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
- 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
- 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
- 4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
- 5. Supplemental costs including the following:
  - The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
  - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

- c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
  - Full rental cost for rented, leased, and/or owned equipment shall not exceed the rates listed in the Rental Rate Blue Book published by Equipment Watch, a unit of Penton Media, Inc., as adjusted to the regional area of the Project. The most recent published edition in effect at the commencement of the actual equipment use shall be used.
  - 2. Rates shall apply to equipment in good working condition. Equipment not in good condition, or larger than required, may be rejected by Engineer or accepted at reduced rates.
  - 3. Equipment in Use: Actual equipment use time documented by the Engineer shall be the basis that the equipment was on and utilized at the Project site. In addition to the leasing rate above, equipment operational costs shall be paid at the estimated operating cost, payment category (and the table below), and associated rate set forth in the Blue Book if not already included in the lease rate.

The hours of operation shall be based upon actual equipment usage to the nearest full hour, as recorded by the Engineer.

Actual Usage	Blue Book Payment Category
Less than 8 hours	Hourly Rate
8 or more hours but less than 7 days	Daily Rate
7 or more days but less than 30 days	Weekly Rate
30 days or more	Monthly Rate

- 4. Equipment when idle (Standby): Idle or standby equipment is equipment on-site or in transit to and from the Work site and necessary to perform the Work under the modification but not in actual use. Idle equipment time, as documented by the Engineer, shall be paid at the leasing rate determined in 11.01.A.5.c., excluding operational costs.
- 5. Where a breakdown occurs on any piece of equipment, payment shall cease for that equipment and any other equipment idled by the breakdown. If any part of the Work is shutdown by the Owner, standby time will be paid during non-operating hours if diversion of equipment to other Work is not practicable. Engineer reserves the right to cease standby time payment when an extended shutdown is anticipated.

- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to any of the Work that has been completed and accepted by the Owner, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D.), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee. If, however, any such loss or damage to the Work that has been accepted by Owner requires reconstruction and Contractor is placed in charge thereof, Contractor shall be paid for services, a fee proportionate to that stated in Paragraph 12.01.C.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.
- B. Costs Excluded: The term Cost of the Work shall not include any of the following items:
  - 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
  - 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
  - 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
  - 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

- 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.
- C. Contractor's Fee: When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

#### 11.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

#### B. Cash Allowances:

- 1. Contractor agrees that:
  - a. the cash allowances include the cost to Contractor (less any applicable trade discounts)
    of materials and equipment required by the allowances to be delivered at the Site, and all
    applicable taxes; and
  - b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

### C. Contingency Allowance:

- 1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

# 11.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the

- actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

# ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

# 12.01 Change of Contract Price

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
  - where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
  - where the Work involved is not covered by unit prices contained in the Contract Documents, by a lump sum value fixed by the Owner or by unit price values fixed by the Owner (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
  - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and where the method under Paragraph 12.01.B.2. is not selected by the Owner, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).
- C. Contractor's Fee: The Contractor's fee for overhead and profit shall be determined as follows:
  - 1. a mutually acceptable fixed fee; or
  - 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
    - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
    - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent based on subcontractor's actual Cost of the Work;
    - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1

and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor; except the maximum total allowable cost to Owner shall be the Cost of the Work plus a maximum collective aggregate fee for Contractor and all tiered Subcontractors of 26.8 percent.

- d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
- e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

# 12.02 Change of Contract Times

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

#### 12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times may be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, quarantine restrictions, strikes, freight embargoes, acts of war (declared or not declared), or acts of God.
- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor may be entitled to an equitable adjustment in Contract Times, but not Contract Price, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

- D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.
- F. If the Progress Schedule reflects a completion date or milestone date prior to the completion date or milestone date established by the Contract Documents, this shall afford no basis to claim for delay should Contractor not complete the Work prior to the projected completion date. Should a change order be executed with a revised completion date or milestone date, the Progress Schedule shall be revised to reflect the new completion date or milestone date.

# ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

#### 13.01 Notice of Defects

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

# 13.02 Access to Work

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

# 13.03 Tests and Inspections

- A. Contractor is responsible for the initial and subsequent inspections of Contractor's Work to ensure that the Work conforms to the requirements of the Contract Documents. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests. Contractor shall establish an inspection program and a testing plan acceptable to the Engineer and shall maintain complete inspection and testing records available to Engineer.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all non-contractor inspections, tests, or approvals required by the Contract Documents except:
  - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
  - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

- 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.
- G. Tests required by Contract Documents to be performed by Contractor and that require test certificates to be submitted to Owner or Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required testing laboratories or agencies shall meet the following applicable requirements:
  - 1. "Recommended Requirements for Independent Laboratory Qualification", published by the American Council of Independent Laboratories.
  - 2. Basic requirements of ASTM E329, "Standard of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction" as applicable.
  - 3. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

# 13.04 Uncovering Work

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

# 13.05 Owner May Stop the Work

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.
- B. If Owner stops Work under Paragraph 13.05.A. Contractor shall not be entitled to an extension of Contract Time or increase in Contract Price.

#### 13.06 Correction or Removal of Defective Work

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- C. Contractor shall promptly segregate and remove rejected products from the Site.
- D. If rejected products or Work is not removed within 48 hours, as provided in Paragraph 13.05 above, the Owner will have the right and authority to stop the Work immediately and will have the right to arrange for the removal of said rejected products or Work at the cost and expense of the Contractor.

#### 13.07 Correction Period

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions, and all to the satisfaction of the Owner:
  - 1. repair such defective land or areas; or
  - 2. correct such defective Work; or
  - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
  - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) shall be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.
- F. Repetitive malfunction of an equipment or product item shall be cause for replacement and an extension of the correction period to a date one year following acceptable replacement. A repetitive malfunction shall be defined as the third failure of an equipment or product item following original acceptance.

#### 13.08 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or

arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount shall be paid by Contractor to Owner.

# 13.09 Owner May Correct Defective Work

- A. If Contractor fails within a reasonable time, as defined by the Engineer, after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.
- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

# ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

#### 14.01 Schedule of Values

A. The Schedule of Values established as provided in Paragraph 2.07.A and as modified will serve as the basis for progress payments and will be incorporated into a form of Application for Payment

acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

# 14.02 Progress Payments

#### A. Applications for Payments:

- 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review five copies of an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
- Beginning with the second Application for Payment, each Application shall include an affidavit
  of Contractor stating that all previous progress payments received on account of the Work
  have been applied on account to discharge Contractor's legitimate obligations associated with
  prior Applications for Payment.

# 3. Retainage:

- a. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- b No form of collateral in lieu of cash will be acceptable as retainage.
- Amounts retained by the Contractor from payments due to suppliers and subcontractors (expressed as a percentage) shall not exceed that being retained by the Owner.

#### B. Review of Applications:

- Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
- 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
  - a. the Work has progressed to the point indicated;

- b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and
- c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
- 3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
  - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or
  - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
- 4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
  - a. to supervise, direct, or control the Work, or
  - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
  - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
  - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
  - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
- 5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
  - a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
  - b. the Contract Price has been reduced by Change Orders;

- c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
- d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

# C. Payment Becomes Due:

1. Thirty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

# D. Reduction in Payment:

- 1. Owner may refuse to make payment of the full amount recommended by Engineer because:
  - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
  - Liens have been filed in connection with the Work, except where Contractor has delivered
    a specific bond satisfactory to Owner to secure the satisfaction and discharge of such
    Liens;
  - c. there are other items entitling Owner to a set-off against the amount recommended; or
  - d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
- 2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.
- 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement; if any.
- 4. Items entitling Owner to retain set-offs from the amount recommended, include but are not limited to:
  - a. Owner compensation to Engineer at an estimated average rate as specified in the Supplementary Conditions per each extra personnel hour for labor plus expenses because of the following Contractor-caused events:
    - (1) Witnessing retesting of corrected or replaced defective Work;

- (2) Return visits to manufacturing facilities to witness factory testing or retesting;
- (3) Submittal reviews in excess of three reviews by Engineer for substantially the same Submittal:
- (4) Evaluation of proposed substitutes and in making changes to Contract Documents occasioned thereby;
- (5) Hours worked by Contractor, in excess of normal work hours as defined by Article 6.02 of the General Conditions, necessitating Engineer to work overtime;
- (6) Return visits to the Project by Engineer for Commissioning Activities not performed on the initial visit:
- b. Fines levied against the Owner for Contractor's performance of NPDES Erosion and Sedimentation Control Measures or other permit violations.
- c. The repair, rebuilding or restoration of property improvements or facilities by the Owner as outlined in Paragraph 6.13.
- d. Liability for liquidated damages incurred by Contractor as set forth in the Agreement.

# 14.03 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment, retainage notwithstanding, free and clear of all Liens.
- B. No materials or supplies for the Work shall be purchased by Contractor or subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. Contractor warrants that Contractor has good title to all materials and supplies used by Contractor in the Work, free from all liens, claims or encumbrances.

#### 14.04 Substantial Completion

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion. Specific items of Work that must be completed prior to the Engineer's issuance of a certificate of Substantial Completion include, but are not limited to, the following:
  - 1. Correction of all deficient Work items listed by all state, local, and other regulatory agencies or departments.
  - 2. All submittals must be received and approved by the Engineer, including but not necessarily limited to, the following:

- a. Record documents.
- b. Factory test reports, where required.
- c. Equipment and structure test reports.
- d. Manufacturer's Certificate of Proper Installation.
- e. Operating and maintenance information, instructions, manuals, documents, drawings, diagrams, and records.
- f. Spare parts lists.
- 3. All additional warranty or insurance coverage requirements have been provided.
- 4. All manufacturer/vendor-provided operator training is complete and documented.
- 5. Other items of Work specified elsewhere as being prerequisite for Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.
- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.
- 14.05 Partial Utilization

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
  - Owner at any time may direct Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to sufficiently progressed towards its intended use. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
  - Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work described in Paragraph 14.05.A.1 ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
  - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
  - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

#### 14.06 Final Inspection

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

# 14.07 Final Payment

# A. Application for Payment:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments. Under no circumstances will Contractor's application for final payment be accepted by the Engineer until all Work required by the Contract Documents has been completed.

- 2. The final Application for Payment shall be accompanied (except as previously delivered) by:
  - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
  - b. consent of the surety, if any, to final payment, if requested by the Engineer;
  - c. a list of all Claims against Owner that Contractor believes are unsettled;
  - d. an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work have been paid or otherwise satisfied;
  - e. the final Change Order signed by the Contractor to close the Contract; and
  - f. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work, if requested by the Engineer.
- 3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

# B. Engineer's Review of Application and Acceptance:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying all documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. Thereupon Engineer will give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment. If the Application for Payment and accompanying documentation are appropriate as to form and substance, Owner will in accordance with the applicable State or local General Law, pay Contractor the amount recommended by Engineer.

# C. Payment Becomes Due:

 Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

# 14.08 Final Completion Delayed

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, 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 to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

#### 14.09 Waiver of Claims

- A. The making and acceptance of final payment will constitute:
  - a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
  - 2. a waiver of all Claims by Contractor against Owner.

# **ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION**

# 15.01 Owner May Suspend Work

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor may be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

# 15.02 Owner May Terminate for Cause

- A. The occurrence of any one or more of the following events will justify termination for cause:
  - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
  - 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
  - 3. Contractor's repeated disregard of the authority of Engineer;
  - 4. Contractor's violation in any substantial way of any provisions of the Contract Documents;

- 5. If Contractor abandons the Work, or sublets this Contract or any part thereof, without the previous written consent of Owner, or if the Contract or any claim thereunder shall be assigned by Contractor otherwise than as herein specified;
- Contractor is adjudged bankrupt or insolvent;
- 7. Contractor makes a general assignment for the benefit of creditors;
- 8. A trustee or receiver is appointed for Contractor or for any of Contractor's property;
- 9. Contractor files a petition to take advantage of any debtor's relief act, or to reorganize under the bankruptcy or applicable laws;
- 10. Contractor repeatedly fails to supply sufficient skilled workmen, materials or equipment;
- 11. Contractor fails to make satisfactory progress toward timely completion of the work; or
- 12. Contractor repeatedly fails to make prompt payments to subcontractors or material suppliers for labor, materials or equipment.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor, unless Contractor otherwise cures the deficiency in accordance with Paragraph 15.02.D.:
  - exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);
  - 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and
  - 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

# 15.03 Owner May Terminate For Convenience

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate or discontinue, in whole or in part, the Contract. In such case, Contractor shall be paid for (without duplication of any items):
  - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination:
  - direct expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work;
  - all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others;
  - 4. reasonable expenses directly attributable to termination; and
  - 5. ten percent overhead and profit for those costs agreed to in Paragraphs 15.03.A.1 through 15.03.A.4 above.
- B. Contractor shall submit within 30 calendar days after receipt of notice of termination a written statement setting forth its proposal for an adjustment to the Contract Price to include only the incurred costs described in this clause. Owner shall review, analyze, and verify such proposal and negotiate an equitable amount and the Contract may be modified accordingly.
- C. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

# 15.04 Contractor May Stop Work or Terminate

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such

- amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.
- C. Except as allowed in Paragraph A above, the Contractor shall not suspend the work and shall not remove any equipment, tools, supplies, materials, or other items without the written permission of the Owner.

#### **ARTICLE 16 - DISPUTE RESOLUTION**

16.01 Methods and Procedures

Α.

#### **ARTICLE 17 - MISCELLANEOUS**

#### 17.01 Giving Notice

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
  - 1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
  - 2. delivered at or sent by registered or certified mail, postage prepaid, or by facsimile transmission and followed by written confirmation, to the last business address known to the giver of the notice.
- B. All notices required of Contractor shall be performed in writing to the appropriate entity.
- C. Electronic mail and messages will not be recognized as a written notice.
- D. If the Contractor does not notify the Owner in accordance with Paragraph 10.05 of the belief that a field order, work by other contractors or the Owner, or subsurface, latent, or unusual unknown conditions entitles the Contractor to a Change Order, no consideration for time or money will be given the Contractor.

### 17.02 Computation of Times

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

#### 17.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other

provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

# 17.04 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

# 17.05 Controlling Law

A. This Contract is to be governed by the law of the state in which the Project is located.

# 17.06 Headings

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

#### 17.07 Addresses

A. Both the address given in the Bid form upon which this Agreement is founded, and Contractor's office at or near the site of the Work are hereby designated as places to either of which notices, letters, and other communications to Contractor shall be certified, mailed, or delivered. The delivering at the above named place, or depositing in a postpaid wrapper directed to the first-named place, in any post office box regularly maintained by the post office department, of any notice, letter or other communication to Contractor shall be deemed sufficient service thereof upon date of such delivery or mailing. The first-named address may be changed at any time by an instrument in writing, executed by Contractor, and delivered to and acknowledged by the Owner and Engineer. Nothing herein contained shall be deemed to preclude or render inoperative the service of any notice, letter, or other communication upon Contractor personally.

# 17.08 Forms and Record

- A. The form of all Submittals, notices, change orders and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the Engineer.
- B. Contractor shall maintain throughout the term of the Contract, complete and accurate records of all Contractor's costs which relate to the work performed, including the extra work, under the terms of the Contract. The Owner, or its authorized representative, shall have the right at any reasonable time to examine and audit the original records.
- C. Records to be maintained and retained by Contractor shall include, but not be limited to:
  - 1. Payroll records accounting for total time distribution of Contractor's employees working full or part time on the work;
  - 2. Cancelled payroll checks or signed receipts for payroll payments in cash;

- 3. Invoices for purchases, receiving and issuing documents, and all other unit inventory records for Contractor's stores, stock, or capital items;
- 4. Paid invoices and cancelled checks for materials purchase, subcontractors, and any other third parties' charges;
- 5. Original estimate and change order estimate files and detailed worksheets;
- 6. All project-related correspondence; and
- Subcontractor and supplier change order files (including detailed documentation covering negotiated settlements).
- D. Owner shall also have the right to audit: any other supporting evidence necessary to substantiate charges related to this agreement (both direct and indirect costs, including overhead allocations as they may apply to costs associated with this agreement); and any records necessary to permit evaluation and verification of Contractor compliance with contract requirements and compliance with provisions for pricing change orders, payments, or claims submitted by Contractor or any payees thereof. Contractor shall also be required to include the right to audit provision in the contracts (including those of a lump-sum nature) of all subcontractors, insurance agents, or any other business entity providing goods and services.

# 17.09 Assignment

A. Contractor shall not assign, sell, transfer or otherwise dispose of the whole or any part of this Contract or any monies due or to become due hereunder without written consent of the Owner. In case Contractor assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to Contractor shall be subject to prior liens of all persons, firms and corporations for services rendered or materials supplied for the performance of the Work called for under this Contract.

# 17.10 Inspection by Public Agencies

A. Authorized representatives of the federal, state, local and other governmental agencies having jurisdiction over the work or any part thereof shall have access to the work and any records relevant to the prosecution and progress of the work. The Contractor shall provide proper facilities for such access and inspection.

**END OF SECTION** 

# **Supplementary Conditions**

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC C-700 (2007 Edition, with Barge Modifications 01/09/18). All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

The provisions in this Section of the Specifications shall govern in the event of any conflict between this Section and the General Conditions.

#### SC-1.01 Definitions

SC-1.01.A.9. Add the following language to the end of Paragraph 1.01.A.9:

The Change Order form to be used on this Project is as included in these Contract Documents.

# SC-4.02 Subsurface and Physical Conditions

SC-4.02 Add the following new paragraphs immediately after Paragraph 4.02.B:

- C. The following reports of explorations and tests of subsurface conditions at or contiguous to the Site have been used by the Engineer in preparing the Contract Documents:
  - 1. Report dated January 17, 2020, prepared by OMI, Inc.
- D. No drawings of physical conditions relating to existing surface or subsurface structures at the Site have been used by the Engineer in preparing the Contract Documents.

#### SC-4.06 Hazardous Environmental Conditions

SC-4.06 Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following:

- A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.
- B. Not Used.

#### SC-5.03 Certificates of Insurance

SC-5.03, following Paragraph E, add the following,

# **Supplementary Conditions**

- F. Copies of endorsements showing that each additional insured identified herein have been added to the policies as an additional insured shall be attached to each of the certificates.
- G. Each insurance certificate for all coverages other than Worker's Compensation Insurance must show that a waiver of rights of recovery against any of the insured or the additional insured is in effect.
- H. Certificate for Worker's Compensation and Employer's Liability coverage must indicate inclusion or exclusion for any proprietor, partner, executive officer or member.

#### SC-5.04 Contractor's Insurance

- SC-5.04.B.1, There are other additional insureds other than the Owner and Engineer.
  - 1. Clark Irrigation Design Consulting
  - 2. OMI, Inc.
- SC-5.04.C, following Paragraph 5.04.B.6.b, Add,
  - C. The limits of liability for the insurance required by paragraph 5.04.B.2 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:
    - 1. Worker's compensation, disability benefits and other similar employee benefit acts, and damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees as provided in Paragraphs 5.04.A.1 and 5.04.A.2 of the General Conditions:
      - a. Workers Compensation: Statutory limits
      - b. Employer's Liability, Each Accident: \$1,000,000
      - c. Employer's Liability, Each Employee: \$1,000,000
      - d. Employer's Liability, Disease Policy Limit: \$1,000,000
    - 2. Contractor's General Liability Insurance under paragraphs 5.04.A.3 through 5.04.A.5 of the General Conditions shall provide the following minimum limits and conditions:
      - a. Each Occurrence: \$1,000,000.
      - b. Damage to Rented Premises (each occurrence) \$100,000.
      - c. Medical Expenses (any one person) \$5,000.
      - d. Personal and Advertising Injury: \$1,000,000.
      - e. General Aggregate: \$2,000,000.
      - f. Products-Completed Operations Aggregate: \$2,000,000.

- g. Explosion, collapse, and underground coverage shall be included with such indicated on the insurance certificate under General Liability.
- h. The general aggregate policy limits must be designated to the Project.
- i. Contractual Liability coverage, as required under Paragraph 5.04.B.3 must be indicated on the insurance certificate under General Liability.
- 3. Automobile Liability under Paragraph 5.04.A.6 of the General Conditions, providing for Combined Single Limit (each accident) for all owned, hired, and non-owned vehicles: \$1,000,000.
- 4. Provide Excess Liability or Umbrella Liability insurance providing protection for at least the hazards insured under the primary liability policies with the following limits:

a. General Aggregate: \$5,000,000.

b. Each Occurrence: \$5,000,000.

SC-6.02 Labor; Working Hours

SC-6.02 Add the following subparagraph 6.02.D.1:

1. The following rates will apply for the overtime work on behalf of the Owner: \$100.00/hour to \$90.00/hour, depending on actual Resident Project Representative assigned to the Project.

SC-6.13 Safety and Protection

SC-6.13 Delete the second sentence of Paragraph 6.13.C.

SC-9.03 Project Representative

SC-9.03 Add the following new paragraphs immediately after Paragraph 9.03.A:

- B. The Resident Project Representative (RPR) will be Engineer's employee or agent at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions. RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall be only through or with the full knowledge and approval of Contractor. The RPR shall:
  - 1. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and schedule of values prepared by Contractor and consult with Engineer concerning acceptability.
  - Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.

## 3. Liaison:

- a. Serve as Engineer's liaison with Contractor, working principally through Contractor's authorized representative, assist in providing information regarding the intent of the Contract Documents.
- b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
- c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
- 4. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
- 5. Shop Drawings and Samples:
  - a. Record date of receipt of Samples and approved Shop Drawings.
  - b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.
- 6. *Modifications:* Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.
- 7. Review of Work and Rejection of Defective Work:
  - a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
  - b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress will not produce a completed Project that conforms generally to the Contract Documents or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
- 8. Inspections, Tests, and System Startups:
  - a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate

Owner's personnel, and that Contractor maintains adequate records thereof.

b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

#### 9. Records:

- a. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
- b. Maintain records for use in preparing Project documentation.

# 10. Reports:

- a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and Sample submittals.
- b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
- c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, damage to property by fire or other causes, or the discovery of any Hazardous Environmental Condition.
- 11. Payment Requests: Review Applications for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.
- 12. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

# 13. Completion:

a. Participate in a Substantial Completion inspection, assist in the determination of Substantial Completion and the preparation of lists of items to be completed or corrected.

# **Supplementary Conditions**

- b. Participate in a final inspection in the company of Engineer, Owner, and Contractor and prepare a final list of items to be completed and deficiencies to be remedied.
- c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the Notice of Acceptability of the Work.

#### C. The RPR shall not:

- 1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
- 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
- 3. Undertake any of the responsibilities of Contractor, Subcontractors, Suppliers, or Contractor's superintendent.
- 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work unless such advice or directions are specifically required by the Contract Documents.
- Advise on, issue directions regarding, or assume control over safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
- 6. Participate in specialized field or laboratory tests or inspections conducted offsite by others except as specifically authorized by Engineer.
- 7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
- 8. Authorize Owner to occupy the Project in whole or in part.

# SC-14.02.D.4.e After paragraph 14.02.D. 4.d, add the following:

5. The following rates will be for the additional services performed by the Engineer on behalf of the Owner: To Be Determined.

# SC-14.04 Substantial Completion

# SC-17.05 After paragraph 17.05.A, add the following:

B. The parties acknowledge that this Contract is executed in Marshall County, Alabama and that the Contract is to be performed in Marshall County, Alabama. Each party hereby consents to the Marshall County Court's sole jurisdiction over any dispute which arises as a result of the execution or performance of this Agreement, and each party hereby waives any and all objections to venue in the

00 73 00 - 7 Supplementary Conditions

Marshall County Court.

**END OF SECTION** 

37106-05 04/21/2023

### Part 1 General

### 1.1 Section Includes

- A. Work By Contractor.
- B. Work By Owner.
- C. Work By Others.
- D. Owner-Furnished Items.
- E. Contractor Use Of Site And Premises.
- F. Future Work.
- G. Owner Occupancy.
- H. Quantities.

# 1.2 Work By Contractor

- A. The Work To Be Performed Under This Contract Shall Consist Of Furnishing All Labor, Materials, Tools, Equipment And Incidentals And Performing All Work Required To Construct Complete In Place And Ready To Operate:
  - The Project Improvements Consist Of Demolition Of Existing Baseball Field And Parking Lot Associated With The Construction Of 2 New Softball Fields, A Concession/Restroom Building, a splash pad mechanical building, Picnic Pavilion, Entry Drive, Parking Facilities, Installation Of Sports Field Lighting, Batting Cages, Pedestrian Plazas And Walks, Irrigation, Storm Drainage, Service Utilities, Walls And Landscaping.
- B. All Work Described Above Shall Be Performed As Shown On The Drawings And As Specified.

#### C. Project Location

 The Equipment And Materials To Be Furnished Will Be Installed At The Location Shown On The Drawings. Adjacent To 1500 Sunset Drive, Guntersville, AL 35976.

# 1.3 Work By Owner

- A. The Owner And/Or Utility Companies Will Perform The Following Work Necessary For Completion Of The Project:
  - 1. Removal Of A Portion Of The Trees From The Site (Drawings Indicate The Trees To Be Removed By The City).
  - 2. Installation Of Natural Gas Service From The Main Along Sunset Drive To The Concession/Restroom Building And Installation Of A Gas Meter At The Building.

### Summary of Work

- 3. Relocation/Modification Of Overhead Power Lines As Needed To Facilitate Construction Of The Project.
- 4. Owner Will Directly Procure The Musco Sports Field Lighting System And Deliver It To The Site For Installation By The Contractor.
- 5. Owner will remove the existing sports lighting poles and fixtures from the site after Contractor lays them on the ground.
- B. The Contract Documents For This WORK Are Available For Inspection At The Following:
  - Barge Design Solutions, Inc.
     200 Clinton Avenue, Suite 800
     Huntsville, Alabama 35801
     Office: (256) 533-1561
  - 2. City Of Guntersville
    Parks And Recreation Department
    1500 Sunset Drive
    Guntersville, AL 35976
    (256) 571-7590

### 1.4 Owner Furnished Items

- A. Products Furnished To The Site And Paid For By Owner:
  - 1. None.
- B. OWNER's Responsibilities:
  - 1. Arrange For And Deliver Owner-Reviewed Shop Drawings, Product Data, And Samples To Contractor.

### C. CONTRACTOR's Responsibilities:

- 1. Review Owner-Reviewed Shop Drawings, Product Data, And Samples.
- 2. Receive And Unload Products At Site; Inspect For Completeness Or Damage.
- 3. Handle, Store, Install And Finish Products.
- 4. Repair Or Replace Items Damaged After Receipt.

### 1.5 Contractor Use Of Site And Premises

- A. Limit Use Of Site And Premises To Allow:
  - 1. Owner Occupancy And Operation Of All Existing Facilities And Equipment Which Is To Remain In Service.
  - 2. Public Access To Existing Park Facilities Not Affected By The Project Limits Of Disturbance.

## 1.6 Future Work (If Applicable)

- A. Project Is Designed For Future Work, Including:
  - 1. None.

# 1.7 Partial Owner Occupancy

- A. The Owner Will Occupy Existing Facilities To Which These Improvements Are Being Made And Will Continue Operation During The Period Of Construction.
- B. There Shall Not Be Any Interruption In Service. The Contractor Is Responsible For Fines Assessed Due To His Activities.

### 1.8 Quantities

A. The Owner Reserves The Right To Alter The Quantities Of Work To Be Performed Or To Extend Or Shorten The Improvements At Any Time When And As Found Necessary, And The Contractor Shall Perform The Work As Altered, Increased Or Decreased. Payment For Such Increased Or Decreased Quantity Will Be Made In Accordance With The Instructions To Bidders. No Allowance Will Be Made For Any Change In Anticipated Profits Nor Shall Such Changes Be Considered As Waiving Or Invalidating Any Conditions Or Provisions Of The Contract And Bond.

# Part 2 Products

(NOT USED)

# Part 3 Execution

(NOT USED)

**END OF SECTION** 

### Substitution Procedures

## Part 1 General

## 1.1 Scope

A. This section outlines the restrictions and requirements for substitutions, product and manufacturer options, and construction method options.

### 1.2 Definitions

- A. For the purposes of these Contract Documents, a "substitute item" shall be defined as one of the following:
  - 1. A product or manufacturer offered as a replacement to a specified product or manufacturer.
  - 2. A product or manufacturer offered in addition to a specified product or manufacturer.
- B. For the purposes of these Contract Documents, a "substitute construction method" shall be defined as one of the following:
  - 1. A mean, method, technique, sequence or procedure of construction offered as a replacement for a specified mean, method, technique, sequence or procedure of construction.
  - 2. A mean, method, technique, sequence or procedure of construction offered in addition to a specified mean, method, technique, sequence or procedure of construction.

### 1.3 General

- A. Whenever it is included in the Drawings or specified in the specifications that a substitute or "or equal" item of material or equipment may be furnished or used by the Contractor if acceptable to the A/E, application for such acceptance will not be considered by the A/E until after the effective date of the Notice to Proceed. The procedure for submittal of any such application by the Contractor and consideration by the A/E is set forth in Paragraphs 6.05 of the General Conditions, which may be supplemented in the Supplementary Conditions.
- B. An item or construction method, which is offered where no specific product, manufacturer, mean, method, technique, sequence or procedure of construction is specified or shown on the Drawings, shall not be considered a substitute and shall be at the option of the Contractor, subject to the provisions in the Contract Documents for that item or construction method.
- C. For products specified only by a referenced standard, the Contractor may select any product by any manufacturer, which meets the requirements of the Specifications, unless indicated otherwise in the Contract Documents.

#### Substitution Procedures

- D. If the manufacturer is named on the Drawings or in the Specifications as an acceptable manufacturer, products of that manufacturer meeting all requirements of the Specifications and Drawings are acceptable.
- E. Whenever the Engineer's design is based on a specific product of a particular manufacturer, that manufacturer will be shown on the Drawings and/or listed first in the list of approved manufacturers in the Specifications. Any Bidder intending to furnish products of other than the first listed manufacturer, or furnish substitute items, shall
  - 1. Verify that the item being furnished will fit in the space allowed, perform the same functions and have the same capabilities as the item specified,
  - 2. Include in its Bid the cost of all accessory items which may be required by the other listed substitute product,
  - 3. Include the cost of any architectural, structural, mechanical, piping, electrical or other modifications required, and
  - 4. Include the cost of required additional work by the Engineer, if any, to accommodate the item.
- F. Whenever a product specification includes minimum experience requirements which the manufacturer selected by the Contractor cannot meet, the manufacturer shall furnish the Owner with a cash deposit, or bond acceptable to the Owner in an amount equal to the cost of the product, which shall remain in effect until the experience requirement has been met.

## 1.4 Approvals

- A. Approval, of a substitution as an acceptable manufacturer, of the Engineer is dependent on determination that the product offered:
  - 1. Is essentially equal in function, performance, quality of manufacture, ease of maintenance, reliability, service life and other criteria to that on which the design is based, and
  - 2. Will require no major modifications to structures, electrical systems, control systems or piping systems.

# 1.5 Substitutions and Options

- A. No substitutions will be considered for the manufacturers listed in the Bid.
- B. After Notice to Proceed
  - 1. Substitute items will be considered only if the term "equal to" precedes the names of acceptable manufacturers in the Specification.
  - 2. Where items are specified by referenced standard or specified as indicated above in Article 1.3, Paragraph A, such items shall be submitted to the Engineer for review.
  - 3. The Contractor shall submit shop drawings on the substitute item for the Engineer's review in accordance with the Section 01 33 00.

## C. Prior to Opening of Bids

- 1. No consideration or approvals will be made for products specified by a referenced standard, or specified as indicated in Article 1.3, Paragraph A, above. Such consideration may occur only after the Notice to Proceed.
- 2. No consideration or approvals will be made for products being offered where the term "equal to" precedes the name of an approved product. Such substitution consideration may occur only after the Notice to Proceed.

## Part 2 Products

(NOT USED)

## Part 3 Execution

(NOT USED)

**END OF SECTION** 

### Part 1 General

### 1.1 Extensions of Contract Time

A. If the basis exists for an extension of time in accordance with Article 6 of the Conditions, an extension of time on the basis of weather may be granted only for the number of Weather Delay Days in excess of the number of days listed as the Standard Baseline for that month.

## 1.2 Standard Baseline for Average Climate Range

- A. The Owner has reviewed weather data available from the National Oceanic and Atmospheric Administration (NOAA) and determined a Standard Baseline of average climatic range for the State of Alabama.
- B. Standard Baseline is defined as the normal number of calendar days for each month during which construction activity exposed to weather conditions is expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.
- C. Standard Baseline is as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12	11	8	7	7	6	7	5	4	5	6	11

# 1.3 Adverse Weather and Weather Delays

- A. Adverse Weather is defined as the occurrence of one or more of the following conditions within a twenty-four hour day that prevents construction activity exposed to weather conditions or access to the site:
  - 1. Precipitation (rain, snow, or ice) in excess of one-tenth inch liquid measure;
  - 2. Temperatures that do not rise above that required for the day's construction activity, if such temperature requirement is specified or accepted as standard industry practice; and/or,
  - 3. Sustained wind in excess of twenty-five m.p.h.
- B. Adverse Weather may include, if appropriate, "dry-out" or "mud" days:
  - 1. Resulting from precipitation days that occur beyond the standard baseline;
  - 2. Only if there is a hindrance to site access or sitework and Contractor has taken all reasonable accommodations to avoid such hindrance; and,
  - At a rate no greater than one make-up day for each day or consecutive days of precipitation beyond the standard baseline that total one inch or more, liquid measure, unless specifically recommended otherwise by the Engineer. A Weather

Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day and critical path construction activities were included in the day's schedule, including a weekend day or holiday if Contractor has scheduled construction activity that day.

C. Contractor shall take into account that certain construction activities are more affected by adverse weather and seasonal conditions than other activities, and that "dry-out" or "mud" days are not eligible to be counted as a Weather Delay Day until the standard baseline is exceeded. Hence, Contractor should allow for an appropriate number of additional days associated with the Standard Baseline days in which such applicable construction activities are expected to be prevented and suspended.

## 1.4 Documentation and Submittals

- A. Submit daily jobsite work logs showing which and to what extent critical path construction activities have been affected by weather on a monthly basis.
- B. Submit actual weather data to support claim for time extension obtained from nearest NOAA weather station or other independently verified source approved by Engineer at beginning of project.
- C. Use Standard Baseline data provided in this Section when documenting actual delays due to weather in excess of the average climatic range.
- D. Organize claim and documentation to facilitate evaluation on a basis of calendar month periods, and submit in accordance with the procedures for Claims established in Article 10 of the Conditions.
- E. If an extension of the Contract Time is appropriate, such extension shall be made in accordance with the provisions of Article 6 of the Conditions, and the applicable General Requirements.

**END OF SECTION** 

# **Project Management and Coordination**

## Part 1 General

### 1.1 Section Includes

- A. Coordination
- B. Project Meetings
- C. Preconstruction Conference
- D. Site Mobilization Conference
- E. Project Coordination Meetings
- F. Pre-installation Conferences

### 1.2 Coordination

- A. Coordinate scheduling, submittals, and WORK of the various Sections of specifications to assure efficient and orderly sequence of installation for interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirement characteristics of operating equipment are compatible with utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connection to, and placing in service, such equipment.
- C. Coordinate space requirements and installation of electrical WORK which are indicated diagrammatically on Drawings. Follow routing for pipes and conduit, as closely as practicable. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

# 1.3 Project Meetings

- A. Work under this Section includes all scheduling and administering of pre-construction and progress meetings as herein specified and necessary for the proper and complete performance of this work.
- B. Scheduling and Administration the Contractor:
  - 1. Prepare agenda.
  - 2. Make physical arrangements for the meetings (meetings may be held in the Guntersville Parks and Recreation offices adjacent to the job site).
  - 3. Preside at meetings.
  - 4. Record minutes and include significant proceedings and decisions.
  - 5. Distribute copies of the minutes to participants.

Project Management and Coordination

### 1.4 Preconstruction Conference

- A. The Contractor shall schedule the preconstruction conference prior to the issuance of the Notice to Proceed.
- B. Representatives of the following parties are to be in attendance at the meeting:
  - Owner.
  - 2. Architect/Engineer/Landscape Architect (A/E/LA)
  - 3. Contractor and superintendent.
  - 4. Major subcontractors.
  - 5. Representatives of governmental or regulatory agencies when appropriate.
- C. The agenda for the preconstruction conference shall consist of the following as a minimum:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - Distribution of Contract Documents.
  - 4. Submission of list of major Subcontractors, list of products, Schedule of Values, and a tentative construction schedule.
  - 5. Critical work sequencing.
  - 6. Designation of responsible personnel and emergency telephone numbers.
  - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, change orders and Contract closeout procedures.
  - 8. Schedule and submittal of shop drawings, product data and samples.
  - 9. Procedures for maintaining record documents.
  - 10. Use of premises, including office and storage areas and Owner's requirements.
  - 11. Major equipment deliveries and priorities.
  - 12. Safety and first aid procedures.
  - 13. Security procedures.
  - 14. Housekeeping procedures.
  - 15. Workhours.

### 1.5 Site Mobilization Conference

- A. Contractor will schedule a conference at the Project site prior to Contractor occupancy.
- B. Attendance Required: Owner, A/E/LA, Contractor, Contractor's Superintendent, and major Subcontractors.
- C. Agenda:
  - 1. Use of premises by Owner and Contractor.
  - 2. Owner's requirements and partial occupancy.
  - 3. Construction facilities and controls provided by Owner.
  - 4. Temporary utilities provided by Owner.
  - 5. Survey Layout.
  - 6. Security procedures.
  - 7. Housekeeping procedures.

- Schedules.
- 9. Procedures for testing.
- 10. Procedures for maintaining record documents.
- 11. Requirements for start-up of equipment.
- 12. Inspection and acceptance of equipment put into service during construction period.

# 1.6 Project Coordination Meetings

- A. Schedule regular monthly meetings as directed by the Owner.
- B. Hold called meetings as the progress of the work dictates.
- C. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within two days to Engineer, Owner, participants, and those affected by decisions made.
- D. Representatives of the following parties are to be in attendance at the meetings:
  - 1. Owner
  - 2. A/E/LA
  - 3. Contractor and superintendent.
  - 4. Major subcontractors as pertinent to the agenda.
  - 5. Representatives of governmental or other regulatory agencies as appropriate.
- E. The minimum agenda for progress meetings shall consist of the following:
  - 1. Review and approve minutes of previous meetings.
  - 2. Review work progress since last meeting.
  - 3. Note field observations, problems and decisions.
  - 4. Identify problems which impede planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review off-site fabrication and delivery schedules.
  - 7. Review of maintenance of construction schedule.
  - 8. Review Contractor's corrective measures and procedures to regain plan schedule.
  - 9. Review Contractor's revision to the construction schedule as outlined in the Supplementary Conditions.
  - 10. Planned progress during succeeding WORK period.
  - 11. Coordination of projected progress.
  - 12. Maintenance of quality and work standards.
  - 13. Review proposed changes for their effect on the construction schedule and completion date.
  - 14. Complete other current business.

### 1.7 Pre-Installation Conference

- A. When required in individual specification Section, convene a pre-installation conference at WORK site prior to commencing WORK of the Section.
- B. Require attendance of parties directly affecting, or affected by, WORK of the specific Section.

Project Management and Coordination

- C. Notify A/E/LA and Owner four days in advance of meeting date.
- D. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants, with two copies to Engineer.
- E. Review conditions of installation, preparation and installation procedures, and coordination with related WORK.

## Part 2 Products

NOT USED

## Part 3 Execution

**NOT USED** 

**END OF SECTION** 

## Part 1 General

## 1.1 Scope

- A. Work under this Section includes all scheduling and administering of pre-construction and progress meetings as herein specified and necessary for the proper and complete performance of this work.
- B. Scheduling and Administration by Engineer:
  - 1. Prepare agenda.
  - 2. Make physical arrangements for the meetings.
  - 3. Preside at meetings.
  - 4. Record minutes and include significant proceedings and decisions.
  - 5. Distribute copies of the minutes to participants.

### 1.2 Preconstruction Conference

- A. The Engineer shall schedule the preconstruction conference prior to the issuance of the Notice to Proceed.
- B. Representatives of the following parties are to be in attendance at the meeting:
  - 1. Owner.
  - 2. Engineer.
  - 3. Contractor and superintendent.
  - 4. Major subcontractors.
  - 5. Representatives of governmental or regulatory agencies when appropriate.
- C. The agenda for the preconstruction conference shall consist of the following as a minimum:
  - 1. Distribute and discuss a list of major subcontractors and a tentative construction schedule.
  - 2. Critical work sequencing.
  - 3. Designation of responsible personnel and emergency telephone numbers.
  - 4. Processing of field decisions and change orders.

#### **Project Meetings**

- 5. Adequacy of distribution of Contract Documents.
- 6. Schedule and submittal of shop drawings, product data and samples.
- 7. Pay request format, submittal cutoff date, pay date and retainage.
- 8. Procedures for maintaining record documents.
- 9. Use of premises, including office and storage areas and Owner's requirements.
- 10. Major equipment deliveries and priorities.
- 11. Safety and first aid procedures.
- 12. Security procedures.
- 13. Housekeeping procedures.
- 14. Work hours.

# 1.3 Project Coordination Meetings

- A. Attend regular monthly meetings as directed by the Engineer.
- B. Hold called meetings as the progress of the work dictates.
- C. The meetings shall be held at the location indicated by the Engineer.
- D. Representatives of the following parties are to be in attendance at the meetings:
  - 1. Engineer.
  - 2. Contractor and superintendent.
  - 3. Major subcontractors as pertinent to the agenda.
  - 4. Owner's representative as appropriate.
  - 5. Representatives of governmental or other regulatory agencies as appropriate.
- E. The minimum agenda for progress meetings shall consist of the following:
  - 1. Review and approve minutes of previous meetings.
  - 2. Review work progress since last meeting.
  - 3. Note field observations, problems and decisions.

**Project Meetings** 

- 4. Identify problems which impede planned progress.
- 5. Review off-site fabrication problems.
- 6. Review Contractor's corrective measures and procedures to regain plan schedule.
- 7. Review Contractor's revision to the construction schedule as outlined in the Supplementary Conditions.
- 8. Review submittal schedule; expedite as required to maintain schedule.
- 9. Maintenance of quality and work standards.
- 10. Review changes proposed by Owner for their effect on the construction schedule and completion date.
- 11. Complete other current business.

## Part 2 Products

(NOT USED)

## Part 3 Execution

(NOT USED)

**END OF SECTION** 

### Construction Schedules

### Part 1 General

## 1.1 Scope

- A. Preparing, furnishing, distributing, and periodic updating of the construction schedules as specified herein.
- B. The purpose of the schedule is to demonstrate that the Contractor can complete the overall Project within the Contract Time and meet all required interim milestones.

### 1.2 Submittals

- A. Overall Project Schedule (OPS)
  - 1. Submit the schedule within 10 days after date of the Notice to Proceed.
  - 2. The Engineer will review the schedule and return it within 10 days after receipt.
  - 3. If required, resubmit within 10 days after receipt of a returned copy.
- B. Near Term Schedule (NTS)
  - 1. Submit the first Near Term Schedule within 10 days of the Notice to Proceed.
  - 2. The Engineer will review the schedule and return it within 10 days after receipt.
- C. Submit an update of the OPS and NTS with each progress payment request.
- D. Submit the number of copies required by the Contractor, plus four copies to be retained by the Engineer.

# 1.3 Approval

A. Approval of the Contractor's detailed construction program and revisions thereto shall in no way relieve the Contractor of any of Contractor's duties and obligations under the Contract. Approval is limited to the format of the schedule and does not in any way indicate approval of, or concurrence with, the Contractor's means, methods and ability to carry out the work.

# 1.4 Overall Project Schedule (OPS)

A. The Contractor shall submit to the Owner for approval a detailed Overall Project Schedule of the Contractor's proposed operations for the duration of the Project. The OPS shall be in the form of a Gantt/bar chart.

#### B. Gantt/Bar Chart Schedule

- 1. Each activity with a duration of five or more days shall be identified by a separate bar. Activities with a duration of more than 20 days shall be sub divided into separate activities.
- 2. The schedule shall include activities for shop drawing preparation and review, fabrication, delivery, and installation of major or critical path materials and equipment items.
- 3. The schedule shall show the proposed start and completion date for each activity. A separate listing of activity start and stop dates and working day requirements shall be provided unless the information is shown in text form on the Gantt/bar chart.
- 4. The schedule shall identify the Notice to Proceed date, the Contract Completion date, major milestone dates, and a critical path.
- 5. The schedule shall be printed on a maximum 11 x 17-inch size paper. If the OPS needs to be shown on multiple sheets, a simplified, one page, summary bar chart showing the entire Project shall be provided.
- 6. The schedule shall have a horizontal time scale based on calendar days and shall identify the Monday of each week.
- 7. The schedule shall show the precedence relationship for each activity.

# 1.5 Near Term Schedule (NTS)

- A. The Contractor shall develop and refine a detailed Near Term Schedule showing the day to day activities with committed completion dates which must be performed during the upcoming 30-day period. The detailed schedule shall represent the Contractor's best approach to the Work which must be accomplished to maintain progress consistent with the Overall Project Schedule.
- B. The Near Term Schedule shall be in the form of Gantt/bar chart and shall include a written narrative description of all activities to be performed and describe corrective action to be taken for items that are behind schedule.

# 1.6 Updating

- A. Show all changes occurring since previous submission of the updated schedule.
- B. Indicate progress of each activity and show actual completion dates.
- C. The Contractor shall be prepared to provide a narrative report at the Progress Meetings. The report shall include the following:
  - 1. A description of the overall Project status and comparison to the OPS.

Construction Schedules

- 2. Identify activities which are behind schedule and describe corrective action to be taken.
- 3. A description of changes or revisions to the Project and their effect on the OPS.
- 4. A description of the Near Term Schedule of the activities to be completed during the next 30 days. The report shall include a description of all activities requiring participation by the Engineer and/or Owner.

# Part 2 Products

(NOT USED)

# Part 3 Execution

(NOT USED)

**END OF SECTION** 

# Construction Videos and Photographs

### Part 1 General

## 1.1 Scope

- A. The Contractor shall furnish all equipment and labor materials required to provide the Owner with digital construction videos and photographs of the Project.
- B. Photo and video files shall become the property of the Owner and none of the videos or photographs shall be published without express permission of the Owner.

## 1.2 Pre and Post Construction Videos and Photographs

- A. Prior to the beginning of any work, the Contractor shall take videos and photographs of the work area to record existing conditions.
- B. Following completion of the work, another set of videos and photographs shall be made showing the same areas and features as in the pre-construction videos and photographs.
- C. All conditions which might later be subject to disagreement shall be shown in sufficient detail to provide a basis for decisions.

## 1.3 File Format, Media and Submittals

- A. Photographs shall be in "jpg" format.
- B. Videos shall be in a format viewable by Microsoft Windows Media Player or Apple QuickTime Player. Audio narration is desirable.
- C. Files shall be named such that what is being viewed is self evident.
- D. Files shall be submitted on a flash drive, compact disk (CD) or a digital video disk (DVD). If submitted on DVD, disk shall be recorded in "Minus R" format.
- E. The pre-construction videos and photographs shall be submitted to the Engineer within 25 calendar days after the date of receipt by the Contractor of Notice to Proceed. Post-construction videos and photographs shall be provided prior to final acceptance of the Project.

## Part 2 Products

(NOT USED)

Construction Videos and Photographs

# Part 3 Execution

(NOT USED)

**END OF SECTION** 

### Submittal Procedures

## Part 1 General

# 1.1 Requirements Included

- A. Submittal Procedures
- B. Quality Assurance
- C. Product Data
- D. Manufacturer's Instructions
- E. Manufacturers' Certificates
- F. Samples
- G. Field Samples
- H. Submittal Schedule
- I. Shop Drawings and Coordination of Drawings
- J. Manufacturer's Literature
- K. Samples
- L. Colors and Patterns
- M. Identification of Submittals
- N. Coordination of Submittals
- O. Timing of Submittals
- P. Engineer's Review
- Q. Resubmission Requirements

### 1.2 Submittal Procedures

A. Submittals shall be emailed, or if mailed, two copies for Engineer records, one copy for Owner, (total of three copies) plus Contractor's requirement.

Email or deliver mail submittals to:

Barge Design Solutions, Inc. Attention: Garett Younanian 200 Clinton Avenue, Suite 800 Huntsville, Alabama 35801

Email: Garett.Younanian@bargedesign.com

#### Submittal Procedures

- B. Transmit each item under Engineer-accepted form. Submittals shall contain following information:
  - 1. Date of submittal and dates of any previous submittals.
  - 2. Project Title
  - 3. Number submittals beginning with 001, 002, etc. For resubmittals, append the letter A, B, etc. to the corresponding submittal number.
  - 4. Names of Contractor, subcontractor, supplier and manufacturer, as appropriate.
  - 5. Identification of pertinent Drawing sheet and detail number, Specification Section number, and equipment tag number as appropriate.
  - 6. Field dimensions clearly identified as such.
  - 7. Relation to adjacent or critical features of the work or materials.
  - 8. Applicable standards, such as ASTM or Federal Specification numbers.
  - 9. Identification in writing of deviations from requirements of Contract Documents.
  - 10. An 8 x 3-inch blank space for Contractor and Engineer review stamps.
  - 11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- C. Submittals shall only be accepted from Contractor.
- D. Submittal sheets or Drawings showing more than the particular item under consideration shall have all but the pertinent description of the item for which review is requested crossed out.
- E. Within seven days of notification of award of the Contract or at the Pre-Construction Conference whichever is later, submit the following:
  - 1. Complete list of proposed subcontractors.
  - 2. Complete list of materials suppliers, including brand names (to be furnished as outlined in Instructions to Bidders).
  - 3. Complete list of major equipment suppliers, including model numbers for identification.
- F. Within 20-days of after execution of the Contract between Owner and General Contractors or at the Pre-Construction Conference, whichever is sooner, submit:
  - 1. Complete construction progress schedule as described elsewhere in this section.
  - 2. Two copies of the schedule of shop drawing submittals as described elsewhere in this section.
  - 3. Schedule of values broken down in sufficient detail to assess progress of the work and evaluate monthly pay requests.
- G. Within 30-days after execution of the Contract between Owner and General Contractor, submit:
  - 1. All required samples for color selection under one cover letter or transmittal letter.
  - 2. Comparative literature and samples required for architectural product substitutions.

- 3. Any mock-up or model of the work to be built that may be required by the Contract Documents.
- H. Comply with progress schedule for submittals related to work progress. Coordinate submittal of related items.
- I. After Engineer review of submittal, revise and resubmit as required, identifying changes made since previous submittal.
- J. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

## 1.3 Quality Assurance

#### A. Description of Work Included

- 1. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by a manufacturer's name and catalogue number, reference to recognized industry and government standards, or description of required attributes and performance.
- 2. To ensure that the specified products are furnished and installed in accordance with the design intent, procedures have been established for advance submittal of design data and for their review by the Engineer.
- 3. Make all submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements.

### B. Coordination of Submittals

- 1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal for it conforms in all respects with the requirements of the bidding instruments.
- 2. Shop drawings and submittals shall bear the stamp of approval of the Contractor as evidence that this coordination has been performed. Submittals without this stamp of approval will not be considered but will be returned for proper resubmission.

#### C. Certificates of Compliance

- 1. Certify that all materials used in the work comply with all specified provisions thereof. Certification shall not be construed as relieving the Contractor from the responsibility to furnish satisfactory materials if, after tests are performed on selected samples, the material is found not to meet specified requirements.
- 2. Show on each certification the name and location of the work, the name and address of the Contractor, the quantity and date or dates of shipment or delivery to which the certificate applies, and the name of the manufacturing or fabricating company. Certification shall be in the form of a letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.
- 3. In addition to the above information, all laboratory test reports submitted with certificates of compliance shall show the date or dates of testing, the specified requirements for which testing was performed, and the results of the test or tests.

#### 1.4 Product Data

### A. Preparation:

- 1. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturer's standard data to provide information unique to the work.
- 2. Show performance characteristics and capacities.
- 3. Show dimensions and clearances required.
- 4. Show wiring or piping diagrams and controls.

### B. Manufacturer's standard schematic drawings and diagrams:

- 1. Modify drawings and diagrams to delete information which is not applicable to the Work.
- 2. Supplement standard information to provide information specifically applicable to work.
- C. After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01 78 00 Contract Closeout Documents.

### 1.5 Manufacturer's Instruction

- A. When required in individual specification section, submit manufacturer's printed instructions for delivery, storage, assembly, installation start-up, adjusting, and finishing, in quantities specified for product data.
- B. Identify conflicts between manufacturer's instructions and Contract Documents.

#### 1.6 Manufacturer's Certification

- A. When required in individual specification section, submit manufacturer's certificate to Engineer for review.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Products, but must be acceptable to Engineer.
- D. Submit in quantities specified for product data.

## 1.7 Samples

A. Submit full range of manufacturer's standard colors, textures, and patterns for Engineer's selection.

- B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.
- C. Include identification on each sample, giving full information.
- D. Submit the number specified in respective specification section, one will be retained by Engineer. Reviewed samples which may be used in the work are indicated in the Specification Section.

# 1.8 Field Samples

A. Provide field samples of finishes at Project as required by individual Specifications section. Install sample complete and finished. Acceptable samples in place may be retained in completed work.

## Part 2 Products

### 2.1 Submittal Schedule

- A. General: Compile a complete and comprehensive schedule of all submittals anticipated to be made during the progress of the work. Include a list of each type of item from which the Contractor's drawings, shop drawings, certificates of compliance, material samples, guarantees, or other types of submittals are required. Upon approval by the Engineer, this schedule will become part of the Contract, and the Contractor will be required to adhere to the schedule except when specifically otherwise permitted.
- B. Coordination: Coordinate the schedule with all necessary subcontractors and materials suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure the grouping of submittals as described in Article 3.2 of this section.
- C. Revisions: Revise and update the schedule on a monthly basis as necessary to reflect conditions and sequences. Promptly submit the revised schedules to the Engineer for review and comment.

# 2.2 Shop Drawings and Coordination of Drawings

- A. Shop drawings shall include technical data, drawings, diagrams, procedure and methodology, performance curves, schedules, templates, patterns, test reports, calculations, instructions, measurements and similar information as applicable to the specific item for which the shop drawing is prepared.
- B. Drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to sheet and detail, Specification Section, schedule or room numbers shown on the Contract Drawings.
- C. Provide newly prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated) or appropriate number of prints

#### Submittal Procedures

hereof, with name or preparer (firm name) indicated. The Contract Drawings shall not be traced or reproduced by any method for use as or in lieu of detail shop drawings. Show dimensions and note dimensions that are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawings to be used in connection with the work without appropriate final "Action" markings by the Engineer.

- 1. Minimum assembly drawings sheet size shall be 11 x 17 inches.
- 2. Minimum detail sheet size shall be 8 1/2 x 11 inches.
- Minimum Scale:
  - a. Assembly Drawings Sheet, Scale: 1 inch = 30 feet.
  - b. Detail Sheet, Scale: 1/4 inch = 1 foot.
- D. When approved by the Engineer, electronic files may be submitted on a CD in .pdf format.
- E. Submit the number of copies which are required to be returned (not to exceed three) plus three copies which will be retained by the Engineer.
- F. Shop drawings prepared from facsimiles will not be permitted.

### 2.3 Manufacturer's Literature

- A. Where the contents of submitted literature from the manufacturer includes data not pertinent to the submittal, clearly indicate which portion of the contents is being submitted for review.
- B. Submit the number of copies which are required to be returned (not to exceed three) plus three copies which will be retained by the Engineer.

# 2.4 Samples

- A. Samples shall illustrate materials, equipment or workmanship and established standards by which completed work is judged.
- B. Unless otherwise specifically directed by the Engineer, all samples shall be of the precise article proposed to be furnished. Include "range" samples, not less than three units, where unavoidable variations must be expected, and describe or identify variations between units of each set. Provide full set of optional samples where the Engineer's selection is required. Prepare samples to match the Engineer's sample where indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by the Engineer. Engineer will note "test" samples, except as otherwise indicated, for other requirements, which are the exclusive responsibility of the Contractor.
- C. Number of Samples Required: Unless otherwise specified, submit all samples in the quantity that is required to be returned plus 1 copy to be retained by the Engineer.

D. Reuse of Samples: In situations specifically so approved by the Engineer, the Engineer's retained sample may be used in the construction as one of the installed items.

### 2.5 Colors and Patterns

- A. Unless the precise color and pattern are specifically described in the Contract Documents, and whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern charts to the Engineer for review and selection.
- B. Unless all available colors and patterns have identical costs and identical wearing capabilities, are identically suited to the installation, completely describe the relative costs and capabilities of each.

### Part 3 Execution

#### 3.1 Identification of Submittals

- A. General: Consecutively number all submittals as well as reference specification section numbers. Each submittal shall be accompanied with a letter of transmittal that itemizes all data transmitted and that contains all pertinent information required for identification and checking of submittals.
- B. Internal Identification: On at least the first page of each copy of each submittal, and elsewhere as required for positive identification, clearly indicate the submittal number in which the time was included.
- C. Resubmittals: When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new submittal number.
- D. Submittal Log: Maintain an accurate submittal log for the duration of the Contract that shows the current status of all submittals at all times. Make the submittal log available for the Engineer's review upon request.

### 3.2 Coordination of Submittals

- A. General: Prior to submittal for approval, use all means necessary to coordinate fully all material, including but not necessarily limited to the following:
  - 1. Determine and verify all field dimensions, interface conditions, catalogue numbers, and similar data.
  - 2. Coordinate with other trades and governing agencies as required.
  - 3. Submittals shall contain rating data on equipment and accessories. Features shall be described as specified herein, and capacities shall be stated in the same terms as those specified.
  - 4. Submit a written statement of review and compliance with the requirements of all applicable technical Specifications as well as the requirements of this Section.
  - 5. Clearly indicate in a letter or memorandum on the manufacturer's or fabricator's letterhead all deviations from the Contract Documents on the submittal. If no

deviations are noted, it is assumed that the material fully meets the specified requirements; therefore, the Contractor shall not be relieved of the responsibility for executing the work in accordance with the contract.

- B. Grouping of Submittals: Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents, and the Contractor shall be strictly liable for all delays so occasioned.
- C. Each and every copy of the shop drawings and data shall bear the Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement.
- D. The Owner may back-charge the Contractor for costs associated with having to review a particular shop drawing, product data or sample more than two times to receive a "No Exceptions Taken" mark.

## 3.3 Timing of Submittals

#### A. General:

- 1. Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
- 2. Submit shop drawings in accordance with the approved schedule of shop drawing submittals.

#### B. Engineer's Review Time:

- 1. In scheduling, allow at least twenty (20) working days for review by the Engineer following his receipt of the submittal, except allow longer periods where processing must be delayed for coordination with subsequent submittals. The Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.
- 2. Allow a minimum of ten (10) working days for reprocessing each submittal.
- 3. Advise the Engineer on each submittal as to whether processing time is critical to progress of the work, and therefore the work would be expedited if processing time could be foreshortened.
- C. Delays: Delays caused by tardiness of submittals will not be an acceptable basis for extension of the Contract completion date.

# 3.4 Engineer's Review

A. Acceptable submittals will be marked "No Exceptions Taken". A minimum of three copies will be retained by the Engineer for Engineer's and the Owner's use and the remaining copies will be returned to the Contractor.

- B. Submittals requiring minor corrections before the product is acceptable will be marked "Make Corrections Noted". The Contractor may order, fabricate and ship the items included in the submittals, provided the indicated corrections are made. Drawings must be resubmitted for review and marked "No Exceptions Taken" prior to installation or use of products.
- C. Submittals marked "Amend and Resubmit" must be revised to reflect required changes and the initial review procedure repeated.
- D. The "Rejected See Remarks" notation is used to indicate products which are not acceptable. Upon return of a submittal so marked, the Contractor shall repeat the initial review procedure utilizing acceptable products.
- E. Only two copies of items marked "Amend and Resubmit" and "Rejected See Remarks" will be reviewed and marked. One copy will be retained by the Engineer and the other copy with all remaining unmarked copies will be returned to the Contractor for resubmittal.
- F. No work or products shall be installed without a drawing or submittal bearing the "No Exceptions Taken" notation. The Contractor shall maintain at the job site a complete set of shop drawings bearing the Engineer's stamp.
- G. Substitutions: In the event the Contractor obtains the Engineer's approval for the use of products other than those which are listed first in the Contract Documents, the Contractor shall, at the Contractor's own expense and using methods approved by the Engineer, make any changes to structures, piping and electrical work that may be necessary to accommodate these products.
- H. Use of the "No Exceptions Taken" notation on shop drawings or other submittals is general and shall not relieve the Contractor of the responsibility of furnishing products of the proper dimension, size, quality, quantity, materials and all performance characteristics, to efficiently perform the requirements and intent of the Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for errors of any kind on the shop drawings. Review is intended only to assure conformance with the design concept of the Project and compliance with the information given in the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site. The Contractor is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the work of all trades.
- I. Revisions After Approval: When a submittal has been reviewed by the Engineer, resubmittal for substitutions of materials or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary. The Engineer will also be reimbursed for his time at a rate of \$100.00 per hour.

## 3.5 Resubmission Requirements

#### A. Shop Drawings

1. Revise initial Drawings as required and resubmit as specified for initial submittal, with the resubmittal number shown.

## Submittal Procedures

- 2. Indicate on Drawings all changes which have been made other than those requested by the Engineer.
- B. Project Data and Samples: Resubmit new data and samples as specified for initial submittal, with the resubmittal number shown.

**END OF SECTION** 

# **Quality Requirements**

## Part 1 General

## 1.1 Summary

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services for concrete and compaction are being provided by the Owner. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements. Testing to be proved by OMI, Inc.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect/Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. Specific test and inspection requirements are not specified in this Section.

### 1.2 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 Architect/Engineer/Engineer.
- C. Retain "Mockups" Paragraph below if Project requires mockups. Revise if any mockups are to be constructed at an off-site location.
- D. 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.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or

### **Quality Requirements**

compliance with specified criteria.

- 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.

## 1.3 Conflicting Resolutions

- A. "Referenced Standards" Paragraph below may resolve issues that sometimes arise when using referenced standards due to conflicting requirements in the Contract Documents. Coordinate with Conditions of the Contract. Revise to suit Project, office policy, and Owner's requirements.
- B. 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 Architect/Engineer for a decision before proceeding.
- C. 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 Architect/Engineer for a decision before proceeding.

### 1.4 Informational Submittals

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.

- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - 4. Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.
  - 7. Time schedule or time span for tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.

# 1.5 Contractor's Quality Control plan

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect/Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's qualityassurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractorelected tests and inspections.
- A. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- B. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect/Engineer has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities

### **Quality Requirements**

having jurisdiction.

## 1.6 Reports and Documents

- A. Test and Inspection Reports not being performed by Owner's Testing Agency: Prepare and submit certified written reports specified in other Sections. 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 re-inspecting.
- 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.

# 1.7 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 inservice 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 as-

- sembling 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 products that are similar in material, design, and extent to those indicated for this Project.
- F. 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:
    - 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. Provide sizes and configurations of mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. First subparagraph below attempts to ensure that tested assemblies will be representative of actual construction. This requirement may complicate testing and add cost.
    - e. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
- G. 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 Architect/Engineer.
  - 2. Notify Architect/Engineer seven days in advance of dates and times when mockups will be constructed.
  - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
  - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 5. Obtain Architect/Engineer's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 7. Demolish and remove mockups when directed unless otherwise indicated.

## 1.8 Quality Control

- 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. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
- 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- 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. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 2. 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.
  - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect/Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect/Engineer 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.
- E. 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.
- F. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
  - 1. Distribution: Distribute schedule to Owner, Architect/Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## Part 2 Products (Not Used)

### Part 3 Execution

## 3.1 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/Engineer.
  - 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 Architect/Engineer's reference during normal working hours.

# 3.2 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.
- B. Protect construction exposed by or for quality-control service activities.

## **Quality Requirements**

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION** 

### Part 1 General

## 1.1 Description

- A. Whenever reference is made to conforming to the standards of any technical society, organization, body, code or standard, it shall be construed to mean the latest standard, code, specification or tentative specification adopted and published at the time of advertisement for bids. This shall include the furnishing of materials, testing of materials, fabrication and installation practices. In those cases where the Contractor's quality standards establish more stringent quality requirements, the more stringent requirement shall prevail. Such standards are made a part hereof to the extent which is indicated or intended.
- B. The inclusion of an organization under one category does not preclude that organization's standards from applying to another category.
- C. In addition, all work shall comply with the applicable requirements of local codes, utilities and other authorities having jurisdiction.
- D. All material and equipment, for which a UL Standard, an AGA or NSF approval or an ASME requirement is established, shall be so approved and labeled or stamped. The label or stamp shall be conspicuous and not covered, painted, or otherwise obscured from visual inspection.
- E. The standards which apply to this Project are not necessarily restricted to those from organizations which are listed in Article 1.2.

## 1.2 Standard Organizations

#### A. Piping and Valves

ACPA American Concrete Pipe Association ANSI American National Standards Institute

API American Petroleum Institute

ASME American Society of Mechanical Engineers

AWWA American Water Works Association

CISPI Cast Iron Soil Pipe Institute

DIPRA Ductile Iron Pipe Research Association

FCI Fluid Controls Institute

MSS Manufacturers Standardization Society

NCPI National Clay Pipe Institute NSF National Sanitation Foundation

PPI Plastic Pipe Institute
Uni-Bell PVC Pipe Association

#### B. Materials

AASHTO American Association of State Highway and Transportation Officials

ANSI American National Standards Institute

ASTM American Society for Testing and Materials

### C. Painting and Surface Preparation

NACE National Association of Corrosion Engineers

SSPC Steel Structures Painting Council

#### D. Electrical and Instrumentation

AEIC Association of Edison Illuminating Companies
AIEE American Institute of Electrical Engineers

AIEE American Institute of Electrical Engineers
EIA Electronic Industries Association

ICEA Insulated Cable Engineers Association
IEC International Electrotechnical Commission
IEEE Institute of Electrical and Electronic Engineers

IES Illuminating Engineering Society IPC Institute of Printed Circuits

IPCEA Insulated Power Cable Engineers Association

ISA The Instrumentation, Systems, and Automation Society

NEC National Electric Code

NEMA National Electrical Manufacturers Association

NFPA National Fire Protection Association REA Rural Electrification Administration

TIA Telecommunications Industries Association

UL Underwriter's Laboratories

VRCI Variable Resistive Components Institute

### E. Aluminum

AA Aluminum Association

AAMA American Architectural Manufacturers Association

#### F. Steel and Concrete

ACI American Concrete Institute

AISC American Institute of Steel Construction, Inc.

AISI American Iron and Steel Institute
CRSI Concrete Reinforcing Steel Institute
NRMA National Ready-Mix Association
PCA Portland Cement Association
PCI Prestressed Concrete Institute

### G. Welding

ASME American Society of Mechanical Engineers

AWS American Welding Society

### H. Government and Technical Organizations

AIA American Institute of Architects
APHA American Public Health Association

APWA American Public Works Association ASA American Standards Association

ASAE American Society of Agricultural Engineers

ASCE American Society of Civil Engineers
ASQC American Society of Quality Control
ASSE American Society of Sanitary Engineers

CFR Code of Federal Regulations

CSI Construction Specifications Institute
EDA Economic Development Administration
EPA Environmental Protection Agency
FCC Federal Communications Commission

FmHA Farmers Home Administration

FS Federal Specifications

IAI International Association of IdentificationISEA Industrial Safety Equipment AssociationISO International Organization for Standardization

ITE Institute of Traffic Engineers

NBFU National Board of Fire Underwriters (NFPA) National Fluid Power Association NBS National Bureau of Standards

NISO National Information Standards Organization
OSHA Occupational Safety and Health Administration

SI Salt Institute

SPI The Society of the Plastics Industry, Inc. USDC United States Department of Commerce

WEF Water Environment Federation

### I. General Building Construction

AHA American Hardboard Association

AHAM Association of Home Appliance Manufacturers
AITC American Institute of Timber Construction

APA American Parquet Association, Inc. APA American Plywood Association

BHMA Builders Hardware Manufacturers Association

BIFMA Business and Institutional Furniture Manufacturers Association

DHI Door and Hardware Institute

FM Factory Mutual Fire Insurance Company HPMA Hardwood Plywood Manufacturers Association

HTI Hand Tools Institute

IME Institute of Makers of Explosives

ISANTA International Staple, Nail and Tool Association

ISDSI Insulated Steel Door Systems Institute
IWS Insect Screening Weavers Association
MBMA Metal Building Manufacturers Association

NAAMM National Association of Architectural Metal Manufacturers
NAGDM National Association of Garage Door Manufacturers
NCCLS National Committee for Clinical Laboratory Standards

NFPA National Fire Protection Association NFSA National Fertilizer Solutions Association NKCA National Kitchen Cabinet Association

NWMA National Woodwork Manufacturers Association NWWDA National Wood Window and Door Association

RMA Rubber Manufacturers Association SBC SBCC Standard Building Code

SDI Steel Door Institute

SIA Scaffold Industry Association
SMA Screen Manufacturers Association

SPRI Single-Ply Roofing Institute
TCA Tile Council of America
UBC Uniform Building Code

### J. Roadways

AREA American Railway Engineering Association

DOT Department of Transportation

### K. Plumbing

AGA American Gas Association
NSF National Sanitation Foundation
PDI Plumbing Drainage Institute
SPC SBCC Standard Plumbing Code

#### L. Refrigeration, Heating, and Air Conditioning

AMCA Air Movement and Control Association

ARI American Refrigeration Institute

ASHRAE American Society of Heating, Refrigeration, and Air Conditioning Engineers

ASME American Society of Mechanical Engineers

CGA Compressed Gas Association

CTI Cooling Tower Institute
HEI Heat Exchange Institute

IIAR International Institute of Ammonia Refrigeration

NB National Board of Boilers and Pressure Vessel Inspectors

PFMA Power Fan Manufacturers Association SAE Society of Automotive Engineers

SMACNA Sheet Metal and Air Conditioning Contractors National Association

SMC SBCC Standard Mechanical Code

TEMA Tubular Exchangers Manufacturers Association

#### M. Equipment

AFBMA Anti-Friction Bearing Manufacturers Association, Inc.

AGMA American Gear Manufacturers Association

ALI Automotive Lift Institute

CEMA Conveyor Equipment Manufacturers Association
CMAA Crane Manufacturers Association of America
DEMA Diesel Engine Manufacturers Association
MMA Monorail Manufacturers Association
OPEI Outdoor Power Equipment Institute, Inc.

PTI Power Tool Institute, Inc.

RIA Robotic Industries Association

SAMA Scientific Apparatus Makers Association

# 1.3 Symbols

Symbols and material legends shall be as scheduled on the Drawings.

## Part 2 Products

(NOT USED)

## Part 3 Execution

(NOT USED)

**END OF SECTION** 

# **Testing Laboratory Services**

## Part 1 General

## 1.1 Scope

- A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.
- B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, i.e., concrete strength and slump testing, soil compaction, etc.
- C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer, e.g., testing of pipe.
- D. The testing laboratory or laboratories will be selected by the Owner. The testing laboratory or laboratories will work for the Owner.

## 1.2 Payment for Testing Services

- A. The cost of testing services required by the Contract to be provided by the Contractor shall be paid for by the Contractor i.e., concrete testing, soil compaction, and asphalt testing.
- B. The cost of additional testing services not specifically required in the Specifications, but requested by the Owner or Engineer, shall be paid for by the Owner through the CASH ALLOWANCE.
- C. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.
- D. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the Contractor. Retesting shall be performed by the testing laboratory working for the Owner.

# 1.3 Laboratory Duties

- A. Cooperate with the Owner, Engineer and Contractor.
- B. Provide qualified personnel promptly on notice.
- C. Perform specified inspections, sampling and testing of materials.
  - 1. Comply with specified standards, ASTM, other recognized authorities, and as specified.

#### **Testing Laboratory Services**

- 2. Ascertain compliance with requirements of the Contract Documents.
- D. Promptly notify the Engineer and Contractor of irregularities or deficiencies of work which are observed during performance of services.
- E. Promptly submit three copies (two copies to the Engineer and one copy to the Contractor) of report of inspections and tests in addition to those additional copies required by the Contractor with the following information included:
  - 1. Date issued
  - 2. Project title and number
  - 3. Testing laboratory name and address
  - 4. Name and signature of inspector
  - 5. Date of inspection or sampling
  - 6. Record of temperature and weather
  - 7. Date of test
  - 8. Identification of product and Specification section
  - 9. Location of Project
  - 10. Type of inspection or test
  - 11. Results of test
  - 12. Observations regarding compliance with the Contract Documents
- F. Perform additional services as required.
- G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the work.

# 1.4 Contractor Responsibilities

- A. Cooperate with laboratory personnel, provide access to work and/or comply with manufacturer's requirements.
- B. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.
- C. Furnish copies of mill test reports.
- D. Furnish required labor and facilities to:

- 1. Provide access to work to be tested;
- 2. Obtain and handle samples at the site;
- 3. Facilitate inspections and tests;
- 4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.
- E. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.
- F. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at Contractor's expense.
- G. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Engineer.

## 1.5 Quality Assurance

Testing shall be in accordance with all pertinent codes and regulations and with procedures and requirements of the American Society for Testing and Materials (ASTM).

## 1.6 Product Handling

Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting or replacement of materials with the least possible delay in the progress of the work.

# 1.7 Furnishing Materials

The Contractor shall be responsible for furnishing all materials necessary for testing.

## 1.8 Code Compliance Testing

Inspections and tests required by codes or ordinances or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of, and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

# 1.9 Contractor's Convenience Testing

Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

**Testing Laboratory Services** 

# 1.10 Schedules for Testing

### A. Establishing Schedule

- 1. The Contractor shall, by advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.
- 2. Provide all required time within the construction schedule.
- B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.
- C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

## 1.11 Taking Specimens

Unless otherwise provided in the Contract Documents, all specimens and samples for tests will be taken by the testing laboratory or the Engineer.

# 1.12 Transporting Samples

The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

### Part 2 Products

(NOT USED)

## Part 3 Execution

(NOT USED)

**END OF SECTION** 

### Part 1 General

## 1.1 Scope

- A. Temporary facilities required for this work include, but are not necessarily limited to:
  - 1. Temporary utilities such as water and electricity.
  - 2. First aid facilities.
  - 3. Sanitary facilities.
  - 4. Potable water.
  - 5. Temporary enclosures and construction facilities.

### 1.2 General

- A. First aid facilities, sanitary facilities and potable water shall be available on the Project site on the first day that any activities are conducted on site. The other facilities shall be provided as the schedule of the Project warrants.
- B. Maintenance: Use all means necessary to maintain temporary facilities in proper and safe condition throughout progress of the work. In the event of loss or damage, immediately make all repairs and replacements necessary, at no additional cost to the Owner.
- C. Removal: Remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

# 1.3 Quality Assurance

A. Temporary Electric: Installation of all temporary electric facilities shall comply with NECA, NEMA and UL standards and regulations for such facilities. Install service to comply with NFPA 70.

# 1.4 Temporary Utilities

#### A. General

- 1. Provide and pay all costs for all water, electricity and other utilities required for the performance of the work.
- 2. Pay all costs for temporary utilities until Project completion.
- 3. Costs for temporary utilities shall include all power, water and the like necessary for testing equipment as required by the Contract Documents.

#### B. Temporary Water:

- 1. Connect public water system. Provide reduced pressure backflow prevention.
- 2. Provide all necessary temporary piping. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing, as necessary.
- 3. Upon completion of the Work, remove all such temporary piping.

#### **Temporary Facilities**

4. Provide and remove water meters, as required by governing authority.

### C. Temporary Electricity:

- 1. Provide all necessary wiring for the Contractor's use.
- 2. Provide main service disconnect and over-current protection at convenient location.
- 3. Furnish, locate and install area distribution boxes such that the individual trades may use their own construction type extension cords to obtain adequate power, and artificial lighting at all points where required by inspectors and for safety.
- 4. Existing receptacles may not be utilized during construction.
- 5. If existing site lighting is disabled during construction, provide and maintain temporary lighting to exterior work areas for routine plant operations.

### D. Temporary Sewer Facilities:

- 1. Prior to starting the work, the Contractor shall furnish, for use of Contractor's personnel on the job, all necessary toilet facilities which shall be secluded from public observation. These facilities shall be portable, chemical toilets.
- 2. All facilities, regardless of type, shall be kept in a clean and sanitary condition and shall comply with the requirements and regulations of the area in which the work is performed. Adequacy of these facilities will be subject to the Owner's review and maintenance of same must be satisfactory to the Owner at all times.

### E. Telephone Service:

1. Provide superintendent with cellular telephone for use when away from field office or where field office is not required.

### 1.5 First Aid Facilities

A. The Contractor shall provide a suitable first aid station, equipped with all facilities and medical supplies necessary to administer emergency first aid treatment. The Contractor shall have standing arrangements for the removal and hospital treatment of any injured person. All first aid facilities and emergency ambulance service shall be made available by the Contractor to the Owner and the Owner's personnel.

### 1.6 Potable Water

A. The Contractor shall be responsible for furnishing a supply of potable drinking water for employees, subcontractors, inspectors, consultants and the Owner who are associated with the work.

### 1.7 Enclosures and Construction Facilities

A. Furnish, install and maintain all temporary construction necessary for proper completion of the work in compliance with all pertinent safety and other regulations.

## 1.8 Parking Facilities

- A. Parking for General Contractor and subcontractor personnel will be provided within a designated area of the existing parking lots to the east and west of the site
- B. Maintain all roads, both temporary and permanent, in passable condition for all traffic. Any road blockage shall be coordinated with Engineer, Owner, and governing authorities.

### 1.9 Field Office

- A. Contractor's Office: General Contractor to provide a weather-tight, central facility for storage of all project documents.
- B. Project meetings will be held Guntersville Parks and Recreation offices at 1500 Sunset Drive, adjacent to the project site.

### 1.10 Removal

- A. Clean and repair damage caused by installation or use of temporary facilities.
- B. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

## Part 2 Products

(NOT USED)

### Part 3 Execution

(NOT USED)

**END OF SECTION** 

## **Temporary Barriers and Enclosures**

## Part 1 General

### 1.1 Section Includes

- A. Temporary Barricades.
- B. Temporary Fencing.

## 1.2 Barricades, Lights and Signals

- A. The Contractor shall furnish and erect such barricades, fences, lights and danger signals and shall provide such other precautionary measures for the protection of persons or property and of the work as necessary. Barricades shall be painted in a color that will be visible at night. From sunset to sunrise, the Contractor shall furnish and maintain at least one light at each barricade and sufficient numbers of barricades shall be erected to keep vehicles from being driven on or into any work under construction.
- B. The Contractor will be held responsible for all damage to the work due to failure of barricades, signs and lights and whenever evidence is found of such damage, the Contractor shall immediately remove the damaged portion and replace it at Contractor's cost and expense. The Contractor's responsibility for the maintenance of barricades, signs and lights shall not cease until the Project has been accepted by the Owner.
- C. Traffic control devices shall comply with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways.

# 1.3 Temporary Fencing

- A. Provide fencing along the construction site at all open excavations to control access by unauthorized people.
  - 1. The safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on maximum 10 foot centers, constructed at the approved location. Install fencing to be able to restrain a force of at least 250 pounds against it.
  - 2. In addition, prior to the start of work, enclose those areas at the construction site which are not within the construction fence with a temporary safety fence, including gates and warning signs, to protect the public from construction activities. The safety fence shall be bright orange where it protects excavated areas, shall be made of high-density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly secured to steel posts located on minimum 10 foot centers. Remove the fence from the work site upon completion of the contract.

## Part 2 Products

(NOT USED)

Temporary Barriers and Enclosures

# Part 3 Execution

(NOT USED)

**END OF SECTION** 

## Part 1 General

## 1.1 Scope

A. Limit blowing dust caused by construction operations by applying water or employing other appropriate means or methods to maintain dust control, subject to the approval of the Owner. As a minimum, this may require the use of a water wagon twice a day to suppress dusty conditions.

# 1.2 Protection of Adjacent Property

- A. The Bidders shall visit the site and note the buildings, landscaping, roads, parking areas and other facilities near the work site that may be damaged by their operations. The Contractor shall make adequate provision to fully protect the surrounding area and will be held fully responsible for all damages resulting from Contractor's operations.
- B. Protect all existing facilities (indoors or out) from damage by dust, fumes, spray or spills (indoors or out). Protect motors, bearings, electrical gear, instrumentation and building or other surfaces from dirt, dust, welding fumes, paint spray, spills or droppings causing wear, corrosion, malfunction, failure or defacement by enclosure, sprinkling or other dust palliatives, masking and covering, exhausting or containment.

**END OF SECTION** 

## Temporary Tree and Plant Protection

### Part 1 General

## 1.1 Summary

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

### 1.2 Definitions

- A. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape or at a height 54 inches above the ground line.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

## 1.3 Preinstallation Meeting

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
    - a. Quality-control program.
    - b. Coordination of Work and equipment movement with the locations of protection zones.
    - c. Field quality control.

### 1.4 Field Conditions

- A. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Moving or parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

### Part 2 Products

### 2.1 Materials

- A. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements: Previously used materials may be used when approved by Architect/Engineer.
  - 1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.
    - a. Height: 48 inches.
    - b. Color: High-visibility orange, nonfading.

### Part 3 Execution

### 3.1 Examination

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

# 3.2 Preparation

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated on the drawings. Do not exceed indicated thickness of mulch.
  - 1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

### 3.3 Protection Zones

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering

protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

- B. Maintain protection zones free of weeds and trash.
- C. Maintain protection-zone fencing in good condition as acceptable to Architect/Engineer and remove when construction operations are complete and equipment has been removed from the site.
  - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
  - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

#### 3.4 Excavation

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 20 00 "Earth Moving" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

## 3.5 Regrading

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

### Temporary Tree and Plant Protection

- 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

## 3.6 Repair and Replacement

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect/Engineer.
  - 1. Submit details of proposed pruning and repairs.
  - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
  - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by the Landscape Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect/Engineer determines are incapable of restoring to normal growth pattern.
  - 1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
  - 2. Revise first subparagraph below to suit Project. Replacing larger than 6-inch (150-mm) caliper-size trees with trees of equal size is difficult and not always successful; some jurisdictions have established formulas for large-tree replacements.
  - 3. Plant and maintain new trees as specified in Section 32 90 00 "Exterior Land-scape."
- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

# 3.7 Disposal of Surplus and Waste Materials

- A. General requirements for disposal are specified in Section 02 41 00, Demolition.
- B. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

**END OF SECTION** 

## Part 1 General

### 1.1 Work Included

- A. This Section includes the provisions for the installation and the removal of soil erosion protection and sediment control measures in compliance with the requirements of the Alabama Department of Environmental Management (ADEM) and the National Pollutant Discharge Elimination System (NPDES) program.
- B. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control measures, to ensure economical, effective, and continuous erosion control throughout the construction and post- construction period.
- C. Any required land disturbance permit(s) shall be obtained and paid for by the Contractor.

### 1.2 Reference Standards

- A. ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- B. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units
- C. ASTM C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- D. ASTM C535 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- E. ASTM D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
- F. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3).
- G. ASTM D-1682 Standard Test Methods for Breaking Load and Elongation of Textile Fabrics.
- H. ASTM D-177 Methods of Testing Rubber Hose (Withdrawn 1933)
- I. Alabama Erosion and Sediment Control Handbook, latest edition, as issued by ADEM
- J. AASHTO M-288 Geotextile Specification for Highway Applications
- K. Alabama Department of Transportation (ALDOT) Erosion Prevention and Sediment Control Standard Drawings

## 1.3 Quality Assurance

A. CONTRACTOR is responsible for and must implement all stormwater controls prior to any site work within the project area. Controls must remain in place until after the completion final site stabilization as defined in ALR100000.

#### B. Referenced Standards:

- 1. ADEM General Permit Number ALR100000 General Permit for Stormwater Discharges from Construction Activities, Issued by the Alabama Department of Environment and Conservation, Effective April 1, 2016.
- 2. Erosion control standards specified in the ADEM General Permit relating to discharges of storm water from construction activities.
- 3. Refer to the permit for a complete discussion of the associated requirements.
- C. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Plans are not represented as being comprehensive, but rather to convey the intent to provide complete slope and erosion protection with sediment control for both the Owner's and adjacent property. Any additional erosion and sedimentation control measures required by the Contractor's means, methods, techniques and sequence of operation will be installed by the Contractor at no additional cost to the Owner. Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.
- D. Erosion control measures shall be established before commencing any earth disturbing activities and maintained during the entire duration of construction activities. On-site areas which are subject to severe erosion and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation are to be identified and receive additional erosion protection and sediment control measures.

#### E. Basic Principles

- 1. Coordinate the land disturbance activities to fit the topography, soil types and conditions.
- 2. Minimize the disturbed area and the duration of exposure to erosive elements.
- 3. Provide temporary or permanent stabilization to disturbed areas immediately after rough grading is complete.
- 4. Safely convey run off from the site to a stable outlet to prevent flooding and damage to downstream facilities resulting from increased runoff from the site.
- 5. Retain sediment on site that was generated on site.
- 6. Minimize encroachment upon watercourses.

#### F. Implementation

 The Contractor is solely responsible for the control of erosion within the Project site and the prevention of sedimentation from leaving the Project site or entering waterways.

- 2. The Contractor shall install temporary and permanent erosion and sedimentation controls which will ensure that runoff from the disturbed area of the Project site shall pass through a filter system before exiting the Project site.
- 3. The Contractor shall provide temporary and permanent erosion and sedimentation control measures to prevent silt and sediment from entering the waterways. Where required by regulatory authorities, the Contractor shall obtain a Land Disturbance Permit that allows encroachments on the 60 foot vegetative buffer in specific areas. The Contractor shall exercise extreme care during land disturbance operations within the 60 foot vegetative buffer to prevent degradation of the stream.
- 4. The Contractor shall limit land disturbance activity to those areas shown on the Drawings.
- 5. The Contractor shall maintain erosion and sedimentation control measures within disturbed areas on the entire site at no additional cost to the Owner until the acceptance of the Project. Maintenance shall include mulching, reseeding, clean out of sediment barriers and sediment ponds, replacement of washed out or undermined rip rap and erosion control materials, to the satisfaction of the Engineer.
- 6. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.
- 7. The Contractor shall use all means necessary to control dust on and near the work and all off-site borrow areas, in accordance to the Alabama Erosion and Sediment Control Handbook, latest edition. The Contractor should thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of work on the site.
- 8. Surface water runoff originating upgrade of exposed area shall be controlled to reduce erosion and sediment migration during the period of exposure.
- G. All land-disturbing activities shall be done in accordance with specific regional requirements as to the time of year that clearing can occur on a project due to the presence of endangered or threatened species.

### 1.4 Submittals

- A. Submittals shall be in accordance with Section 01 33 00 and shall include:
- B. Record data for the erosion and sediment control devices.
- C. Joint Notice of Intent with Owner for NPDES permitting.
- D. Joint Notice of Change with owner (if necessary)
- E. NPDES General permit number for the project
- F. Record Data Inspection Reports: Provide inspection procedure and example inspection form to be used on twice weekly basis. Inspections are required to be performed seventy-two (72) hours or more apart each week the site is active. Provide

#### **Erosion Control**

inspection form to document any major grading activities or periods when construction activity ceases for fourteen (14) calendar days or more.

- G. Certification of Completed Plan
- H. Joint Notice of Termination with Owner for NPDES permitting.

### Part 2 Products

### 2.1 Sediment Control Fence

- A. Type A silt fence shall meet the requirements of Alabama Erosion and Sediment Control Handbook, latest edition.
- B. Type C silt fence is a combination of Type A silt fence fabric with woven wire reinforcement. Type C silt fence woven wire reinforcement shall meet the requirements of Alabama Erosion and Sediment Control Handbook, latest edition.
- C. Silt Fence Posts: For silt fence without backing, posts shall be hardwood posts that are 2.25" (nominal) x 2.25" (nominal) x 58". T-type steel posts also may be used. Silt fence with backing shall be installed on painted or galvanized steel TEE or Y-posts with anchor plates, not less than five (5') feet in length with a minimum weight of 1.3 pounds per foot and a minimum Brinell Hardness of 143. Ensure that steel posts have projections for fastening the fabric.
- D. Fasteners for wood posts shall be wire staples or nails. Wire staples shall be minimum 17 gauge, ¾" width, with ½" leg length. Nails shall be minimum 14 gauge, with ¾" button head, and 1" minimum length.

### 2.2 Grass Seed

A. See Section 32 92 19 – SEEDING.

## 2.3 Rolled Erosion Control Products (recps)

- A. Mat to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following design criteria:
  - 1. The type and class of erosion control mat must be specified as appropriate for the slope of the area to be protected and the anticipated length of service.
  - 2. Erosion control mat must meet the applicable Alabama Department of Transportation (ALDOT) Minimum Performance Standards for ALDOT.
- B. Temporary Erosion Control Blankets: Use in concentrated flow areas, all slopes steeper than 3:1 and with a height of ten feet or greater, and cuts and fills within stream buffers, shall be stabilized with the appropriate erosion control matting or blankets.
  - 1. Straw blankets: Shall consist of weed-free straw from agricultural crops formed into a blanket. Blankets shall have a top side of photodegradable plastic mesh

- with a maximum mesh size of  $5/16 \times 5/16$  inch sewn to the straw with biodegradable thread that is appropriate for slopes. The blanket shall have a minimum thickness of 3/8 inch and minimum dry weight of 0.5 pounds per square yard.
- 2. Excelsior blankets: Shall consist of curled wood excelsior (80% of fibers are six inches or longer) formed into a blanket. The blanket shall have clear markings indicating the top side of the blanket and be smolder resistant. Blankets shall have photodegradable plastic mesh having a maximum mesh size of 1- 1/2½ x 3 inches. The blanket shall have a minimum thickness of 1/4 of an inch and a minimum dry weight of 0.8 pounds per square yard. Slopes require excelsior matting with the top side of the blanket covered in the plastic mesh, and for waterways, both sides of the blanket require plastic mesh.
- 3. Coconut fiber blankets: Shall consist of 100% coconut fiber formed into a blanket. The minimum thickness of the blanket shall be 1/4 of an inch with a minimum dry weight of 0.5 pounds per square yard. Blankets shall have photodegradable plastic mesh, with a maximum mesh size of 5/8 x 5/8 inch and sewn to the fiber with a breakdown resistant synthetic yarn. Plastic mesh is required on both sides of the blanket if used in waterways. A maximum of two inches is allowable for the stitch pattern and row spacing.
- 4. Wood fiber blankets: Shall consist of reprocessed wood fibers that does not possess or contain any growth or germination inhibiting factors. The blanket shall have a photodegradable plastic mesh, with a maximum mesh size of 5/8 x 3/4 inch, securely bonded to the top of the mat. The blanket shall have a minimum dry weight of 0.35 pounds per square yard. A maximum of two inches is allowable for the stitch pattern and row spacing. This practice shall be applied only to slopes.
- 5. Jute Mesh: To be applied to slopes. Jute mesh with a 48 inch width shall show between 76 and 80 warpings and a one yard length shall show between 39 to 43 weftings. The woven mesh shall be at least 45 inches wide. Yarn shall have a unit weight of at least 0.9 pounds per square yard, but not more than 1.5 pounds per square yard.
- 6. Anchoring Devices: 11 gauge, at least 6 inches length by 1 inch width, staples or 12 inch minimum length wooden stakes for anchoring the blanket to the ground.
- C. Permanent Matting: Use in concentrated flow areas, all slopes steeper than 3:1 and with a height of ten feet or greater, and cuts and fills within stream buffers, shall be stabilized with the appropriate erosion control matting or blankets.
  - 1. Permanent matting shall consist of a lofty web of mechanically or melt bonded polymer nettings, monofilaments or fibers which are entangled to form a strong and dimensionally stable matrix. Polymer welding, thermal or polymer fusion, or the placement of fibers between two high strength, bi-axially oriented nets bound securely together by parallel lock stitching with polyolefin, nylon or polyester threads are all appropriate bonding methods. Mats shall maintain their shape before, during, and after installation, under dry or water saturated conditions. Mats must be stabilized against ultraviolet degradation and shall be inert to chemicals normally encountered in a natural soil environment.

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2. The mat shall conform to the following physical properties:

Property	Minimum Value
Thickness (inches)	0.5
Weight (#/SY)	0.6
Roll Width (inches)	38
Tensile Strength (lbs./in.)	
(ASTM D 1682-6" strip)	
Length (50% elongation)	15
Length (ultimate)	20
Width (50% elongation)	5
Width (ultimate)	10
Ultraviolet Stability, % (1,000 hrs. in	80
an Atlas ARC Weatherometer,	
ASTM G 23, Type D in accordance	
with ASTM D 822)	

3. Anchoring Materials: Sound wood stakes, 1 x 3 inches stock sawn in a triangular shape, shall be used. Depending on the compaction of the soil, select stakes with a length from 12 to 18 inches. U-shaped staples shall be 11 gauge steel or greater, with legs at a minimum of 8 inches length with a 2 inch crown.

## 2.4 Filter Ring

#### A. Stone Size:

- 1. When utilized at inlets/outlets with diameters less than 12-inches, the filter ring shall be constructed of small riprap, clean from fines, with stone sizes ranging from 2- to 6-inches.
- 2. When utilized at inlets with diameters greater than 12-inches, the filter ring shall be constructed of small riprap, clean from fines, with stone sizes from 2- to 15-inches.
- 3. For added sediment filtering capabilities, the upstream side of the riprap can be faced with smaller coarse aggregate, clean from fines, with a minimum stone size of <sup>3</sup>/<sub>4</sub>-inch.

### 2.5 Channel Stabilization

- A. Vegetated Lining: Vegetated lining shall be designed to resist erosion when the channel is flowing at the 25-year frequency discharge. Temporary erosion control blankets or sod shall be used on all channels and concentrated flow areas to aid in the establishment of the vegetated lining. If a vegetated lining is desired in a channel with velocities between 5- 10 ft./sec., permanent soil reinforcement matting shall be used.
- B. Rock Rip- Rap Lining: Rock rip rap shall be designed to resist displacement when the channel is flowing at the 25-year frequency discharge. Rock rip rap lining should be used when channel velocities are between 5 and 10 ft./sec.

#### C. Concrete Lining

- 1. Concrete shall be constructed in accordance with the plan and details in the Drawings.
- 2. A separation geotextile should be placed under concrete linings to prevent undermining in the event of stress cracks due to settlement of the base material. Geotextiles shall be in accordance with AASHTO M288 Section 7.5, Permanent Erosion Control Requirements.

### 2.6 Geotextile - Erosion Control

- A. Geotextile shall be in accordance with the following criteria:
- B. The geotextile fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, and conform to the properties in the following table.
- C. The geotextile fabric should meet the requirements of the standard specifications for geotextiles, AASHTO designated M-288, erosion control.
- D. The average roll minimum value (weakest principal direction) for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the average roll minimum value (weakest principal direction) stipulated herein.

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Physical Properties	Standard	Average Roll Minimum Value
		(Weakest Principal Direction)
Grab Tensile Strength (lbs.)	ASTM D4632	200
Elongation at Failure (%)	ASTM D4632	15
Mullen Burst Strength (psi)	ASTM D3786	320
Water Flow Rate	ASTM D4491	60
(gal/min/ft²)		
AOS(095) mm	ASTM D4751	0.25
Trapezoid Tear Strength (lbs.)	ASTM D4533	50
Permeability – k	ASTM D4491	0.1
(cm/sec)		
Puncture Resistance (lbs.)	ASTM D4833 (modified)	90

### 2.7 Filter Sock

- A. Furnish materials as follows, unless otherwise shown on the plans.
  - 1. Posts. Furnish metal or wooden posts to be installed for anchoring the mulch socks in place.
  - 2. Filter Sock. Furnish sock material that is 100% biodegradable, photodegradable, or recyclable such as burlap, twine, UV photodegradable plastic, polyester, or any other acceptable material.
  - 3. Mulch. Furnish wood chips produced from a 2 (two) inch minus screening process.

#### **Erosion Control**

- Mulch consists primarily of organic material, separated at the point of generation, and may include shredded bark or stump grindings. No compost will be accepted.
- b. Mulch material must be free of refuse, physical contaminants, and material toxic to plant growth; it is not acceptable for the mulch material to contain ground construction debris, biosolids, or manure.
- c. Large portions of silt, clays, or fine sands are not acceptable in the mulch.

#### 2.8 Check Dams

#### A. Stone Check Dams

- 1. Stone check dams shall be constructed of graded size 2-10-inch stone.
- 2. The geotextile shall be in accordance with AASHTO M288 Section 7.3, Separation Requirements, Table 3.

#### B. Rock Check Dams

- 1. Stone sizing: The stone size shall be determined by the design criteria established in the Rip Rap section Alabama Erosion and Sediment Control Handbook, latest edition. The rock dam can be faced with smaller stone on the upstream side for additional filtering effect.
- 2. Geotextile: Geotextiles shall be used as a separator between the graded stone, the soil base, and the abutments. The geotextile shall be specified in accordance with AASHTO M288 Section 7.5, Permanent Erosion Control Recommendations.

### 2.9 Outlet Protection

- A. The apron shall be lined with riprap, grouted riprap, or concrete. Stone size as indicated for each outlet in the Storm Drain Outlet Protection detail shown in the Drawings.
- B. Select stone for riprap from field stone or quarry stone. The stone should be hard, angular, and highly weather resistant. The specific gravity for the individual stones should be at least 2.5.
- C. A separator must be provided between the riprap and natural ground. Geotextiles shall be used as a separator between the graded stone, the soil base, and the abutments. The geotextile shall be specified in accordance with AASHTO M288-96 Section 7.5, Permanent Erosion Control Recommendations.

## 2.10 Construction Exit

A. Stone: Use sound, tough, durable stone resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Aggregate size shall be #1 or #2 stone (1.5 to 3.5 inch stone).

- B. Geotextile: The geotextile underliner must be placed the full length and width of the entrance. Geotextile selection shall be based on AASHTO M288-98 specification:
  - 1. For subgrades with a CBR greater than or equal to 3 or shear strength greater than 90 kPa, geotextile must meet requirements of section AASHTO M288 Section 7.3, Separation Requirements.
  - 2. For subgrades with a CBR between 1 and 3 or sheer strength between 30 and 90 kPa, geotextile must meet requirements of AASHTO M288 Section 7.4, Stabilization Requirements.

## 2.11 Rip Rap

- A. Stone Rip Rap: Use sound, tough, durable stones resistant to the action of air and water. Slabby or shaley pieces will not be acceptable. Sizes are shown in the Drawings for each design requiring rip rap construction. The following classifications shall be used in the construction of slope or channels as shown on the Drawings:
  - 1. Graded Rip Rap durable, dense, specifically selected and graded, quarried stone, placed to prevent erosion. Sizes shall be in accordance to the Alabama Erosion and Sediment Control Handbook, latest edition.
  - 2. Filter Bedding Stone stone generally less than 6 inches in size, that may be placed under graded rip rap stone in a layer or combination of layers, designed and installed in such a manner as to prevent loss of underlying soil or finer materials because of moving water. Sizes shall be in accordance to the Alabama Erosion and Sediment Control Handbook, latest edition.
  - 3. Surge Stone a quarry run ungraded, unscreened material which may or may not have fines.

# 2.12 Temporary Mulching

- A. Dry straw or hay: Shall be applied at a depth of 2 to 4 inches providing complete soil coverage. Material shall be clean, seed free cereal hay or straw.
- B. Wood waste (chips, sawdust or bark): Shall be applied at a depth of 2 to 3 inches. Organic material from the clearing stage of development should remain on site, be chipped, and applied as mulch.
- C. Mulch Binder: Mulch on slopes exceeding 3 (horizontal) to 1 (vertical) shall be held in place by the use of a mulch binder, as approved by the Engineer. The mulch binder shall be non toxic to plant and animal life and shall be approved by the Engineer.

# 2.13 Temporary Grassing

- A. Grassing materials shall meet the requirements of the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas, latest edition, section that includes "Disturbed Area Stabilization (With Temporary Vegetation)".
- B. Seed rate, fertilization, lime application and other requirements shall be provided as shown on the Drawings.

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C. Water: Water shall be free of excess and harmful chemicals, organisms and substances which may be harmful to plant growth or obnoxious to traffic. Salt or brackish water shall not be used. Water shall be furnished by the Contractor.

### Part 3 Execution

## 3.1 Preparation

- A. Prior to General Stripping of Topsoil and Excavating:
  - 1. Install perimeter dikes and swales.
  - 2. Excavate and shape sediment basins and traps.
  - 3. Construct pipe spillways and install stone filter where required.
  - 4. Install erosion protection and sediment control measures including rock filter dams and silt fence.
  - 5. Machine compact all berms, dikes and embankments for basins and traps.
- B. Construct sediment basins and traps where indicated on Drawings during rough grading as grading progresses. If no sediment basin is on site, maintain minimum disturbance area requirements for BMP measures.
- C. Temporarily seed basin slopes and topsoil stockpiles.
  - 1. Rate: ½ lb./1000 SF
  - 2. Application of temporary stabilization must be initiated within fourteen (14) days to disturbed areas of a site where construction activities have temporarily or permanently ceased.
  - 3. Reseed as required until good stand of grass is achieved.
- D. Install stabilized construction entrance(s).

#### 3.2 Installation

- A. Silt Fence (With And Without Backing)
  - 1. Sediment barriers shall not be used in any flowing stream, creek or river.
  - 2. Sediment barriers shall be installed as shown on the Drawings and as directed by the Engineer.
  - 3. Along stream buffers and other sensitive areas, two rows of Type C silt fence or one row of Type C silt fence backed by hay bales shall be used.
  - 4. Sediment barriers shall be maintained to ensure the depth of impounded sediment is no more than one half of the original height of the barrier or as directed by the Engineer. Torn, damaged, destroyed or washed out barriers shall be repaired, reinforced or replaced with new material and installed as shown on the Drawings and as directed by the Engineer.
  - 5. Sediment Barrier Removal

- a. Sediment barrier shall be removed once the disturbed area has been stabilized with a permanent vegetative cover and the sediment barrier is no longer required as directed by the Engineer.
- b. Accumulated sediment shall be removed from the barrier and spread over the site.
- c. All non-biodegradable parts of the barrier shall be disposed of properly.
- d. The disturbed area created by barrier removal shall be permanently stabilized.

#### B. Check Dams

- Check dams shall be installed to minimize the erosion rate by reducing the velocity of stormwater in areas of concentrated flow. This practice is applicable for use in ditches and small open channels and is not to be used in a stream. The dams should only be used while permanent stabilization measures are being installed.
- 2. Check and rock dams shall be installed as shown on the Drawings and as directed by the Engineer. Spacing: Maximum spacing between dams should be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam. Two or more check dams in a series should be used when the drainage area exceeds the limitation for one dam.
- 3. Height: The height of the check dam from the bottom of the channel to the bottom of the weir should be a minimum of 1 foot above the ditch bottom. The center of the check dam must be at least 9 inches lower than outer edges. Dam height should be 2 feet maximum measured to center of check dam.
- 4. Weir: The depth of flow on the center of the structure (weir) shall be computed for the peak flow rate generated by a 2-year, 24-hour storm in order to ensure that the top of the structure will not be overtopped. For sites draining to high quality streams or streams listed as impaired by sediment, the depth must be determined for the 5-year, 24-hour peak flow rate. The weir must be at least 9 inches deep.
- 5. Side Slopes: Side slopes shall be 2:1 or flatter.
- 6. Stone check dams: Mechanical or hand placement shall be required to ensure complete coverage of entire width of ditch or swale and that center of dam is lower than edges.
- 7. Rock dams: Mechanical or hand placement will be required to insure that the rock dam extends completely across the channel and securely ties into both channel banks. The center of the dam must be no less than six inches lower than the lowest side, to serve as a type of weir.
- 8. A geotextile should be used as a separator between the graded stone and the soil base and abutments. The geotextile shall be placed immediately adjacent to the subgrade without any voids and extend five feet beyond the downstream toe of the dam to prevent scour.

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9. Check and rock dams shall be maintained to ensure the depth of impounded sediment is no more than one half of the original height of the check dam or as directed by the Engineer. Damaged, destroyed or washed out check dams shall be repaired, reinforced or replaced with new material and installed as shown on the Drawings and as directed by the Engineer.

#### 10. Check and Rock Dams removal

- a. Check and rock dams shall be removed once the disturbed area has been stabilized with a permanent vegetative cover and the sediment barrier is no longer required as directed by the Engineer.
- b. Accumulated sediment shall be removed from the check and rock dams when it reaches a depth of one-half of the original height of the dam and removed from the site.
- c. All non-biodegradable parts of the barrier shall be disposed of properly.
- d. The disturbed area created by check or rock dam removal shall be permanently stabilized.

### C. Sand Bag Berm

- The purpose of a sand bag berm is to intercept sediment-laden water from disturbed areas. Sand bags shall be used for construction in streambeds or channels. In addition, sand bags shall be used to create a retention pond or detain sediment and release water in sheet flow.
- 2. A temporary sand bag berm shall be installed across a channel (only when construction activities are occurring in a streambed or channel) or outside of the right of way in a developing or disturbed area and should be used when the contributing drainage area is greater than 5 acres. The berm shall be a minimum height of 18", measured from the top of the existing ground at the upslope toe to the top of the berm. The berm shall be sized to have a minimum width of 48" measured at the bottom of the berm and 18" measured at the top of the berm.
- 3. The sand bag berm shall be inspected after each rain. The sand bags shall be reshaped or replaced as needed during inspection. Additional inspections shall be made daily by the responsible party and when the silt reaches 6"; the accumulated silt shall be removed and disposed of at an approved site in a manner that will not contribute to additional siltation. The sand bag berm shall be left in place until all upstream areas are stabilized and accumulated silt removed; removal must be done by hand to avoid damage to the sand bags.

### D. Erosion Control Matting and Blankets

- 1. Erosion Control Matting and Blankets be placed as shown on the Drawings and as directed by the Engineer.
- After the site has been shaped and graded to the approved design, prepare a
  friable seedbed relatively free from clods and rocks more than one inch in
  diameter, and any foreign material that will prevent contact of the soil
  stabilization mat with the soil surface. Surface must be smooth to ensure proper

- contact of blankets or matting to the soil surface. If necessary, redirect any runoff from the ditch or slope during installation.
- 3. Follow manufacturer's recommendations and follow details as shown on the Drawings for laying and stapling.
- 4. All erosion control blankets and matting should be inspected periodically following installation, particularly after rainstorms to check for erosion and undermining. Any dislocation or failure should be repaired immediately. If washouts or breakage occurs, reinstall the material after repairing damage to the slope or ditch. Continue to monitor these areas until they become permanently stabilized.

#### E. Protection Of Bare Areas

- 1. Apply seeding and soil retention blanket to bare areas including new embankment areas, fills, stripped areas, graded areas or otherwise disturbed areas, which have a grade greater than 5% or which will be exposed for more than 14 days.
- 2. Bare working areas on which it is not practical or desirable to install seeding and soil retention blankets shall be temporarily sloped to drain at a minimum of 0.2% and a maximum of 5% grade. These areas shall then be "trackwalked" with a crawler dozer traveling up and down the slope to form the effect of small "terraces" with the tracks of the dozer. Apply a minimum of three (3) coverages to each area with the dozer tracks.
- 3. Route runoff from the areas through the appropriate silt fence system and other controls as necessary.
- 4. Protect earth spoil areas by "trackwalking" and silt fences.

### F. Interceptor Swale

- Interceptor swales may have a v-shape or be trapezoidal with a flat bottom and side slopes of 2:1 or flatter. These are used to shorten the length of exposed slope by intercepting runoff and can also serve as perimeter swales preventing off-site runoff from entering the disturbed area or prevent sediment-laden runoff from leaving the construction site or disturbed area. Minimum compaction for the swale shall be 90% of maximum density as determined by Standard Proctor compaction test (ASTM D698). The swales should remain in place until the disturbed area is permanently stabilized.
- 2. Stone Stabilization shall be used when grades exceed 2% or velocities exceed 4 feet per second and shall consist of a layer of crushed stone 3" thick, or flexible channel liner soil retention blankets. Stabilization shall extend across the bottom of the swale and up both sides of the channel to minimum height of 3" above the design water surface elevation based on a two year storm.
- 3. Interceptor swale shall be installed across exposed slopes during construction and should intercept no more than five (5) acres of runoff. Swales shall have a minimum bottom width of 2'-0" and a maximum depth of 1'-6" with side slopes of 3:1 or flatter. Swale must have positive drainage for its entire length to an outlet.

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- 4. Swales should be inspected on a weekly basis during wet weather and repairs should be made promptly to maintain a consistent cross section.
- 5. All trees, brush, stumps, obstructions and other material shall be removed and disposed of so as not to interfere with the proper functioning of the swale.
- 6. Outlet: Each swale must have an adequate outlet. The outlet may be a constructed or natural waterway, a stabilized vegetated area or another energy dissipation device. In all cases, the outlet must discharge in such a manner as to not cause erosion or sedimentation problems. Protected outlets should be constructed and stabilized prior to construction of the swale.

#### G. Diversion Dike

- 1. A diversion dike intercepts runoff from small upland areas and diverts it away from exposed slopes to a stabilized outlet, such as a rock berm, sandbag berm, or stone outlet structure. Drainage area shall be 5 acres or less.
- 2. Design: The dike should be compacted and designed to have stable side slopes, which should not be steeper than 2:1. When maintenance by machine mowing is planned, side slopes should be no steeper than 3:1. The ridge should be a minimum width of 4 feet at the design water elevation after settlement. Its design should allow for ten percent settlement.
- 3. Stone Stabilization (required for velocities in excess of 6 fps) shall consist of Class 4 aggregate fill and shall be placed in a layer of at least 3" thickness and shall extend a minimum height of 3" above the design water surface up the existing slope and the upstream face of the dike.
- 4. Geotextile shall be placed under the stone stabilization.
- 5. Diversion dikes shall be installed prior to and maintained for the duration of construction. Dikes shall have a minimum top width of 2'-0" and a minimum height of compacted fill of 18" measured from the top of the existing ground at the upslope toe to top of the dike. The soil for the dike shall be placed in lifts of 8" or less and be compacted to 95% standard proctor density. The channel which is formed by dike must have positive drainage for its entire length to an outlet.
- 6. Diverted runoff from a protected or stabilized area shall have its outlet flow directed to an undisturbed stabilized area or into a level spreader or grade stabilization structure.
- 7. Diverted runoff from a disturbed or exposed area shall be conveyed to sediment trap such as a rock berm, temporary sediment trap or sediment basin or to an area protected by any of these measures.

#### H. Temporary Stabilized Construction Entrance/Exit

- Construction exit(s) shall be placed as shown on the Drawings and as directed by the Engineer. A construction exit shall be located at any point traffic will be leaving a disturbed area to a public right of way, street, alley, sidewalk or parking area.
- 2. Placement of Construction Exit Material: The ground surface upon which the construction exit material is to be placed shall be prepared to a smooth condition

free from obstructions, depressions or debris. The geotextile underliner shall be placed to provide a minimum number of overlaps and a minimum width of one foot of overlap at each joint. The stone shall be placed with its top elevation conforming to the surrounding roadway elevations. The stone shall be dropped no more than three feet during construction.

- 3. Construction Exit Maintenance: The Contractor shall regularly maintain the exit with the top dressing of stone to prevent tracking or flow of soil onto public rights of way and paved surfaces as directed by the Engineer. This shall require periodic top dressing with 1.5-3.5 inch stone, as conditions demand.
- 4. Construction Exit Removal: Construction exit(s) shall be removed and properly disposed of when the disturbed area has been properly stabilized, the tracking or flow of soil onto public rights of way or paved surfaces has ceased and as directed by the Engineer.
- 5. When necessary, vehicles must be cleaned to remove sediment prior to entry onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin or other sedimentation/filtration device. All sediment shall be prevented from entering any storm drain, ditch or watercourse using approved methods.

#### I. Outlet Protection

- 1. Ensure that the subgrade for the filter and rip rap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the rip rap thickness.
- 2. The rip rap and gravel filter must conform to the specified grading limits shown in the plans.
- 3. Geotextile must meet design requirements and be properly protected from punching or tearing during installation. Repair any damage by removing the rip rap and placing another piece of filter fabric over the damaged area. All connecting joints should overlap a minimum of 1 foot. If the damage is extensive, replace the entire filter fabric.
- 4. Rip rap may be placed by equipment, but take care to avoid damaging the filter.
- 5. The minimum thickness of the rip rap should be 1.5 times the maximum stone diameter.
- 6. Construct the apron on zero grade with no overfall at the end. Make the top of the rip rap at the downstream end level with the receiving area or slightly below it.
- 7. Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.
- 8. Immediately after construction, stabilize all disturbed areas with vegetation.
- 9. Filter: Install a filter to prevent soil movement through the openings in the rip rap. The filter should consist of a graded gravel layer or a synthetic filter cloth.

#### **Erosion Control**

10. Maintenance: Inspect rip rap outlet structures after heavy rains to see if any erosion around or below the rip rap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

### J. Surface Roughening And Tracking

- All construction slopes require surface roughening to facilitate stabilization with vegetation, particularly slopes steeper than 3:1. Slopes to be covered with rolled erosion control products need not be roughened.
- 2. Cut Slope Roughening For Areas To Be Mowed:
  - a. Stair-step grade slopes with a gradient steeper than 3:1.
  - b. Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
  - c. Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall.
  - d. Do not make individual vertical cuts more than 2 feet in soft materials or more than 3 feet in rocky materials.
- 3. Fill Slope Roughening For Areas Not Bo Be Mowed
  - a. Place fill slopes with a gradient steeper than 3:1 in lifts not to exceed 9 inches, and make sure each lift is properly compacted. Ensure that the face of the slope consists of loose, uncompacted fill 4 to 6 inches deep.
  - b. Do not blade or scrape the final slope.
- 4. Cuts, Fills, And Graded Areas That Will Be Mowed
  - a. Make mowed slopes no steeper than 3:1.
  - b. Roughen these areas to shallow grooves by normal tilling, disking, harrowing, or use of cultipacker-seeder. Make the final pass of any such tillage implement on the contour.
  - c. Make grooves, formed by such implements, close together (less than 10 inches) and not less than 1 inch deep.
- 5. Roughening With Tracked Machinery
  - a. Limit roughening with tracked machinery to sandy soils to avoid undue compaction of the soil surface.
  - b. Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during final grading operations.
  - c. Seeding immediately seed and mulch roughened areas to obtain optimum seed germination and growth.

- 6. Periodically check the seeded slopes for rills and washes. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.
- 7. If roughening is washed away in a storm, the surface will have to be reroughened and new seed laid.

#### K. Tire Washing Facility

- Tire washing requires a supply of water either by overhead tank, pressurized tank or by water pipeline. All wash water should drain into a sediment-trapping device such as a sediment basin or sediment trap before discharging off the construction project.
- 2. If chlorinated water (such as ordinary tap water or hydrant water) is used, allow the water to sit for 24 hours, to allow chlorine to dissipate into the air, prior to discharging effluent to a stream. Effluent may be checked by a standard pool test kit to verify that it is chlorine-free.
- 3. Prevent entering vehicles from driving through the tire wash rack area.
- 4. Wash racks should be designed and constructed/manufactured for anticipated traffic loads.
- 5. Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- 6. Incorporate with a stabilized construction entrance/exit.
- 7. Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. But smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- 8. Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- 9. Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- 10. Post signage at tire washing facilities or designate personnel to oversee traffic exiting the construction site at tire washing facility locations.
- Remove accumulated sediment in tire wash rack and sediment traps as necessary to maintain system performance. Inspect routinely for damage and repair as needed.

#### L. Concrete Truck Wash-Out Facility

- 1. Install sand filter bed of at least fifty (50 ft2) square feet in area and at least twelve (12") inches in depth. Bottom of filter bed shall allow filtered wash water to percolate into the subgrade.
- 2. Install twelve (12") inch high berm around periphery of filter bed to prevent stormwater runoff contamination of the filter sand.
- 3. Remove, dispose, and replace filter sand that becomes clogged to such a degree that wash water does not immediately percolate down into the filter bed.
- 4. Maintain sand filter bed until all concrete has been placed on the project site.

#### **Erosion Control**

5. Upon completion of all concrete placements on the project site remove and dispose of filter sand, backfill bed with compacted select fill to 90% Standard Proctor Density and restore the disturbed surface.

#### M. Stream Buffer

- 1. All construction sites containing and/or adjacent to receiving streams or waters are required to have stream buffers between the top of the stream bank and the disturbance area.
- 2. Stream buffers consist of undisturbed natural vegetation, including maintaining the original tree line along the stream or channel banks. Promptly stabilize disturbed buffers with a dense cover of strong rooted grasses, native plants and native trees.
- 3. Construction related materials and equipment must be stored outside the buffer area.
- 4. For sites that contain and/or are adjacent to a receiving stream designated as impaired or Exceptional Alabama waters a 60-foot natural riparian buffer zone adjacent to the receiving stream shall be preserved, to the maximum extent practicable, during construction activities at the site. The natural buffer zone should be established between the top of stream bank and the disturbed construction area. The 60-feet criterion for the width of the buffer zone can be established on an average width basis at a project, as long as the minimum width of the buffer zone is more than 30 feet at any measured location.
- 5. A 30-foot natural riparian buffer zone adjacent to all streams at the construction site shall be preserved, to the maximum extent practicable, during construction activities at the site. The riparian buffer zone should be preserved between the top of stream bank and the disturbed construction area. The 30-feet criterion for the width of the buffer zone can be established on an average width basis at a project, as long as the minimum width of the buffer zone is more than 15 feet at any measured location.
- 6. Install controls along the outer upstream edge of the stream buffer to prevent inadvertent disturbance to the buffer. Consider high visibility controls, such as fencing.
- 7. Where a stream crossing is necessary, comply with the conditions of the Aquatic Resource Alteration Permit for the amount of stream buffer that can be disturbed.
- 8. Ensure that sediment controls are installed upgradient from the buffer to protect it from sediment-laden runoff.
- 9. Install level spreaders to convert concentrated flow into sheet flow prior to discharging across the buffer.
- 10. If a buffer is disturbed, the buffer should be restored as follows:
  - a. All areas of the buffer being restored must be planted with native or natural vegetation that is appropriate to achieve a stable stream protection corridor, including tree canopy.
  - b. All areas of the buffer being restored must be stabilized against erosion.

- c. During restoration activities, erosion prevention and sediment control measures must be installed to protect the stream. These measures can include turf reinforcement mats, erosion control blankets, wattles, etc., to stabilize the area in the short- and long-term.
- d. To increase the chances for the success and health of the buffer, the plant species, density, placement, and diversity in the buffer restoration plan must be appropriate for stream buffers. Proposed planting and long-term maintenance practices must also be appropriate and properly performed.
- e. Vegetation mortality must be included in the planting densities in buffer restoration plans.

#### 11. Temporary Culvert Crossing:

- a. All culverts must be strong enough to support their cross-sectioned area under maximum expected loads.
- b. The invert elevation of the culvert should be installed on the natural streambed grade at both ends.
- c. A geotextile should be placed on the streambed and stream banks prior to the placement of the pipe culvert(s) and aggregate. The geotextile will prevent the migration of soil particles from the subgrade into the graded stone. The geotextile should cover the streambed and extend a minimum of six inches and a maximum of one foot beyond the end of the culvert and bedding material.
- d. The culverts should extend a minimum of one foot beyond the upstream and downstream toe of the aggregate placed around the culvert.
- e. The culvert(s) should be covered with small riprap, such as. The depth of riprap above the top of the culvert should be one-half the diameter of the culvert or 18", whichever is greater.
- f. Multiple culverts should be separated by one-half the diameter of the culvert or 12" whichever distance is greater. A final layer of coarse aggregate, such as #57, should be applied to minimum depth of 6 inches.
- 12. The structure should be inspected after every rainfall and at least twice a week, and all damages repaired immediately. Any material lost to the stream shall be removed but only after discussion with ADEM staff. The structure should be removed immediately after construction is finished, and the streambed and banks must be stabilized and restored to pre-construction conditions.
- 13. Embankment: The fill material shall be taken from approved areas shown on the Drawings. It shall be clean mineral soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material. Relatively pervious materials such as sand or gravel (Unified Soil Classes GW, GP, SW & SP) shall be placed in the downstream section of the embankment. Areas on which fills

**Erosion Control** 

are to be placed shall be scarified prior to placement of fill. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. Fill material shall be placed in six-inch to eight-inch thick continuous layers over the entire length of the fill. Compaction shall be obtained by routing and hauling the construction equipment over the fill so that the entire surface of the fill is traversed by at least one wheel or tread track of the equipment or by the use of a compactor. The embankment shall be constructed to an elevation 5 percent higher than the design height to allow for settlement.

- 14. Vegetative Treatment: Stabilize the embankment and all other disturbed areas in accordance with the appropriate permanent vegetative measure immediately following construction. In no case shall the embankment remain unstabilized for more than seven days.
- 15. Erosion and Pollution Control: Construction operations will be carried out in such a manner that erosion and water pollution will be minimized. State and local law concerning pollution abatement shall be complied with.
- 16. Maintenance: Repair all damages caused by soil erosion or construction equipment at or before the end of each working day. Sediment shall be removed from the basin when it reaches the specified distance below the top of the riser. Sediment shall not enter adjacent streams or drainage ways during sediment removal or disposal. The sediment shall not be deposited downstream from the embankment, adjacent to a stream or floodplain.
- 17. Final Disposal: When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits are to be leveled or otherwise disposed of in accordance with approved sediment control plan. The proposed use of a sediment basin site will often dictate final disposition of the basin and any sediment contained therein. If the site is scheduled for future construction, then the embankment and trapped sediment must be removed, safely disposed of, and backfilled with a structural fill. When the basin area is to remain open space, the pond may be pumped dry, graded and backfilled.

# 3.3 During Construction Period

- A. Inspect at least twice every 7 days, at least 72 hours apart, and no more than 24 hours after a rainfall event of one half inch or greater.
- B. All erosion and sediment control measures and other protective measures identified in the SWPPP must be maintained in effective operating condition.
- C. The Contractor shall ensure that sedimentation and erosion that occur due to work activities are minimized and contained within the designated project work areas. Erosion and sedimentation occurring outside the work area will be resolved by and coordinated by Contractor with impacted landowners as required.
- D. Maintain Basins, Dikes, Traps, Stone Filters, Etc.:
  - 1. Inspect according to the schedule outlined in Item "A" above.
  - 2. Repair or replace damaged or missing items.

- E. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.
- F. Construct inlets as soon as possible. Install protective measures around inlets as described in this specification and detailed on Drawings.
- G. Provide necessary swales and dikes to direct all stormwater towards and into sediment basins and traps.
- H. Do not unnecessarily disturb existing vegetation (grass and trees).
- I. Take appropriate measures to minimize materials transported or tracked by construction vehicles onto any roadway.
- J. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
- K. Topsoil and Fine Grade Slopes and Swales, Etc. Seed and mulch per project specifications as soon as areas become ready.

# 3.4 Near Completion of Construction

- A. Eliminate basins, dikes, traps, etc.
- B. Grade to finished or existing grades.
- C. Fine grade all remaining earth areas, then seed and mulch.
- D. Remove remaining sediment controls (silt fence, rock berms, etc.) once final stabilization, meeting ALR100000 requirements, has been achieved.

**END OF SECTION** 

## Part 1 General

# 1.1 Scope

- A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the work site. In addition, the Contractor shall provide preparation for shipment, loading, unloading, handling and preparation for installation and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the work.
- B. All equipment, materials and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Owner prior to being incorporated into the work.

# 1.2 Transportation

- A. All equipment shall be suitably boxed, crated or otherwise protected during transportation.
- B. Where equipment will be installed using existing cranes or hoisting equipment, the Contractor shall ensure that the weights of the assembled sections do not exceed the capacity of the cranes or hoisting equipment.
- C. Small items and appurtenances such as gauges, valves, switches, instruments and probes which could be damaged during shipment shall be removed from the equipment prior to shipment, packaged and shipped separately. All openings shall be plugged or sealed to prevent the entrance of water or dirt.

# 1.3 Handling

- A. All equipment, materials and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation.
- B. Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Eyebolts or lifting lugs furnished on the equipment shall be used in handling the equipment. Spreader bars or lifting beams shall be used when the distance between lifting points exceeds that permitted by standard industry practice.
- C. Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground.
- D. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

Product Delivery Requirements

# Part 2 Products

(NOT USED)

# Part 3 Execution

(NOT USED)

**END OF SECTION** 

# Product Storage and Handling Requirements

## Part 1 General

# 1.1 Scope

A. The work under this Section includes, but is not necessarily limited to, the furnishing of all labor, tools and materials necessary to properly store and protect all materials, equipment, products and the like, as necessary for the proper and complete performance of the work.

# 1.2 Storage and Protection

### A. Storage

- 1. Maintain ample way for foot traffic at all times, except as otherwise approved by the Owner.
- 2. All property damaged by reason of storing of material shall be properly replaced at no additional cost to the Owner.
- 3. Packaged materials shall be delivered in original unopened containers and so stored until ready for use.
- 4. All materials shall meet the requirements of these Specifications at the time that they are used in the work.
- 5. Store products in accordance with manufacturer's recommendations.

#### B. Protection

- Use all means necessary to protect the materials, equipment and products in accordance with manufacturer's recommendations of every section before, during and after installation and to protect the installed work and materials of all other trades.
- 2. All materials shall be delivered, stored and handled to prevent the inclusion of foreign materials and damage by water, breakage, vandalism or other causes.
- 3. Substantially constructed weather-tight storage sheds, with raised floors, shall be provided and maintained as may be required to adequately protect those materials and products stored on the site which may require protection from damage by the elements.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary for the approval of the Owner and at no additional cost to the Owner.
- D. Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending

Product Storage and Handling Requirements

between supports. Items such as pipe, structural steel and sheet construction products shall be stored with one end elevated to facilitate drainage.

- E. Unless otherwise permitted in writing by the Owner, building products and materials such as cement, grout, plaster, gypsumboard, particleboard, resilient flooring, acoustical tile, paneling, finish lumber, insulation, wiring, etc., shall be stored indoors in a dry location. Building products such as rough lumber, plywood, concrete block and structural tile may be stored outdoors under a properly secured waterproof covering.
- F. Tarps and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarps and covers shall be arranged to prevent ponding of water.

## 1.3 Extended Storage

A. In the event that certain items of major equipment such as air compressors, pumps and mechanical aerators have to be stored for an extended period of time, the Contractor shall provide satisfactory long-term storage facilities which are acceptable to the Owner. The Contractor shall provide all special packaging, protective coverings, protective coatings, power, nitrogen purge, desiccants, lubricants and exercising necessary or recommended by the manufacturer to properly maintain and protect the equipment during the period of extended storage.

# 1.4 Owner Furnished Equipment

A. The Contractor shall provide storage and protection for all Owner furnished equipment and materials, including extended storage as specified above.

## Part 2 Products

(NOT USED)

## Part 3 Execution

(NOT USED)

**END OF SECTION** 

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# Part 1 General

# 1.1 Scope

- A. Construction staking shall include all of the surveying work required to layout the work and control the location of the finished Project. The Contractor shall have the full responsibility for constructing the Project to the correct horizontal and vertical alignment, as shown on the Drawings, as specified, or as ordered by the Engineer. The Contractor shall assume all costs associated with rectifying work constructed in the wrong location.
- B. From the information shown on the Drawings and the information to be provided as indicated under Project Conditions below, the Contractor shall:
  - 1. Be responsible for setting reference points and/or offsets, establishment of baselines, and all other layout, staking, and all other surveying required for the construction of the Project.
  - 2. Safeguard all reference points, stakes, grade marks, horizontal and vertical control points, and shall bear the cost of re-establishing same if disturbed.
  - 3. Stake out the permanent and temporary easements or the limits of construction to ensure that the work is not deviating from the indicated limits.
  - 4. Be responsible for all damage done to reference points, baselines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, baselines, center lines and temporary bench marks as a result of the operations.
- C. Baselines shall be defined as the line to which the location of the work is referenced, i.e., edge of pavement, road centerline, property line, right-of-way or survey line.
- D. Record Drawing surveys shall be performed in accordance with Section 01 78 39 of these Specifications.

# 1.2 Project Conditions

- A. The Drawings provide the location and/or coordinates of principal components of the Project. The alignment of some components of the Project may be indicated in the Specifications. The Engineer may order changes to the location of some of the components of the Project or provide clarification to questions regarding the correct alignment.
- B. The survey points, control points, and baseline to be provided to the Contractor shall be limited to only that information which can be found on the Project site by the Contractor.

# 1.3 Quality Assurance

- A. The Contractor shall furnish documentation, prepared by a surveyor currently registered in the State in which the Project is located, confirming that staking is being done to the horizontal and vertical alignment shown in the Contract Documents. This requires that the Contractor hire, at the Contractor's own expense, a currently registered surveyor, acceptable to the Owner, to provide ongoing construction staking or confirmation of such.
- B. Any deviations from the Drawings shall be confirmed by the Engineer prior to construction of that portion of the Project.
- C. Construction Surveying Cash Allowance
  - 1. This cash allowance is solely for the use of the Engineer for verification of the Contractor's reference points, centerlines and work performed and is not to be used by the Contractor to provide cut sheets.
  - 2. The presence of this cash allowance in no way relieves the Contractor of the responsibility of installing reference points, centerlines, temporary bench marks, verifying that the work has been performed accurately, and all other work covered by this Section.

### 1.4 Site Work

A. Staking Precision: The precision of construction staking shall match the precision of a component's location indicated on the Drawings. Staking of utilities shall be done in accordance with generally accepted practice for the type of utility.

## 1.5 Pressure Mains and Accessories

A. Staking Precision: The precision of construction staking required shall be that which the correct location of the main can be established for construction and verified by the Engineer. Where the location of components of the main, e.g. fittings, valves, road crossings and are not dimensioned, the establishment of the location of these components shall be based upon scaling these locations from the Drawings with relation to readily identifiable land marks, e.g., survey reference points, power poles, manholes, etc.

#### B. Reference Points

- Reference points shall be placed, at or no more than three feet, from the outside
  of the construction easement or right-of-way. The location of the reference
  points shall be recorded in a log with a copy provided to the Engineer for use,
  prior to verifying reference point locations. Distances shall be accurately
  measured to 0.01 foot.
- 2. The Contractor shall give the Engineer reasonable notice that reference points

Construction Layout

are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

## 1.6 Sewers and Accessories

A. Staking Precision: The precision of construction staking shall be no less than 1:10,000. Horizontal distances shall be measured with a precision no less than 0.01 feet, and horizontal angles measured with a precision of no less than 10 seconds.

#### B. Reference Points

- 1. The surveyor shall obtain the coordinates on each manhole and provide this information to the Engineer.
- 2. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the Engineer for use prior to his verifying reference point locations. Distances between reference points and the manhole centerlines shall be accurately measured to the nearest 0.01 foot.
- 3. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.

Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

**END OF SECTION** 

## Part 1 General

## 1.1 Section Includes

- A. Requirements pertaining to cutting (including excavating,) coring, fitting, and patching of the Work in existing required to:
  - 1. Make the several parts fit properly;
  - 2. Uncover work to provide for removal, installing, inspecting, or both, of ill-timed work:
  - 3. Remove and replace work not conforming to requirements of the Contract Documents; and
  - 4. Remove and replace defective work.
  - 5. Remove samples of the installed work as specified for testing.
  - 6. Install specified work in existing construction.
- B. In addition, upon written instructions of the Architect/Engineer/LA (A/E/LA):
  - 1. Uncover work to provide for the A/E/LA's observation of covered or concealed work.
  - 2. Remove samples of the installed materials for testing.
  - 3. Remove work to provide for alteration of existing work.

### C. Protection of Work

- 1. Do not cut or alter Work performed under separate Contracts without the A/E/LA's written permission.
- 2. Do not endanger any work by cutting or altering the work or any part of it.

### 1.2 Submittals

- A. Submit in accordance with Section 01 33 00 Submittal Procedures.
- B. Prior to cutting which affects the structural safety of the Project or the work of another contractor, submit a written notice to the A/E/LA requesting consent to proceed with cutting. The notice shall include:
  - 1. Identification of Project
  - 2. Description of defective work
  - 3. Necessity for cutting
  - 4. Effect on other work or on the structural integrity of the Project.
  - 5. Description of the proposed work including:

#### **Cutting and Patching**

- a. Scope of cutting and patching
- b. Subcontractor and trades to execute work
- c. Products proposed to be used
- d. Extent of refinishing
- 6. Alternatives to cutting and patching.
- 7. Designation of party responsible for the cost of cutting and patching.
- C. Cost Estimate: Prior to cutting and patching performed on instruction of the A/E/LA, submit a cost estimate.
- D. Should conditions of the work or the schedule necessitate alternative materials or methods, submit a written recommendation to the A/E/LA that includes:
  - 1. Compelling conditions for alternative materials or methods
  - 2. Recommended alternative materials or methods
  - 3. Submittals as required for substitutions
- E. Uncovered Work: Submit written notice to the A/E/LA designating the time the work will be uncovered for the A/E/LA's observation.

# 1.3 Quality Assurance

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. The safety provisions of applicable laws, building and construction codes shall be observed.
- C. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching any operating elements.

# 1.4 Payment for Cost

- A. Contractor's Costs: Costs caused by ill-timed or defective work or work not conforming to the Contract Documents, including costs for additional services of the Landscape Architect, shall be paid by the Contractor.
- B. Owner's Costs: Cost of work done as the result of the Landscape Architect's/Owner's instructions, which is not shown on the Drawings or specified, other than defective or non-conforming work, will be paid for by the Owner.

## Part 2 Products

## 2.1 Materials

- A. General: Use materials that are identical to existing materials. If identical materials are not available, or existing materials do not meet codes or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials. Submit method of repair including lapping, splicing and joining of new and existing materials.
- B. For replacement of items removed, use materials complying with pertinent Sections this Project Manual.
- C. All cut concrete shall be provided with steel dowels filled with non-shrink grout prior to patching or placement of new concrete.

## Part 3 Execution

#### 3.1 Surface Conditions

#### A. Inspection:

- 1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.
- 2. Identify all existing utilities, protect and maintain service to occupied areas.
- 3. Unless specified otherwise, inspect and determine location of existing rebars in concrete walls.
- 4. After uncovering the work, inspect conditions affecting installation of new work.

#### B. Discrepancies:

- 1. If uncovered conditions are not as anticipated, immediately notify in writing the Landscape Architect and secure needed directions.
- 2. Do not proceed until unsatisfactory conditions are corrected.

# 3.2 Preparation Prior to Cutting

- A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the work.
- B. Provide protection for other portions of the Project and provide protection from the elements.

### 3.3 Performance

A. Perform required excavating and backfilling as required under other pertinent

#### **Cutting and Patching**

Sections of the Project Manual.

- Perform cutting and demolition by methods, which will prevent damage to other
  portions of the Contracted Work and provide proper surfaces to receive a
  proper installation of repair and new work.
- 2. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes noted in the applicable technical specifications.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction.
  - In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Impact tools are not to be used in the building. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces, or spaces.
  - 3. Cut through concrete and asphalt using a cutting machine such as a carborundum saw or diamond core drill. Use methods or locations that could avoid cutting the rebars. All cut rebars, approved by the Landscape Architect, shall be rounded off any sharp edges and dabbed with a coat of protective coating against rusting.
  - 4. Comply with requirements of applicable Sections of DIVISION 31 where cutting and patching requires excavating and backfilling.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
  - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  - Restore exposed finishes of patched areas and extend finish restoration in a manner that will eliminate evidence of patching and refinishing. Assemblies shall be entirely refinished.
  - 3. Restore complete caulking, etc. to achieve maximum performance as required at no additional cost to the Owner.

# 3.4 Cleaning

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature.

**END OF SECTION** 

# Cleaning and Waste Management

## Part 1 General

## 1.1 Work Included

A. Section includes requirements for cleanup, re-stabilization, restoration, and disposal to maintain a safe and well-kept job site and properly repair disturbed areas.

# 1.2 Quality Assurance

- A. Daily, and more often if necessary, conduct inspections verifying that requirements of cleanliness are being met.
- B. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

# 1.3 Cleaning Materials and Equipment

- A. Provide all required personnel, equipment and materials needed to maintain the specified standard of cleanliness.
- B. Use only the cleaning materials, methods and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Engineer.

# 1.4 Cleaning During Construction

- A. (For Interior Areas) Proceed with construction cleanup concurrently with construction progress.
  - 1. Remove mud, oil, grease, soil, gravel, trash, scrap, debris, and excess materials that are unsightly or may cause accidents to persons or properties.
  - 2. Remove water from floor areas where electrical power tools are to be used, and prevent stains on concrete that will be exposed in finish work.
  - 3. Select and employ cleaning materials and equipment with care to avoid scratching, marring, defacing, staining, or discoloring surfaces cleaned.
- B. (For Exterior Areas) Throughout all phases of construction, including suspension of work, and until the Final Acceptance, the Contractor shall keep the site clean and free from rubbish and debris. The Contractor shall also abate dust nuisance by cleaning, sweeping and sprinkling with water, or other means as necessary. The use of water resulting in mud on driveways, parking lots or streets will not be permitted as a substitute for sweeping or other methods.
  - 1. The road(s) on the construction site shall be paved immediately after the installation of underground utilities and the construction and underground/final

### Cleaning and Waste Management

- inspection of storm drainage, curbs, and gutters. The exit road on the construction site shall be paved first.
- 2. Vehicles exiting the construction site shall have all dirt clods and mud removed from their tires.
- 3. Materials and equipment shall be removed from the site as soon as they are no longer necessary. Before the final inspection, the site shall be cleared of equipment, unused materials and rubbish so as to present a satisfactory clean and neat appearance. All cleanup costs shall be included in the Contractor's Bid.
- 4. Care shall be taken to prevent spillage on haul routes. Any such spillage shall be removed immediately and the area cleaned.
- 5. Excess excavated material from catch basins or similar structures shall be removed from the site immediately. Sufficient material may remain for use as backfill if permitted by the Specifications. Forms and form lumber shall be removed from the site as soon as practicable after stripping.
- C. Failure of the Contractor to comply with the Engineer's cleanup orders may result in an order to suspend work until the condition is corrected. No additional compensation will be allowed as a result of such suspension.

# 1.5 Final Cleaning

- A. Upon completion of the work, the Contractor shall remove from the site all plant, materials, tools and equipment belonging to him, and leave the site with an appearance acceptable to the Owner.
- B. Thoroughly clean all equipment and materials installed and deliver over such materials and equipment in a bright, clean, polished and new appearing condition.
- C. Restore or replace all landscape features scarred or damaged by the Contractor's equipment or operations as nearly as possible to original condition, at the Contractor's expense. The Owner will approve the method of restoration to be used.
- D. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction, as directed by the Owner. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. The restored areas shall be filled, graded, and spread with sufficient topsoil to provide a minimum depth of four inches of suitable soil for the growth of grass, and the entire area shall be seeded or sodded with the original type of grass. Areas shall be restored to original contours as shown on the Plans. If the Plans do not cover the specific areas to be restored, the areas shall be graded to drain and give a smooth transition to the surroundings.

# 1.6 Measurement and Payment

A. No separate payment will be made for any items of work, materials, parts, equipment, supplies, or related items required to perform and complete the requirements of this section. The costs for all such items required shall be considered subsidiary to other items of this Contract and shall not be paid for separately.

# Part 2 Products

(NOT USED)

## Part 3 Execution

(NOT USED)

**END OF SECTION** 

# Part 1 General

# 1.1 Project Maintenance and Warranty

- A. Maintain and keep in good repair the work covered by these Drawings and Specifications until acceptance by the Owner.
- B. The Contractor shall warrant all work for a period of one (1) year for upon record of completion or as stated in the General Conditions. The Owner will give notice of observed defects with reasonable promptness.
- C. The Contractor shall not be obligated to make replacements which become necessary because of ordinary wear and tear, or as a result of improper operation or maintenance, or as a result of improper work or damage by another Contractor or the Owner, or to perform any work which is normally performed by a maintenance crew during operation.
- D. In the event of multiple failures of major consequences prior to the expiration of the Correction Period described in the General Conditions, the affected unit shall be disassembled, inspected and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the failure shall be replaced. A new warranty and Correction Period, as described in the General Conditions, against defective or deficient design, workmanship, and materials shall commence on the day that the item is reassembled and placed back into operation. As used herein, multiple failure shall be interpreted to mean two or more successive failures of the same kind in the same item or failures of the same kind in two or more items. Major failures may include, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts, broken or chipped gear teeth, premature bearing failure, excessive wear or excessive leakage around seals. Failures which are directly and clearly traceable to operator abuse, such as operations in conflict with published operating procedures or improper maintenance, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over- or under-lubrication and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one-year warranty. Should multiple failures occur in a given item, all products of the same size and type shall be disassembled, inspected, modified or replaced as necessary and rewarranted for one year from the date of reassembly.
- E. The Contractor shall, at Contractor's own expense, furnish all labor, materials, tools and equipment required and shall make such repairs and removals and shall perform such work or reconstruction as may be made necessary by any structural or functional defect or failure resulting from neglect, faulty workmanship or faulty materials, in any part of the work performed by the Contractor. Such repair shall also include refilling of trenches, excavations or embankments which show settlement or erosion after backfilling or placement.
- F. Except as noted on the Drawings or as specified, all structures such as embankments and fences shall be returned to their original condition prior to the completion of the Contract. Any and all damage to any facility not designated for removal, resulting from

#### Warranties

the Contractor's operations, shall be promptly repaired by the Contractor at no cost to the Owner.

- G. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance of same for the duration of the Correction Period, as defined in the General Conditions. In the event the repairs and maintenance are not made immediately and it becomes necessary for the owner of the road to make such repairs, the Contractor shall reimburse the owner of the road for the cost of such repairs.
- H. In the event the Contractor fails to proceed to remedy the defects upon notification within 15 days of the date of such notice, the Owner reserves the right to cause the required materials to be procured and the work to be done, as described in the Drawings and Specifications, and to hold the Contractor and the sureties on Contractor's bond liable for the cost and expense thereof.
- I. Notice to Contractor for repairs and reconstruction will be made in the form of a registered letter addressed to the Contractor at Contractor's home office.
- J. Neither the foregoing paragraphs nor any provision in the Contract Documents, nor any special guarantee time limit implies any limitation of the Contractor's liability within the law of the place of construction.

## Part 2 Products

(NOT USED)

# Part 3 Execution

(NOT USED)

**END OF SECTION** 

## Part 1 General

# 1.1 Scope

- A. The work under this Section includes, but is not necessarily limited to, the compiling, maintaining, recording and submitting of Project record documents as herein specified.
- B. Record documents include, but are not limited to:
  - 1. Drawings;
  - 2. Specifications;
  - 3. Change orders and other modifications to the Contract;
  - 4. Engineer field orders or written instructions, including Requests for Information (RFI) and Clarification Memorandums;
  - 5. Reviewed shop drawings, product data and samples;
  - 6. Test records.
- C. The Contractor shall maintain on the Project site throughout the Contract Time an up to date set of Record Drawings.

# 1.2 Maintenance of Documents and Samples

#### A. Storage

- 1. Store documents and samples in the Contractor's field office, apart from documents used for construction.
- 2. Provide files and racks for storage of documents.
- 3. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with format of these Specifications.
- C. Maintenance
  - 1. Maintain documents in a clean, dry, legible condition and in good order.
  - 2. Do not use record documents for construction purposes.
  - 3. Maintain at the site for the Owner one copy of all record documents.
- D. Make documents and samples available at all times for inspection by Engineer.

E. Failure to maintain the Record Documents in a satisfactory manner may be cause for withholding of a certificate for payment.

# 1.3 Quality Assurance

- A. Unless noted otherwise, Record Drawings shall provide dimensions, distances and coordinates to the nearest 0.1 foot.
- B. Unless noted otherwise, Record Drawings shall provide elevations to the nearest 0.01 foot for all pertinent items constructed by the Contractor.
- C. For sanitary sewer construction, the Contractor shall prepare the Record Drawings from a post-construction, field run survey. The Record Drawings shall provide elevations to the nearest 0.01 foot for all manhole inverts, manhole frames and other pertinent items constructed by the Contractor. The Record Drawings shall provide dimensions, distances, and coordinates to the nearest 0.01 foot and horizontal angles to the nearest 10 seconds.

# 1.4 Recording

- A. Label each document "Project Record" in neat, large printed letters.
- B. Recording
  - 1. Record information concurrently with construction progress.
  - 2. Do not conceal any work until required information is recorded.

# 1.5 Record Drawings

- A. Record Drawings shall be reproducible, shall have a title block indicating that the drawings are Record Drawings, the name of the company preparing the Record Drawings, and the date the Record Drawings were prepared.
- B. Legibly mark drawings to record actual construction, including:
  - 1. All Construction
    - a. Changes of dimension and detail.
    - b. Changes made by Requests for Information (RFI), field order, clarification memorandums or by change order.
    - c. Details not on original Drawings.
  - 2. Site Improvements, Including Underground Utilities
    - a. Horizontal and vertical locations of all exposed and underground utilities and appurtenances, both new facilities constructed and those utilities

- encountered, referenced to permanent surface improvements.
- b. Location of and dimensions of roadways and parking areas, providing dimensions to back of curb when present.
- c. The locations shall be referenced to at least two easily identifiable, permanent landmarks (e.g., power poles, valve markers, etc.) or benchmarks.

#### 3. Structures

- a. Depths of various elements of foundation in relation to finish first floor datum or top of wall.
- b. Location of internal and buried utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

# 1.6 Specifications

- A. Legibly mark each section to record:
  - 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
  - 2. Changes made by Requests for Information (RFI), field order, clarification memorandums, or by change order.

### 1.7 Submittal

- A. At contract closeout, deliver Record Documents to the Engineer for the Owner.
- B. Accompany submittal with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name and address
  - 4. Title and number of each record document
  - 5. Signature of Contractor or Contractor's authorized representative

# Part 2 Products

(NOT USED)

# Part 3 Execution

(NOT USED)

**END OF SECTION** 

## Part 1 General

## 1.1 Work Included

- A. Demolition of designated pavements and other existing facilities.
- B. Unless otherwise noted, removal all demolition material from the project site and properly dispose of all demolition material at a location selected and provided by the Contractor.
- C. Final grading and finishing of site.

# 1.2 Project Description

#### A. Demolition Plan

1. General Requirements: Do not begin demolition or deconstruction until authorization is received from the Engineer. Remove rubbish and debris from the project site; do not allow accumulations. Store materials that cannot be removed daily in areas specified by the Engineer.

## 1.3 Items to Remain in Place

- A. Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Owner. Repair or replace damaged items as approved by the Engineer. Coordinate the work of this section with all other work indicated.
- B. Do not overload pavements to remain.
- C. Existing Construction Limits and Protection: Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.
  - Trees: Protect trees within the project site which might be damaged during demolition, and which are indicated to be left in place, in accordance with local ordinances. If no local ordinances govern tree protection, provide a minimum 4-foot-high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Landscape Architect.
  - 2. Utility Service: Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Owner and disconnected and sealed by the Contractor.

#### Demolition

#### D. Facilities:

 Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.

# 1.4 Quality Assurance

- A. Comply with federal, state, and local hauling and disposal regulations.
- B. Dust and Debris Control: Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

# 1.5 Existing Conditions

- A. Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Landscape Architect showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch by 6 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document.
- B. Submit survey results.

## Part 2 Products

(NOT USED)

## Part 3 Execution

## 3.1 Existing Facilities To Be Removed

### A. Paving and Slabs

 Remove sawcut concrete and asphaltic concrete paving and slabs including aggregate base as indicated. Provide neat sawcuts at limits of pavement removal as indicated.

#### B. Patching

1. Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. For concrete and masonry, completely fill holes and depressions left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

#### C. Fencing

1. Remove and dispose of all existing ball field fencing including concrete post footings.

# 3.2 Concurrent Earth-Moving Operations

A. Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Fill holes and other hazardous openings.

# 3.3 Disposition Of Material

- A. Title to Materials: Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Owner's property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Engineer of the Contractor's demolition and removal procedures, and authorization by the Engineer to begin demolition and deconstruction. The Owner will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.
- B. Sports Field Lighting: Contractor shall be responsible for dismantling the sports field lighting poles and fixtures and placing them on the ground. The City will remove all poles and fixtures for re-use at another location. Contractor will be responsible for demolition of the pole bases, underground conduit and wire.

# 3.4 Cleanup

A. Remove debris and rubbish. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

Demolition

# 3.5 Disposal Of Removed Materials

A. Regulation of Removed Materials: Dispose of debris, rubbish, scrap, and other non-salvageable materials resulting from removal operations in accordance with all applicable federal, state and local regulations. Storage of removed materials on the project site is prohibited.

**END OF SECTION** 

## Part 1 General

### 1.1 Extent of Work

A. The extent of concrete work is shown on the Drawings.

# 1.2 Quality Assurance

- A. Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
  - 1. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
  - 2. ACI 305, Hot Weather Concreting.
  - 3. ACI 306, Cold Weather Concreting.
  - 4. ACI 308, Standard Practice for Curing Concrete.
  - 5. ACI 315, Detailing Manual.
  - 6. ACI 318, Building Code Requirements for Reinforced Concrete.
  - 7. ACI 347. Recommended Practice for Concrete Formwork.
  - 8. CRSI Manual of Standard Practice.
- B. The Contractor is responsible for correcting concrete work that does not conform to the specified requirements, including requirements for strength, tolerances, and finishes. Correct deficient concrete as directed by the Landscape Architect.
- C. Materials and installed work may require testing and retesting, as directed by the Landscape Architect and paid for by the Owner. Allow free access to material stockpiles and facilities at all times. Tests not specifically indicated to be done at the Owner's expense, including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.

### 1.3 Submittals

- A. Comply with applicable requirements of Section 01 33 00.
- B. Submit manufacturer/supplier certifications for aggregate and cement. Provide the project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates, materials manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results.
- C. Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing and sealing compounds, and others requested by the Landscape Architect.
- D. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315, Detailing Manual, showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement.

#### Cast-In-Place Concrete

Show on the shop drawings special reinforcement required and openings through concrete structures.

- E. Submit mix design in accordance with ACI requirements. Provide for each mix design, the project name, city, general contractor, concrete strength, and it's intended use.
- F. Submit 2 copies of laboratory test reports with standard deviation analysis or trial batch data. All concrete materials shall be listed.
- G. Submittals shall be approved by the Landscape Architect prior to procurement or fabrication of materials.

# Part 2 Products

### 2.1 Form Materials

- A. Forms for Exposed Finish Concrete: Unless otherwise specified or shown on the Drawings, construct formwork for exposed concrete surfaces with plywood, metal, metal framed plywood, or other panel type materials acceptable to the Landscape Architect in order to provide exposed surfaces that are continuous, straight, and smooth. To minimize the number of joints and to conform to the joint system shown on the Drawings, furnish panels in the largest practicable sizes. Provide form material that is thick enough to withstand pressure of newly placed concrete without bowing or deflection.
- B. Forms for Unexposed Finish Concrete: For surfaces that will be unexposed in the finished structure, form concrete with plywood, lumber, metal, or other material acceptable to the Landscape Architect. If lumber is used, it shall be dressed on at least two edges and one side for tight fit.
- C. Form Coatings: Provide commercial formulation form coating compounds that will not bond with, stain, or adversely affect concrete surface and that will not impair subsequent treatments of concrete surfaces to be cured with water or curing compound.

# 2.2 Reinforcing Materials

- A. Reinforcing Bar: ASTM A615, Grade 60.
- B. Supports for Reinforcement: Provide supports for reinforcement, including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Unless otherwise indicated on the Drawings, use wire type bar supports complying with CRSI recommendations. Wood, brick, and other devices will not be acceptable. Comply with the following:
  - For concrete surfaces exposed to view, where leg supports are in contact with forms, provide supports with legs that are hot dip galvanized or protected by either plastic or stainless steel.

### 2.3 Concrete Materials

- A. Portland Cement: ASTM C150, Type I or I/II. Use only one brand of cement throughout the project, unless otherwise acceptable to the Landscape Architect.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean, fresh, drinkable.

#### D. Admixtures

- 1. Water Reducing Admixture: Eucon WR 75, WR-91 or MR by the Euclid Chemical Company, Pozzolith 220-N by Master Builders, or WRDA 15 by W.R. Grace. The admixture shall conform to ASTM C494, Type A, and not contain more chloride ions than are present in municipal drinking water.
- 2. Water Reducing, Retarding Admixture: Eucon Retarder 75 by the Euclid Chemical Company or Pozzolith 100 XR by Master Builders. The admixture shall conform to ASTM C494, Type D, and not contain more chloride ions than are present in municipal drinking water.
- 3. Mid-range Water Reducing Admixture: Eucon MR or Plastol 341 by the Euclid Chemical Company, Polyheed 997 by Master Builders or Daracem SD by W.R. Grace. The admixture shall conform to ASTM C494 Type A.
- 4. Nonchloride Accelerator: Accelguard 80, Accelguard 90 or NCA by the Euclid Chemical Company or Darex Set Accelerator by W. R. Grace. The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.
- 5. Air Entraining Admixture: AEA-92 by Euclid Chemical Corporation, MB AE-90 by Master Builders, or Darex AEA by W.R. Grace. The admixture shall conform to ASTM C260.
- 6. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
- 7. Certification: Written conformance to the aforementioned requirements and the chloride ion content will be required from the admixture manufacturer prior to mix design review by the Landscape Architect.

#### 2.4 Related Materials

- A. Contraction/Construction Joint Filler: The joint filler shall be a two (2) component 100% solids compound, with a minimum shore A hardness of 80. Products: Subject to compliance with requirements, provide "Euco 700 or QWIK Joint" by the Euclid Chemical Company, "Sikadur 51 SL" by Sika Chemical Corporation, or MM-80 by Metzer/McGuire.
- B. Moisture Retaining Covering: One of the following, complying with ASTM C171:
  - 1. Waterproof paper.
  - 2. Polyethylene film.
  - 3. Polyethylene coated burlap.
  - 4. Waterborne, Membrane Forming Compound: ASTM C309, Type 1, Class B.
- C. Curing and Sealing Compound: Kurez DR VOX or Kurez W VOX by the Euclid Chemical Company, Master Kure 200W by Master Builders or Kure-n-Seal by

#### Cast-In-Place Concrete

Sonneborn. The compound shall conform to FS TT C 800A, 30 percent solids content minimum, and have test data from an independent laboratory indicating a maximum moisture loss of 0.030 gram per square centimeter when applied at a coverage rate of 300 square feet per gallon. Manufacturer's certification is required.

- D. Bonding Compound: Euco Weld by Euclid Chemical Company or Weldcrete by the Larsen Company. The compound shall be a polyvinyl acetate, rewettable type.
- E. Epoxy Adhesive: Euco Epoxy No. 452 or No. 620 by Euclid Chemical Company, Sikadur Hi Mod by Sika Chemical Corporation, or Epcon Ceramic 6 by ITW Ramset. The compound shall conform to ASTM C881, be a 2 component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces.
- F. Nonshrink Grout: Euco NS by the Euclid Chemical Company or Masterflow 713 by Master Builders. The grout shall conform to CRD C 621 80, "Corps of Landscape Architects Specification for Nonshrink Grout."

# 2.5 Mix Design

#### A. Preparation

- 1. Prepare design mixes for each type and strength of concrete in accordance with applicable provisions of ACI-318 and ASTM C94. Use an independent testing facility acceptable to the Landscape Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same one used for field quality control testing unless this is acceptable to the Landscape Architect. Submit to the Landscape Architect written reports of each proposed mix in accordance with Section 01 33 00.
- 2. The design mix shall provide normal weight concrete with compressive strength as indicated on the Drawings.

#### B. Water/Cementitious Ratio:

1. All concrete subject to freezing and thawing shall have a maximum water/cement ratio of 0.45 (4000 psi at 28 days or more).

#### C. Admixtures

- 1. All concrete placed at air temperatures below 50 degrees F shall contain the specified nonchloride accelerator. All concrete required to be air entrained shall contain an approved air entraining admixture. All pumped concrete, fiber concrete and concrete with a water/cement ratio below 0.50 shall contain the specified high range water reducing admixture (superplasticizer) or mid-range water reducing admixture.
  - a. Use an air entraining admixture in all concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:
    - 1) 2.5 percent to 5.5 percent for maximum 2 inches aggregate.
    - 2) 4.5 percent to 7.5 percent for maximum 3/4 inch aggregate.
    - 3) 5.5 percent to 8.5 percent for maximum 1/2 inch aggregate.

2. Use the amounts of admixtures recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.

#### D. Slump Limits

- 1. All concrete containing the high range water reducing admixture (superplasticizer) shall have a maximum slump of 8 inches unless otherwise approved by the Landscape Architect. The concrete shall arrive at the job site at a slump of 2 inches to 3 inches and be verified; then the high range water reducing admixture shall be added to increase the slump to the approved level.
- 2. All other concrete shall have a maximum slump of 3 inches for slabs and 4 inches for other members.

# 2.6 Proportioning

## A. Ready Mix Concrete

- 1. Comply with the requirements of ASTM C94 and of these specifications.
- 2. During hot weather or under conditions that contribute to rapid setting of concrete, a shorter mixing time than that specified in ASTM C94 may be required. When the air temperature is between 85 degrees and 90 degrees F, reduce the mixing and delivery time from 1 1/2 hours to 75 minutes; when the air temperature is above 90 degrees F, reduce the mixing time to 60 minutes.
- 3. Each load of concrete arriving at the job shall be accompanied by a delivery ticket that shall be collected by the Contractor and submitted to the Landscape Architect and shall contain the following information:
  - a. The design mix and strength of mix of concrete being delivered.
  - b. The exact time the cement, aggregate, and water were discharged into the delivery truck.

## Part 3 Execution

## 3.1 Forms

- A. Design, erect, support, brace, and maintain formwork to support any vertical and lateral loads that may be applied until such loads can be supported by the concrete structure. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position. Design and construction of form work shall be the responsibility of the Contractor.
- B. Design formwork so that it can be readily removed without impact, shock, or damage to cast in place concrete surfaces and adjacent materials.
- C. Construct forms complying with ACI 347 and ACI SP-4 to the sizes, shapes, lines, and dimensions shown on the Drawings so that in the finished structures the work will be level and plumb and have accurate alignment, location, and grade within the tolerance limits of ACI 301. Provide for openings, offsets, keyways, chamfers, blocking, anchorages, inserts, and other features that the work requires. Use selected materials to obtain the required finishes. Butt joints solidly, and provide backup at joints to prevent leakage of cement paste.

- D. Fabricate forms so that they can be easily removed without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep for the concrete to be placed with bottom forms only. To form keyways, reglets, recesses, and the like, kerf wood inserts to prevent swelling and to permit easy removal.
- E. Chamfer exposed corners and edges as shown on the Drawings, using wood, metal, PVC, or rubber chamfer strips fabricated to produce smooth, uniform lines and tight edge joints.
- F. Use metal form ties that are factory made, adjustable in length, designed to prevent form deflection, and either removable or snap off and that will prevent the concrete surface's being spalled when the ties are removed. If snap off ties are used, the portion remaining within the concrete after removal must be at least 1 1/2 inches inside the concrete and be provided with a waterproofing washer unless the Drawings indicate otherwise.
- G. Clean thoroughly forms and adjacent surfaces that are to receive concrete. Remove chips, wood, sawdust, dirt, sediment, and any other debris just before the concrete is placed. After concrete placement, retighten forms if necessary to eliminate mortar leaks.

## 3.2 Placing Reinforcement

- A. For details and methods of placing reinforcement and supports, comply with the specified codes and standards, the recommended practice of the CRSI as outlined in "Placing Reinforcing Bars," and these specifications.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials that reduce or destroy the bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement with metal chairs, runners, bolsters, spacers, and hangers as required for security.
- D. Place reinforcement to obtain at least the minimum coverage for concrete protection as required by ACI 318 and ACI 350 as applicable. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so that ends are directed into the concrete, not toward exposed concrete surfaces.
- E. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment or similar construction loads.

### 3.3 Joints

A. Locate and install construction joints, as shown of the Drawings, or specified herein, so that the strength and appearance of the structure will not be impaired.

- B. Provide keyways at least 1 1/2 inches deep in construction joints that are in walls and slabs or between walls and footings.
- C. Install joint filler and sealant materials as specified by the manufacturer.
- D. Construct contraction (control) joints in slabs on ground to form panels of patterns as shown. The soff-cut saw system shall be used immediately after final finishing and to a depth of 1/3 slab thickness. A conventional saw shall be used as soon as possible without dislodging aggregate and to a depth of 1/3 slab thickness, if the initial soff-cut did not achieve the 1/3 depth.
- F. Install semi-rigid joint filler or joint sealant in accordance with the direction of the manufacturer.

## 3.4 Preparation Of Form Surfaces

- A. Before placing reinforcement, coat the contact surfaces of forms with a form coating compound.
- B. Thin the form coating compound only with the amount and type of thinning agent and only under the conditions recommended by the compound manufacturer. Do not allow excess form coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply the form coating compound in compliance with the manufacturer's instructions.
- C. Coat steel forms with a nonstaining, rust preventive form oil, or otherwise protect against rusting. Rust stained steel formwork is not acceptable.

## 3.5 Concrete Placements

- A. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades that the formwork is complete so that they may then install their work; cooperate with other trades in setting such work. Wherever form coatings are not used, wet wood thoroughly just before placing concrete.
- B. Coordinate the installation of joint materials and moisture barriers with the placement of forms and reinforcing steel.
- C. Deposit concrete either continuously or in layers thick enough to prevent its being placed on concrete that has hardened enough to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as close to its final location as practicable in order to avoid segregation due to rehandling or flowing.
- D. Use mechanical vibrating equipment supplemented by hand spading, rodding, or tamping to consolidate placed concrete. The equipment and procedures used to consolidate the concrete shall comply with the recommended practices of ACI 309 and suit both the type of concrete and project conditions.

- E. Do not use vibrators to transport concrete once it is inside the forms. Insert and withdraw vibrators vertically at uniformly spaced locations no further apart than the visible horizontal effectiveness of the machine. Limit layer heights so that the vibrator is effective into 6 inches of the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix. Lower frequency vibrators may be used with "flowing" concrete.
- F. Consolidate concrete during placing operations so that it is thoroughly worked around reinforcement and other embedded items and into corners.
- G. Maintain reinforcement in the proper position during placement operations.

#### H. Cold Weather Placement

- Comply with ACI 306 and the requirements herein specified to protect concrete work from physical damage or reduced strength due to frost, freezing, or low temperatures.
- 2. When the air temperature has fallen or is expected to fall below 40 degrees F, heat all water and aggregates uniformly before mixing so that the concrete, at point of placement, will have a temperature of not less than 50 degrees nor more than 80 degrees F.
- 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- 4. Use only the specified nonchloride accelerator. Do not use calcium chloride or admixtures containing more than 0.05 percent chloride ions.

#### I. Hot Weather Placement

- 1. When the weather is hot enough to impair the concrete's quality and strength, place the concrete as specified herein and in ACI 305.
- 2. Cool ingredients before mixing so that when the concrete is placed, its temperature is below 90 degrees F. Mixing water may be chilled, or else a portion of the water may be in the form of chopped ice.
- 3. If reinforcing steel becomes hotter than the ambient air temperature, cool it with water soaked burlap so that its temperature will not exceed the ambient air temperature.
- 4. When high temperatures and/or placing or humidity conditions dictate, the mix may be initially retarded by use of the water reducing, retarding formulation (Type D) of the specified water reducing admixture (Type A).

## 3.6 Finish of Formed Surfaces

- A. Rough Form Finishes: For formed concrete surfaces not exposed to view in the finished work or covered by other construction, use a rough form finish unless otherwise indicated by the Drawings. Repair and patch tie holes and defective areas, and rub down or chip off fins and other projections more than 1/4 inch high.
- B. Rubbed Finish: At all formed surfaces exposed inside and outside the structure, apply rubbed finish as follows:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

# 3.7 Curing

- A. After placing and finishing the concrete, start initial curing of concrete as soon as free water has disappeared from concrete surface. Keep continuously moist for not less than 7 days.
- B. Begin final curing immediately after final finishing. Continue final curing for at least 7 days in accordance with ACI 301 and ACI 308. Avoid rapid drying at the end of the final curing period.
- C. Cure concrete by moist curing, moisture retaining cover curing, membrane curing, or combinations of these methods, as specified herein and ACI 308.
- D. Provide moisture curing by one of the following methods:
  - 1. Keep concrete surface continuously wet by covering with water.
  - 2. Spray it continuously with a water fog.
  - Cover the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water and keeping it wet; position the absorptive cover so that it covers the concrete surface and edges and laps adjacent absorptive covers by 4 inches.

### 3.8 Removal and Reuse of Forms

- A. Formwork not supporting weight of concrete (e.g., curbs, walls, and similar parts of the work) may be removed after curing at a temperature of not less than 50 degrees F 24 hours after the concrete is placed, provided the concrete is hard enough not to be damaged by form removal operations and provided curing and protection operations are maintained.
- B. Form facing material may be removed 4 days after concrete placement only if shores and other vertical supports have been arranged to permit it to be removed without loosening or disturbing shores and supports.
- C. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact form surfaces as specified above for new formwork.
- D. When forms are extended for successive concrete placement, clean surfaces thoroughly, remove fins and laitance, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces.

#### 3.9 Miscellaneous Concrete Items

#### Cast-In-Place Concrete

A. Nonshrink Grout: All column base plates, equipment bases, and other locations noted on the structural drawings shall be grouted with the specified nonshrink grout. All exposed grout shall be of the specified nonmetallic type.

## 3.10 Concrete Surface Repairs

- A. Repair and patch defective areas with cement mortar immediately after removing forms.
- B. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete, but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing cement mortar, thoroughly clean, dampen with water, and apply the specified bonding compound. The cement mortar shall be placed after the bonding compound has dried.
- C. Remove and replace concrete with defective surfaces if these effects cannot be repaired to the satisfaction of the Owner and Landscape Architect. Such surface defects include irregularities of color and texture, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, and fill with dry pack mortar or with precast cement cone plugs secured in place with bonding agent.
- D. Where possible, repair concealed formed surfaces that contain defects which adversely affect the durability of the concrete. If such defects cannot be repaired, remove and replace the concrete.
- E. After the concrete has cured at least 14 days, correct high areas in unformed surfaces by grinding.
- F. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting them out and refilling with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Landscape Architect.
- G. Repair isolated random cracks and single holes not over 1 inch in diameter by the dry pack method. Groove top of cracks, cut out holes until sound concrete is reached, and clean to remove dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply the specified bonding compound. Place dry pack after the bonding compound has dried. Dry pack shall consist of 1 part portland cement to 2 1/2 parts fine aggregate passing a No. 16 mesh sieve. Mix with no more water than is necessary for handling and placing. Compact dry pack mixture in place, and finish to match adjacent concrete. Keep patched area continuously moist for no less than 72 hours.
- H. All structural repairs shall be made, with prior approval of the Landscape Architect as to the method and procedure, using the specified epoxy adhesive and/or epoxy mortar.

I. Repair methods not specified above may be used, subject to acceptance by the Landscape Architect.

# 3.11 Quality Control Testing During Construction

- A. The Owner will employ a testing laboratory to perform any or all of the tests specified below and to submit reports on these tests. Sampling and testing for quality control during the placement of concrete may include the following, as directed by the Landscape Architect:
  - 1. Sampling Fresh Concrete: ASTM C172, but modified for slump to comply with ASTM C94.
  - 2. Slump: ASTM C143; one test for each concrete load at point of discharge and one test of each set of compressive strength test specimens.
  - Air Content: ASTM C173 volumetric method for lightweight concrete; ASTM C231 pressure method for normal weight concrete; one test for each set of compressive strength test specimens.
  - 4. Water Content: The water content of freshly mixed concrete will be tested each time cylinders are made and as directed by the Landscape Architect in accordance with AASHTO TP 23, Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
  - 5. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below or when 80 degrees F and above and each time a set of compression test specimens is made.
  - 6. Compression Test Specimen: ASTM C31; one set of 6 standard cylinders for each compressive strength test, unless otherwise directed by the Landscape Architect. Mold and store cylinders of laboratory cured test specimens except when the Landscape Architect requires field cured test specimens.
  - 7. Compressive Strength Tests: ASTM C39; one set for each 100 cubic yards or fraction thereof of each concrete class placed in any one day or one set for each 5,000 square feet of surface area placed; 2 specimens tested at 7 days, 2 specimens tested at 28 days, and 1 specimen retained in reserve for later testing, if needed.
- B. When the frequency of testing provides less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or, if fewer than 5 are used, from each batch.
- C. The strength level shall be considered satisfactory as long as the averages of all sets of 3 consecutive strength test results equal or exceed the specified strength f'c, and no individual test result falls below the specified strength f'c by more than 500 psi.
- D. When the strength of field cured cylinders is less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in place concrete.

#### Cast-In-Place Concrete

- E. Test results will be reported to the Landscape Architect and Contractor in writing on the same day that the test is made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, and compressive breaking strength and type of break for both 7 day tests and 28 day tests.
- F. Non-Compliant Test Reports: All test reports indicating non-compliance should be provided immediately to all parties on the test report distribution list.
- G. The testing service will make additional tests of in place concrete when the test results indicate that the required strength level has not been achieved and other characteristics have not been attained in the structure, as directed by the Landscape Architect. The testing service may conduct tests to determine the adequacy of concrete by cored cylinders that comply with ASTM C42 or by such other methods as are directed by the Landscape Architect. The Contractor shall pay for such tests and any additional testing that may be required when concrete is verified to be unacceptable.

**END OF SECTION** 

## Part 1 General

# 1.1 Summary

- A. Section Includes:
  - 1. Concrete masonry units.
  - 2. Steel reinforcing bars.

## 1.2 Definitions

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

## 1.3 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
- C. Samples: For each type and color of the following:
  - 1. Exposed CMUs.
  - 2. Pigmented mortar.

### 1.4 Informational Submittals

- A. Material Certificates: For each type and size of product. For masonry units, include data on material properties material test reports substantiating compliance with requirements.
- 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 C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
  - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

# 1.5 Quality Assurance

A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.

#### Concrete Unit Masonry

1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.

## 1.6 Field Conditions

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## Part 2 Products

# 2.1 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.
- C. See BIA Technical Notes 16B and NCMA TEK 7-3 for information on determining fire-resistance ratings of masonry walls.
- D. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

# 2.2 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.
- B. CMUs: ASTM C90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
  - 2. Density Classification: Normal weight.

#### 2.3 Concrete Lintels

A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

## 2.4 Mortar and Grout Materials

- A. Portland Cement: ASTM C150/C150M, 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.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- F. Aggregate for Mortar: ASTM C144.
  - 1. White-Mortar Aggregates: Natural white sand or crushed white stone.
  - 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
- J. Water: Potable.

## 2.5 Reinforcement

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, 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.

#### Concrete Unit Masonry

- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
  - 1. Mill-galvanized coating is not as thick as hot-dip galvanized coating. According to ASTM A951/A951M, mill-galvanized coating may be applied to wire before fabricating, but hot-dip galvanized coating must be applied after fabricating.
  - 2. Interior Walls: Hot-dip galvanized, carbon steel.
  - 3. Exterior Walls: Hot-dip galvanized carbon steel.
  - 4. Wire Size for Side Rods: 0.148-inch diameter.
  - 5. Wire Size for Cross Rods: 0.148-inch diameter.
  - 6. Spacing of Cross Rods: Not more than 16 inches o.c.
  - 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

## 2.6 Ties and Anchors

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
  - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
  - 2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
  - 3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized-steel wire.
  - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized-steel wire.
- C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  - Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch-thick steel sheet, galvanized after fabrication.
  - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized-steel wire.
  - 3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.060-inch-thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.

- D. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
  - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

# 2.7 Embedded Flashing Materials

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
  - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
  - 2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
  - Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
  - 4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  - 5. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
  - 6. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
  - Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
  - Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, crosslaminated polyethylene film to produce an overall thickness of not less than 0.030 inch
  - 3. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch.
  - 4. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

#### Concrete Unit Masonry

- 5. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch thick.
- C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

# 2.8 Miscellaneous Masonry Accessories

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, 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 D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, 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 D226/D226M, Type I (No. 15 asphalt felt).

# 2.9 Masonry Cell-Fill

- A. Foamed in place insulation: Amino Plast type
  - 1. Thermal Conductivity: ASTM C177;
    - a. 200 K value at 25 degrees F.
    - b. 218 K value at 75 degrees F.
  - 2. Water Vapor Transmission: ASTM E96; 6 to 7 perms per inch
  - 3. Density: ASTM D1622, 0.8 lb per cubic foot
  - 4. Flame Spread and Smoke Developed Rating: Class A product

### B. MANUFACTURERS

- PolyMaster, Inc. R501
- 2. Tailored Chemical Corefill 500
- 3. Thermco
- C. Lightweight-Aggregate Fill: ASTM C331/C331M.

#### 2.10 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 portland cement-lime or masonry cement mortar unless otherwise indicated.
  - 3. For exterior masonry, use portland cement-lime or masonry cement mortar.
  - 4. For reinforced masonry, use portland cement-lime or masonry cement mortar.
  - Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, 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 M Type S.
  - 2. For reinforced masonry, use Type S Type N.
  - 3. For mortar parge coats, use Type S or Type N.
  - 4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
  - 5. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.
  - 2. Pigments shall not exceed 5 percent of masonry cement by weight.
- E. Grout for Unit Masonry: Comply with ASTM C476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) 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 C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
  - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

## Part 3 Execution

## 3.1 Installation, General

A. 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.

## 3.2 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.
- 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 1/2inch maximum.
- 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
- 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

#### C. Joints:

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

# 3.3 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. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. 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.
- F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

## 3.4 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.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

# 3.5 Masonry Cell-Fill

A. Place foam insulation into cavities to fill void spaces.

## 3.6 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 o.c.
  - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  - 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 indi-
- C. First paragraph below can be deleted if rigid anchors are used to bond walls at intersections.
- D. Provide continuity at wall intersections by using prefabricated T-shaped units.
- E. Provide continuity at corners by using prefabricated L-shaped units.

# 3.7 Anchoring Masonry To Structural Steel And Concrete

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
  - Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

# 3.8 Flashing

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
  - Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place throughwall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

- 2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
- 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
- 4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

# 3.9 Reinforced Unit Masonry

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 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.
  - Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of 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: Owner 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.

# 3.11 Repairing, Pointing, and Cleaning

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

#### Concrete Unit Masonry

- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
  - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

## 3.12 Masonry Waste Disposal

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
  - 1. Generally, retain subparagraph below. If required, increase limit if acid-soil plants are used for foundation plantings.
  - 2. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

**END OF SECTION** 

## Part 1 General

# 1.1 Summary

- A. Section Includes:
  - 1. Stone masonry anchored to unit masonry backup.
  - 2. Stone masonry anchored to wood framing and sheathing.
- B. Products Installed but Not Furnished under This Section Include:
  - 1. Steel lintels in unit masonry.
  - 2. Steel shelf angles for supporting unit masonry.

## 1.2 Action Submittals

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples:
  - 1. For each stone type indicated.
  - 2. For each color of mortar required.

### 1.3 Field Conditions

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. 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 above and will remain so until masonry has dried.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## Part 2 Products

## 2.1 Quarry Stone

- A. Material Standards:
  - 1. Maximum Absorption per ASTM C97/C97M: 3 percent.
  - 2. Minimum Compressive Strength per ASTM C170/C170M: 7500 psi.
- B. Varieties and Sources: Subject to compliance with requirements, available stone varieties that may be incorporated into the Work include, but are not limited to, the following:

1. Thin veneer by Majestic Products, Dayton, Tennessee. <u>Davidzollinger01@gmail.com</u> 423-618-7910

## 2.2 Mortar Materials

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.
  - 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Masonry Cement: ASTM C91/C91M.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in stone masonry mortar.
- E. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 10 percent of portland cement by weight.
- F. Colored Masonry Cement Mix: Packaged blend of masonry cement and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 5 percent of masonry cement by weight.
- G. Aggregate: ASTM C144 and as follows:
  - 1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve
  - 2. White Aggregates: Natural white sand or ground white stone.
  - 3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
- H. Water: Potable.

#### 2.3 Veneer Anchors

- A. Materials:
  - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M; with ASTM A153/A153M, Class B-2.
  - 2. Stainless Steel Wire: ASTM A580/A580M, Type 304.
  - Hot-Dip Galvanized-Steel Sheet: ASTM A1008/A1008M, cold-rolled, carbon-steel sheet, hot-dip galvanized after fabrication to comply with ASTM A153/A153M, Class B-2.
  - 4. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

- B. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
- C. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inch-diameter, hot-dip galvanized steel wire.
- D. Corrugated-Metal Veneer Anchors: Not less than 0.030-inch-thick by 7/8-inch-wide hotdip galvanized steel sheet with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch.
- E. Adjustable Masonry-Veneer Anchors:
  - 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
  - 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-thick steel sheet, galvanized after fabrication.
  - 3. Fabricate wire ties from 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
  - 4. Fabricate wire connector sections from 0.187-inch-diameter, hot-dip galvanized-steel wire.
  - 5. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
- F. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:
  - Anchor Section: Rib-stiffened, sheet metal plate with screw holes in top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit veneer anchor section.
- G. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:
  - 1. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 9 inches long, with screw holes in top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 5-1/2 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
- H. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:
  - 1. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes in top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
- I. Adjustable, Screw-Attached Veneer Anchors: Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:

- 1. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes in top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised ribstiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
- J. Adjustable, Seismic Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in stone masonry mortar joint, complying with the following requirements:
  - 1. Anchor Section: Rib-stiffened, sheet metal plate with screw holes in top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section. Size wire tie to extend at least 1-1/2 inches into stone masonry but with at least a 5/8-inch cover on exterior face.
  - 2. Connector Section: Sheet metal clip welded to wire tie with integral tabs designed to engage continuous wire.
  - 3. Continuous Wire: 0.188-inch-diameter, hot-dip galvanized steel wire.
- K. Adjustable, Seismic Veneer Anchors: Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in stone masonry mortar joint, complying with the following requirements:
  - 1. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes in top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
  - 2. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire.
  - 3. Continuous Wire: 0.188-inch-diameter, hot-dip galvanized steel wire.

# 2.4 Embedded Flashing Materials

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
  - 1. Stainless Steel: ASTM A240/A240M. Type 304, 0.016 inch thick.
  - 2. Copper: ASTM B370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. weight or 0.0135 inch thick for fully concealed flashing; 16-oz./sq. ft. weight or 0.0216 inch thick elsewhere.
  - 3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
  - 4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
  - 5. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
  - 6. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.

- B. Flexible Flashing: For flashing unexposed to the exterior, use one of the following unless otherwise indicated:
  - 1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded with asphalt between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
  - 2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive, rubberized-asphalt compound, bonded to a high-density, cross-laminated, polyethylene film to produce an overall thickness of not less than 0.030 inch.

## 2.5 Miscellaneous Masonry Materials

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Cementitious Dampproofing: Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
- C. Asphalt Dampproofing: Cut-back asphalt complying with ASTM D4479/D4479M, Type I or asphalt emulsion complying with ASTM D1227, Type III or Type IV.
- D. Weep/Vent Products: Use one of the following unless otherwise indicated:
  - 1. Wicking Material: Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity behind stone masonry. Use only for weeps.
  - 2. Round Plastic Tubing: Medium-density polyethylene, 3/8-inch OD by thickness of stone masonry.
  - 3. Mesh Weep Holes/Vents: Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches high by thickness of stone masonry; in color selected from manufacturer's standard.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
  - 1. Provide one of the following configurations:
    - Strips, full depth of cavity and 10 inches wide, with dovetail-shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
    - b. Strips, not less than 3/4 inch thick and 10 inches wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
    - c. Sheets or strips full depth of cavity and installed to full height of cavity.
    - d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.

## 2.6 Masonry Cleaners

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

### 2.7 Fabrication

- A. Cut Split or Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.
  - 1. Shape stone specified to be laid in three-course, random range ashlar pattern with split beds.
- B. Thickness of Stone: Provide thickness indicated, but not less than the following:
  - 1. Thickness: 2 inches plus or minus 1/4 inch. Thickness does not include projection of pitched faces.
- C. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples.
  - 1. Finish: Mixed split face, seam face, and rock face (pitched face).
  - 2. Finish for Sills: Smooth.
  - 3. Finish for Lintels: Smooth.
  - 4. Finish for Copings: Smooth.
    - a. Finish exposed ends of copings same as front and back faces.

#### 2.8 Mortar Mixes

- A. General: Do not use admixtures unless otherwise indicated.
  - 1. Do not use calcium chloride.
  - 2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
  - 3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Mortar for Stone Masonry: Comply with ASTM C270, Proportion Specification.
  - 1. Mortar for Setting Stone: Type S.
  - 2. Mortar for Pointing Stone: Type N.

- C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.
  - 2. Pigments shall not exceed 5 percent of masonry cement by weight.

## Part 3 Execution

## 3.1 Prepartion

- A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
- B. Coat concrete and unit masonry backup with asphalt dampproofing.

## 3.2 Installation of Stone Masonry

- A. Perform necessary field cutting and trimming as stone is set.
  - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
  - 2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
  - 3. Pitch face at field-split edges as needed to match stones that are not field split.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones in range ashlar pattern with course heights as indicated, random lengths, and uniform joint widths, with offset between vertical joints as indicated.
- D. Arrange stones in broken-range ashlar pattern with uniform course heights, random lengths, and uniform joint widths.
- E. Arrange stones in three-course, random-range ashlar pattern with random course heights, random lengths (interrupted coursed), and uniform joint widths.
- F. Arrange stones in coursed rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.
- G. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- H. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 3/8 inch at widest points.

- I. Provide sealant joints of widths and at locations indicated.
  - 1. Keep sealant joints free of mortar and other rigid materials.
  - 2. Sealant joints are specified in Section 079200 "Joint Sealants."
- J. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
  - 1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 8 inches, and behind weather barrier.
  - 2. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 4 inches, and extend into or through inner wythe to comply with requirements in Section 042000 "Unit Masonry."
  - 3. At concrete backing, extend flashing through stone masonry, turned up a minimum of 4 inches, and insert in reglet.
  - 4. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
  - 5. At sills, extend flashing not less than 4 inches at ends.
  - 6. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
  - 7. Extend sheet metal flashing 1/2 inch beyond masonry face at exterior, and turn flashing down to form a drip.
  - 8. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal drip edge.
  - 9. Install metal flashing termination beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal flashing termination.
  - 10. Cut flexible flashing flush with wall face after completing masonry wall construction.
- K. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
  - 1. Use wicking material to form weep holes.
  - 2. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
  - 3. Space weep holes 16 inches o.c.
  - 4. Trim wicking material used in weep holes flush with exterior wall face after mortar has set.
  - 5. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- L. Install vents in head joints at top of each continuous cavity at spacing indicated. Use mesh weep holes/vents or open head joints to form vents.
- M. Coat limestone with cementitious dampproofing as follows:
  - 1. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches above finish-grade elevations.

2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.

#### 3.3 Construction Tolerances

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

## 3.4 Installation of Stone Masonry

- A. Anchor stone masonry to concrete with corrugated-metal veneer anchors unless otherwise indicated. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.
- B. Anchor stone masonry to unit masonry with corrugated-metal or individual wire veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells at a distance of at least one-half of unit masonry thickness.
- C. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry.
- D. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement with vertical rods inserted through anchors and through eyes of masonry joint reinforcement projecting from unit masonry.
- E. Anchor stone masonry to stud framing with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors through sheathing to framing with two screws.
- F. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
  - 1. Install continuous wire reinforcement in horizontal joints and attach to seismic veneer anchors as stone is set.
- G. Space anchors to provide not less than one anchor per 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

- H. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- I. Space anchors not more than 18 inches o.c. vertically and 32 inches o.c. horizontally, with not less than one anchor per 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- J. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
- K. Fill space between back of stone masonry and weather-resistant sheathing paper with mortar as stone is set.
- L. Provide 1-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
  - 1. Slope beds toward cavity to minimize mortar protrusions into cavity.
  - 2. Do not attempt to trowel or remove mortar fins protruding into cavity.
- M. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

## 3.5 Pointing

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
  - 1. Joint Profile: Smooth, flat face slightly below edges of stone.

# 3.6 Adjusting and Cleaning

- A. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

- 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
- 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
- 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
- 5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
- 6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
- 7. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

### 3.7 Excess Materials and Waste

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
  - 1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

**END OF SECTION** 

# Rough Carpentry

## Part 1 General

# 1.1 Summary

#### A. Section Includes:

- 1. Framing with dimension lumber.
- 2. Framing with engineered wood products.
- 3. Shear wall panels.
- 4. Rooftop equipment bases and support curbs.
- 5. Wood blocking and nailers.
- 6. Wood furring and grounds.
- 7. Wood sleepers.
- 8. Plywood backing panels.

### 1.2 Action Submittals

A. Product Data: For each type of process and factory-fabricated product.

### 1.3 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. Shear panels.
  - 5. Power-driven fasteners.
  - Post-installed anchors.
  - 7. Metal framing anchors.

# Part 2 Products

## 2.1 Wood Products, General

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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.

### Rough Carpentry

- 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.
- C. 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, as published by manufacturer, shall 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.

## 2.2 Wood-Preservative-Treated-Lumber

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with 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, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
  - 5. Wood floor plates that are installed over concrete slabs-on-grade.

### 2.3 Fire-Retardant-Treated Materials

A. General: Where fire-retardant-treated materials are indicated, materials shall comply 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 E84, 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.
  - 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 D2898. 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 D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to 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. Framing for stages.
  - 3. Concealed blocking.
  - 4. Framing for non-load-bearing partitions.
  - 5. Framing for non-load-bearing exterior walls.
  - 6. Roof construction.
  - 7. Plywood backing panels.

# 2.4 Dimension Lumber Framing

- A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
  - 1. Application: All interior partitions.
  - 2. Species:
    - a. Southern pine or 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 Partitions: No. 2 grade.
  - 1. Application: Framing other than interior partitions not indicated as load bearing.
  - 2. Species:
    - a. Hem-fir (north); NLGA.
    - b. Southern pine; SPIB.
    - c. Douglas fir-larch; WCLIB or WWPA.
    - d. Southern pine or mixed southern pine; SPIB.
    - e. Spruce-pine-fir; NLGA.

### Rough Carpentry

- f. Douglas fir-south; WWPA.
- g. Hem-fir; WCLIB or WWPA.
- h. Douglas fir-larch (north); NLGA.
- i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Framing Other Than Non-Load-Bearing 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 singlemember use.
  - 1. Application: Framing other than interior partitions not indicated as load-bearing.
- D. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
  - 1. Species and Grade: As indicated above for load-bearing construction of same type.

## 2.5 Engineered Wood Products

- A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
  - 1. Extreme Fiber Stress in Bending, Edgewise: 3100 psi for 12-inch nominal-depth members.
  - 2. Modulus of Elasticity, Edgewise: 2,000,000 psi.
- B. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D5055.
  - 1. Web Material: Either OSB or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
  - 2. Structural Properties: Depths and design values not less than those indicated.
  - Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA-EWS standard.
- C. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.
  - 1. Manufacturer: Provide products by same manufacturer as I-joists.
  - 2. Material: glued-laminated wood or product made from any combination solid lumber, wood strands, and veneers.
  - 3. Thickness: 1 inch.
  - 4. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

- D. Insulated Rim Boards: Insulated product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
  - 1. Manufacturer: Provide products by same manufacturer as I-joists.
  - 2. Rim Board Material: All-veneer product glued-laminated wood or product made from any combination solid lumber, wood strands, and veneers.
  - 3. Rim Board Thickness: 1 inch.
  - 4. Insulation: 1-1/2-inch-thick polyisocyanurate foam complying with ASTM C1289.
  - 5. Inside Facing: 7/16-inch-thick OSB.
  - 6. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

#### 2.6 Shear Wall Panels

- A. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood or OSB sheathing.
- B. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized-steel panel, steel top and bottom plates, and wood studs.
- C. Allowable design loads, as published by manufacturer, shall 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.

## 2.7 Miscellaneous Lumber

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.
  - 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
  - 2. Eastern softwoods; No. 2 Common grade; NeLMA.
  - 3. Northern species; No. 2 Common grade; NLGA.
  - 4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

# 2.8 Plywood Backing Panels

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

### 2.9 Fasteners

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressurepreservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

## 2.10 Metal Framing Anchors

- A. Allowable design loads, as published by manufacturer, shall 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. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
  - 1. Use for wood-preservative-treated lumber and where indicated.

## 2.11 Miscellaneous Materials

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

# Part 3 Execution

#### 3.1 Installation

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install shear wall panels to comply with manufacturer's written instructions.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. 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 (IBC).
  - 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.

#### 3.2 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

### Rough Carpentry

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 wet enough 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** 

### Part 1 General

### 1.1 Summary

#### A. Section Includes:

1. Framing using timbers.

### 1.2 General

A. Heavy timber framing and connections shall be designed by the timber manufacturer's engineer. Provide sealed drawings and calculations for review.

#### 1.3 Definitions

- A. Timbers: Lumber of 5 inches nominal or greater in least dimension.
- B. Inspection agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NHLA: National Hardwood Lumber Association.
  - 3. NLGA: National Lumber Grades Authority.
  - 4. SPIB: Southern Pine Inspection Bureau (The).
  - 5. WCLIB: West Coast Lumber Inspection Bureau.
  - 6. WWPA: Western Wood Products Association.

#### 1.4 Informational Submittals

A. Certificates of Inspection: Issued by lumber-grading agency for exposed timber not marked with grade stamp.

# 1.5 Delivery, Storage, and Handling

- A. Schedule delivery of materials to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

# Part 2 Products

#### 2.1 Timber

A. Comply with DOC PS 20 and with grading rules of lumber-grading agencies certified by ALSC's Board of Review as applicable.

#### Heavy Timber Construction

- 1. Factory mark each item of timber with grade stamp of grading agency.
- 2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.
- 3. Species: Rough cut Cypress.
- B. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing.
- C. Dressing: Provide dressed timber (S4S) unless otherwise indicated.

### 2.2 Timber Connectors

- A. Provide bolts, 3/4 inch as required by design, complying with ASTM A307, Grade A; provide nuts complying with ASTM A563; and, where indicated, provide flat washers.
- B. Brackets for attachment to masonry walls shall be made with epoxy or screw type post installed anchors.
- C. Provide shear plates, 2-5/8 inches in diameter, complying with ASTM D5933.
- D. Materials: Unless otherwise indicated, fabricate from the following materials:
  - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.
  - 2. Round steel bars complying with ASTM A575, Grade M 1020.
  - 3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.
- E. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness.
- F. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123/A123M or ASTM A153/A153M.

#### 2.3 Miscellaneous Materials

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Transparent, penetrating wood sealer that is compatible with indicated finish.

#### 2.4 Fabrication

A. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

- B. Coat crosscuts with end sealer.
- C. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

### Part 3 Execution

### 3.1 Installation

- A. General: Erect heavy timber framing true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
- B. Fitting: Fit members by cutting and restoring exposed surfaces to match specified surfacing.
  - 1. Predrill for fasteners using timber connectors as templates.
  - 2. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
  - Coat crosscuts with end sealer.
- C. Install timber connectors as indicated.
  - 1. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

# 3.2 Adjusting

A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber framing if repairs are not approved by Architect.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

A. Section includes glued-laminated wood roof decking

### 1.2 Action Submittals

A. Product Data: For each type of product.

#### 1.3 Informational Submittals

A. Research/Evaluation Reports: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, from ICC-ES.

## Part 2 Products

### 2.1 Wood Roof Decking, General

A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

### 2.2 Glue Laminated Wood Roof Decking

- A. Face Species: Douglas fir-larch or Douglas fir-larch (North) Ponderosa pine Southern pine Western cedars or western cedars (North).
- B. Roof Decking Nominal Size: 4 by 6.
- C. Face Grade: Custom or Supreme: Clear face is required. Occasional pieces may contain a small knot or minor characteristic that does not detract from the overall appearance.
- D. Face Grade: Decorative: Sound knots and natural characteristics are allowed, including chipped edge knots, short end splits, seasoning checks, and some pin holes. Face knot holes, stains, end slits, skips, roller splits, and planer burns are not allowed.
- E. Face Grade: Service: Face knot holes, stains, end splits, skips, roller splits, planer burns, and other nonstrength-reducing characteristics are allowed. Strength-reducing characteristics are not allowed.
- F. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.
- G. Face Surface: Smooth.
- H. Edge Pattern: Vee grooved.

#### Wood Roof Decking

I. Laminating Adhesive: Wet-use type complying with ASTM D2559.

## 2.3 Accessory Materials

- A. Fastener Material: Hot-dip galvanized steel.
- B. Sealants: Latex, complying with applicable requirements in Section 079200 "Joint Sealants" and recommended by sealant manufacturer and manufacturer of substrates for intended application.

### Part 3 Execution

#### 3.1 Installation

- A. Install solid-sawn wood roof decking to comply with AITC 112.
  - Locate end joints for combination simple and two-span continuous lay-up.
- B. Install laminated wood roof decking to comply with manufacturer's written instructions.
  - 1. Locate end joints for combination simple and two-span continuous lay-up.
  - 2. Nail each course of glued-laminated wood roof decking at each support with one nail slant nailed above the tongue and one nail straight nailed through the face.
    - a. Use 12d nails for 2-by-6 and 2-by-8 roof decking.
    - b. Use 30d nails for 3-by-6 and 3-by-8 roof decking.
    - c. Use 60d nails for 4-by-6 and 4-by-8 roof decking. Predrill roof decking to prevent splitting.
    - d. Use 30d tongue nails in bottom tongue and 3/8-inch face spikes for 5-by-6 and 5-by-8 roof decking. Predrill roof decking at spikes to prevent splitting.
  - 3. Slant nail each course of glued-laminated wood roof decking to the tongue of the adjacent course at 30 inches o.c. and within 12 inches of the end of each unit. Stagger nailing 15 inches in adjacent courses.
    - a. Use 6d nails for 2-by-6 and 2-by-8 roof decking.
    - b. Use 8d nails for 3-by-6 and 3-by-8 roof decking.
    - c. Use 10d nails for 4-by-6 and 4-by-8 roof decking.
    - d. Use 16d nails for 5-by-6 and 5-by-8 roof decking.
- C. Anchor wood roof decking, where supported on walls, with bolts as indicated.
- D. Apply joint sealant to seal roof decking at exterior walls at the following locations:
  - 1. Between roof decking and supports located at exterior walls.
  - 2. Between roof decking and exterior walls that butt against underside of roof decking.
  - 3. Between tongues and grooves of roof decking over exterior walls and supports at exterior walls.

# 3.2 Protection

A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Wall sheathing.
- 2. Roof sheathing.
- 3. Sheathing joint and penetration treatment.

### 1.2 Action Submittals

A. Product Data: For each type of process and factory-fabricated product.

#### 1.3 Informational Submittals

- A. Evaluation Reports: For the following, from ICC-ES:
  - 1. Wood-preservative-treated plywood.
  - 2. Fire-retardant-treated plywood.
  - 3. Foam-plastic sheathing.

## Part 2 Products

## 2.1 Performance Requirements

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

# 2.2 Preservative-Treated Plywood

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

## 2.3 Fire-Retardant-Treated Plywood

- 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 Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, 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.
  - Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. 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 D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
  - 3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings.

# 2.4 Wall Sheathing

- A. Plywood Sheathing: DOC PS 1, sheathing.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.
- C. Foil-Faced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type I or Type II, Class 2, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.
  - 1. Thickness: As indicated.
  - 2. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

# 2.5 Roof Sheathing

A. Plywood Sheathing: Either DOC PS 1 or DOC PS 2, sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.

## 2.6 Subfloor Underlayment

- A. Plywood Subflooring: Either DOC PS 1 or DOC PS 2, single-floor panels or sheathing.
- B. Oriented-Strand-Board Subflooring: DOC PS 2, Exposure 1, Structural I sheathing.

### 2.7 Fasteners

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
  - 2. For roof and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

### 2.8 Sheathing Joint-And-Penetration Treatment Materials

A. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

#### 2.9 Miscellaneous Materials

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

### Part 3 Execution

### 3.1 Installation, General

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
  - 3. ICC-ES evaluation report for fastener.

#### Sheathing

- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

#### 3.2 Wood Structural Panel Installation

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Combination Subfloor-Underlayment:
    - a. Nail to wood framing.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch apart at edges and ends.
  - 2. Wall and Roof Sheathing:
    - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch apart at edges and ends.
  - 3. Underlayment:
    - a. Nail to subflooring.
    - b. Space panels 1/32 inch apart at edges and ends.
    - Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

# 3.3 Foam-Plastic Sheathing Installation

- A. Comply with manufacturer's written instructions.
- B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
- C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

#### **END OF SECTION**

# **Shop-Fabricated Wood Trusses**

### Part 1 General

## 1.1 Summary

#### A. Section Includes:

Wood roof trusses.

#### 1.2 Action Submittals

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
- B. Shop Drawings: Show fabrication and installation details for trusses.
  - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
  - 2. Indicate sizes, stress grades, and species of lumber.
  - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
  - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
  - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
  - 6. Show splice details and bearing details.
- C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.3 Informational Submittals

- A. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
- B. Evaluation Reports: For the following, from ICC-ES:
  - 1. Metal-plate connectors.
  - 2. Metal truss accessories.

# 1.4 Quality Assurance

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
  - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.

- 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction and is certified for chain of custody by an FSCaccredited certification body.

# 1.5 Delivery, Storage, and Handling

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

## Part 2 Products

## 2.1 Performance Requirements

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

### 2.2 Dimension Lumber

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (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. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

#### 2.3 Metal Connector Plates

- A. Fabricate connector plates to comply with TPI 1.
- B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

#### 2.4 Fasteners

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
  - 2. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

### 2.5 Metal Framing Anchors and Accessories

- A. Allowable design loads, as published by manufacturer, shall comply with 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. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

#### 2.6 Fabrication

- A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
  - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

### Part 3 Execution

#### 3.1 Installation

A. Install wood trusses only after supporting construction is in place and is braced and secured.

#### Shop-Fabricated Wood Trusses

- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- F. Securely connect each truss ply required for forming built-up girder trusses.
- G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
  - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
  - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- H. Install wood trusses within installation tolerances in TPI 1.
- I. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- J. Replace wood trusses that are damaged or do not comply with requirements.

**END OF SECTION** 

## Interior Architectural Woodwork

### Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Interior standing and running trim.
- 2. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
- 3. Shop priming of interior architectural woodwork.
- 4. Shop finishing of interior architectural woodwork.

## 1.2 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 Action Submittals

- A. Product Data: For the following:
  - Anchors.
  - Adhesives.
  - 3. Shop finishing materials.
  - Fire-Retardant Treatment: Include data and warranty information from chemicaltreatment manufacturer and certification by treating plant that treated materials comply with requirements.

#### B. Shop Drawings:

- 1. Include the following:
  - a. Dimensioned plans, elevations, and sections.
  - b. Attachment details.
- 2. Show large-scale details.
- 3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
- 4. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples: For each exposed product and for each shop-applied color and finish specified.

#### 1.4 Informational Submittals

- A. Qualification Data: For architectural woodwork manufacturer.
- B. Product Certificates: For the following:

Interior Architectural Woodwork

- Composite wood and agrifiber products.
- 2. Adhesives.
- C. Field quality-control reports.

#### 1.5 Closeout Submittals

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

### 1.6 Quality Assurance

- A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
  - 1. Installer Qualifications: Manufacturer of products and Licensed participant in AWI's Quality Certification Program.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockups of typical interior architectural woodwork as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

### 1.7 Field Conditions

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

### Part 2 Products

# 2.1 Architectural Woodwork, General

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
  - 1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.

## 2.2 Interior Standing And Running Trim for Transparent Finish

A. Architectural Woodwork Standards Grade: Custom.

#### B. Softwood Lumber:

- Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
- 2. Species: Eastern white pine.
- 3. Cut: Plain sawn.
- 4. Wood Moisture Content: 5 to 10 percent.
- 5. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- 6. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
  - a. For veneered base, use softwood lumber core, glued for width.
- 7. For base wider than available lumber, glue for width. Do not use veneered construction.
- 8. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.
- 9. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.

# 2.3 Interior Standing And Running Trim for Opaque Finish

- A. Architectural Woodwork Standards Grade: Custom.
  - 1. Wood Species: Eastern white pine, sugar pine, or western white pine.
  - 2. Wood Moisture Content: 5 to 10 percent.

### 2.4 Hardwood Sheet Materials

- A. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.
  - 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
  - 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
  - 3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
  - 4. Softwood Plywood: DOC PS 1, medium-density overlay.
  - 5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

### 2.5 Fire-Retardant-Treated Wood Materials

- A. Fire-Retardant-Treated Wood Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.
  - 1. Use treated materials that comply with requirements of the Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
  - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
  - 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, 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. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
  - 2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
  - 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
  - 4. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less according to ASTM E84.
  - 1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
  - 2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1, except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screwholding capacity on face and edge, 250 and 175 lbf, respectively.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals

mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less according to ASTM E84.

### 2.6 Miscellaneous Materials

- A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
  - 1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.
    - a. Provide where in contact with concrete or masonry.
    - b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
    - c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
    - d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
  - 2. Fire-Retardant Treatment: Complying with requirements; provide where indicated.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
  - 1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
  - 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

#### 2.7 Fabrication

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
  - 1. Ease edges to radius indicated for the following:
    - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
    - b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

#### Interior Architectural Woodwork

- 1. Disassemble components only as necessary for shipment and installation.
- 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
- 3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
  - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
  - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

# 2.8 Shop Priming

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
- B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 099123 "Interior Painting."
  - 1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.
- C. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."
  - 1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

# 2.9 Shop Finishing

- A. Finish interior architectural woodwork with transparent finish at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
  - Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to endgrain surfaces.

#### C. Transparent Finish:

1. Architectural Woodwork Standards Grade: Custom.

- 2. Finish: System 1, Lacquer, Nitrocellulose.
- 3. Finish: System 2, Lacquer, Pre Catalyzed.
- 4. Finish: System 3, Lacquer, Post Catalyzed.
- 5. Finish: System 4, Latex Acrylic, Water Based.
- 6. Finish: System 5, Varnish, Conversion.
- 7. Finish: System 6, Oil, Synthetic Penetrating.
- 8. Finish: System 7, Vinyl, Catalyzed.
- 9. Finish: System 8, Acrylic Cross Linking, Water Based.
- 10. Finish: System 9, UV Curable, Acrylated Epoxy, Polyester, or Urethane.
- 11. Finish: System 10, UV Curable, Water Based.
- 12. Finish: System 11, Polyurethane, Catalyzed.
- 13. Finish: System 12, Polyurethane, Water Based.
- 14. Finish: System 13, Polyester, Catalyzed.
- 15. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
- 16. Staining: Match approved sample for color.
- 17. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
- 18. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
- 19. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter according to ASTM D523.

#### D. Opaque Finish:

- 1. Architectural Woodworking Standards Grade: Custom.
- 2. Finish: System 1, Lacquer, Nitrocellulose.
- 3. Finish: System 2, Lacquer, Pre Catalyzed.
- 4. Finish: System 3, Lacquer, Post Catalyzed.
- 5. Finish: System 4, Latex Acrylic, Water Based.
- 6. Finish: System 5, Varnish, Conversion.
- 7. Finish: System 7, Vinyl, Catalyzed.
- 8. Finish: System 8, Acrylic Cross Linking, Water Based.
- 9. Finish: System 9, UV Curable, Acrylated Epoxy, Polyester, or Urethane.
- 10. Finish: System 10, UV Curable, Water Based.
- 11. Finish: System 11, Polyurethane, Catalyzed.
- 12. Finish: System 12, Polyurethane, Water Based.
- 13. Finish: System 13, Polyester, Catalyzed.
- 14. Color: As selected by Architect from manufacturer's full range.
- 15. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter according to ASTM D523.

## Part 3 Execution

## 3.1 Preparation

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

#### Interior Architectural Woodwork

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

#### 3.2 Installation

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
  - 1. Shim as required with concealed shims.
  - 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.
- F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
  - 1. Secure with countersunk, concealed fasteners and blind nailing.
  - 2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
  - 3. For shop-finished items, use filler matching finish of items being installed.

#### H. Standing and Running Trim:

- 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
- 2. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary.
- 3. Scarf running joints and stagger in adjacent and related members.
- 4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
- 5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

# 3.3 Field Quality Control

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
  - 1. Inspection entity shall prepare and submit report of inspection.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

- A. Section Includes:
  - 1. Polyisocyanurate foam-plastic board insulation.
  - 2. Glass-fiber blanket insulation.

#### 1.2 Action Submittals

- A. Product Data: For the following:
  - 1. Polvisocyanurate foam-plastic board insulation.
  - 2. Glass-fiber blanket insulation.

#### 1.3 Information Submittals

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
  - 1. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product test reports.
- C. Research reports.

### Part 2 Products

# 2.1 Polyisocyanurate Foam-Plastic Board Insulation

- A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.
  - 1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
  - 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

#### 2.2 Glass-Fiber Blanket Insulation

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
  - Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
  - 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
  - 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

#### Thermal Insulation

- B. Glass-Fiber Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
  - Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

### 2.3 Accessories

- A. Insulation for Miscellaneous Voids:
  - 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
  - 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

### Part 3 Execution

### 3.1 Installation, General

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

# 3.2 Installation of Cavity-Wall Insulation

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
  - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
  - 2. Press units firmly against inside substrates.
  - 3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

#### 3.3 Insulation Of In Framed Construction

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  - 6. For wood-framed construction, install blankets according to ASTM C1320 and as follows:
    - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
  - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

**END OF SECTION** 

### Foamed-In-Place Insulation

### Part 1 General

## 1.1 Summary

- A. Section Includes:
  - 1. Closed-cell spray polyurethane foam.

### 1.2 Action Submittals

A. Product Data: For each type of product.

#### 1.3 Informational Submittals

- A. Product test reports.
- B. Research reports.

### Part 2 Products

## 2.1 Closed-Cell Spray Polyurethane Foam

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
  - 1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

### Part 3 Execution

#### 3.1 Installation

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

#### **END OF SECTION**

# Standing-Seam Metal Roof Panels

### Part 1 General

## 1.1 Summary

#### A. Section Includes:

1. Standing-seam metal roof panels.

# 1.2 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
- C. Samples: For each type of metal panel indicated.

#### 1.4 Informational Submittals

- A. Product test reports.
- B. Warranties: Sample of special warranties.

#### 1.5 Closeout Submittals

A. Maintenance data.

# 1.6 Quality Assurance

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

# 1.7 Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on 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: 20 years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion.

## Part 2 Products

### 2.1 Performance Requirements

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
  - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 or ASTM E331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- D. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E2140.
- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
  - 1. Uplift Rating: UL 60.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base 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.

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# 2.2 Standing-Seam Metal Roof Panels

- A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
  - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.
  - 2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.
- B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
  - Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
    - a. Nominal Thickness: 0.040 inch.
    - b. Exterior Finish: Two-coat fluoropolymer.
    - c. Color: As selected by Architect from manufacturer's full range.
  - 2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
    - a. Thickness: 0.040 inch.
    - b. Surface: Smooth, flat finish.
    - c. Exterior Finish: Two-coat fluoropolymer.
    - d. Color: As selected by Architect from manufacturer's full range.
  - 3. Clips: Two-piece floating to accommodate thermal movement.
    - a. Material: 0.064-inch-nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
    - b. Material: 0.062-inch-thick, stainless-steel sheet.
  - 4. Panel Coverage: 24 inches.
  - 5. Panel Height: 1.5 inches.

# 2.3 Underlayment Materials

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt

#### Standing-Seam Metal Roof Panels

adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

- 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.
- 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.
- B. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.
- C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

#### 2.4 Miscellaneous Materials

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
  - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefinfoam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Gutters and Downspouts: Formed from same material as roof panels according to SMACNA's "Architectural Sheet Metal Manual." Finish to match metal roof panels, roof fascia and rake trim.
- E. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

- F. Panel Fasteners: Self-tapping screws designed to withstand design loads.
- G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
  - 2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
  - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

### 2.5 Fabrication

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

### 2.6 Finishes

#### A. Panels and Accessories:

- 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
- 2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

# Part 3 Execution

# 3.1 Preparation

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

## 3.2 Installation of Underlayment

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
  - 1. Apply over the entire roof surface.
  - 2. Apply over the roof area indicated below:
    - a. Roof perimeter for a distance up from eaves of 36 inches beyond interior wall line.
    - b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
    - c. Rake edges for a distance of 18 inches.
    - d. Hips and ridges for a distance on each side of 12 inches.
    - e. Roof-to-wall intersections for a distance from wall of 18 inches.
    - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches.

# 3.3 Installation of Standing Seam Metal Roof Panels

- A. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
  - 1. Install clips to supports with self-tapping fasteners.
  - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
  - 4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
  - 5. Watertight Installation:
    - a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.

Standing-Seam Metal Roof Panels

- b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
- c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.
- B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
- C. 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.

## 3.4 Cleaning and Protection

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

A. Section includes fiber-cement siding and soffit.

## 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Samples: For fiber-cement siding and soffit including related accessories.

## 1.1 Informational Submittals

- A. Product certificates.
- B. Product test reports.
- C. Research/evaluation reports.
- D. Sample warranty.

### 1.2 Closeout Submittals

A. Maintenance data.

# 1.3 Quality Assurance

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
  - 1. Build mockup of typical wall area as shown on Drawings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

# 1.4 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## Part 2 Products

# 2.1 Fiber-Cement Siding

- A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. James Hardie Building Products, Inc.
- B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: Not less than 5/16 inch.
- D. Vertical Pattern: 48-inch-wide sheets with wood-grain texture and 2 ½" Batten Strips at 24 inches o.c.
- E. Panel Texture: 48-inch-wide sheets with wood-grain texture.
- F. Factory Priming: Manufacturer's standard acrylic primer.

## 2.2 Fiber-Cement Soffit

- A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. James Hardie Building Products, Inc.
- B. Nominal Thickness: Not less than 5/16 inch.
- C. Pattern: 16-inch-wide sheets with wood-grain texture.
- D. Factory Priming: Manufacturer's standard acrylic primer.

## 2.3 Accessories

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
- B. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating.

#### C. Fasteners:

- 1. For fastening to wood, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1 inch into substrate.
- 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
- 3. For fastening fiber cement, use hot-dip galvanized fasteners.

## Part 3 Execution

## 3.1 Installation

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
  - 1. Install fasteners no more than 24 inches o.c.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

# 3.2 Adjusting and Cleaning

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

- A. Section Includes:
  - 1. Roof-edge specialties.
  - 2. Roof-edge drainage systems.
  - 3. Weathervane
- B. Preinstallation Conference: Conduct conference at Project site.

## 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For roof specialties.
  - 1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
- C. Samples: For each type of roof specialty and for each color and texture specified.

## 1.3 Informational Submittals

- A. Product Test Reports: For tests performed by a qualified testing agency.
- B. Sample warranty.

## 1.4 Closeout Submittals

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

## 1.5 Warranty

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 074113.16 Standing Seam Metal Roof
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

## Part 2 Products

## 2.1 Performance Requirements

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base 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.

# 2.2 Roof-Edge Specialties

- 1. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.
  - a. Surface: Smooth, flat finish.
  - b. Finish: Two-coat fluoropolymer.
  - c. Color: As selected by Architect from manufacturer's full range.
- 2. Corners: Factory mitered and soldered.
- 3. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

# 2.3 Roof-Edge Drainage Systems

- A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
  - 1. Zinc-Coated Steel: Nominal 0.034-inch thickness.
  - 2. Aluminum Sheet: 0.063 inch thick.
  - 3. Copper Sheet: 20 oz./sq. ft.
  - 4. Gutter Profile: Style F according to SMACNA's "Architectural Sheet Metal Manual."
  - 5. Corners: Factory mitered and soldered.
  - 6. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
  - 7. Gutter Accessories: Continuous screened leaf guard with sheet metal frame.
- B. Downspouts: Plain rectangular complete with smooth-curve elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
  - 1. Zinc-Coated Steel: Nominal 0.034-inch thickness.
  - 2. Formed Aluminum: 0.063 inch thick.

- 3. Copper: 16 oz./sq. ft.
- C. Zinc-Coated Steel Finish: Two-coat fluoropolymer.
  - 1. Color: As selected by Architect from manufacturer's full range.
- D. Aluminum Finish: Two-coat fluoropolymer.
  - 1. Color: As selected by Architect from manufacturer's full range.
- E. Copper Finish: Pre-patinated dark brown.

### 2.4 Weathervane

- A. Weathervane includes the figure, copper spacer balls, the directionals, rod and ring. Weathervane figure is made in the USA from 16 ounce copper, each piece is hammered and bent to form a unique piece.
- B. Approximate figure dimensions: 20"L X 27"H. Provide full line catalog for figure selection by owner.
- C. Add approx. 10" to dimension height for directionals and spacer balls
- D. Directional Dimensions: 18"L with 3" lettering
- E. Patina copper finish with scrolled directional.
- F. Basis of design: Weathervane Factory, 1318 Main Road, Eddington, ME 04428, Phone 1.207.843.0440

### 2.5 Materials

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
- C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- D. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

# 2.6 Underlayment Materials

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 1. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
  - 2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F .

### **Roof Specialties**

- B. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

## 2.7 Miscellaneous Materials

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
  - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
  - 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
  - 3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
  - 4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
  - 5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
- B. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- F. Solder for Copper: ASTM B32, lead-free solder.

## 2.8 Finishes

- A. Coil-Coated Galvanized-Steel Sheet Finishes:
  - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.
    - Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
    - b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat.

- c. Two-Coat Mica Fluoropolymer: AAMA 621. Fluoropolymer finish with suspended mica flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
- d. Three-Coat Metallic Fluoropolymer: AAMA 621. Fluoropolymer finish with suspended metallic flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat.

#### B. Coil-Coated Aluminum Sheet Finishes:

- 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
  - b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat.
  - c. Two-Coat Mica Fluoropolymer: AAMA 2605. Fluoropolymer finish with suspended mica flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat.
  - d. Three-Coat Metallic Fluoropolymer: AAMA 2605. Fluoropolymer finish with suspended metallic flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat.
- 2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- 3. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

## C. Copper Sheet Finishes:

- 1. Non-Patinated Finish: Mill finish.
- 2. Pre-Patinated Finish: Chemically treated according to ASTM B882.

## Part 3 Execution

# 3.1 Installation of Underlayment

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
  - 1. Apply continuously under roof-edge specialties.
  - 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

### **Roof Specialties**

- B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

## 3.2 Installation, General

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
  - 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  - 4. Torch cutting of roof specialties is not permitted.
  - 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - Coat concealed side of uncoated aluminum and stainless steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
  - 1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
  - 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-

tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pretinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

## 3.3 Installation of Roof-Edge Specialties

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

## 3.4 Installation of Roof-Edge Drainage System

- A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 30 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
  - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
  - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
  - 1. Provide elbows at base of downspouts at grade to direct water away from building.
  - 2. Connect downspouts to underground drainage system indicated.

# 3.5 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 and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed.

**END OF SECTION** 

# Part 1 General

## 1.1 Summary

### A. Section Includes:

- 1. Silicone joint sealants.
- 2. Nonstaining silicone joint sealants.
- 3. Urethane joint sealants.
- 4. Immersible joint sealants.
- 5. Mildew-resistant joint sealants.
- 6. Latex joint sealants.

# 1.2 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

## 1.3 Action Submittals

- A. Product Data: For each joint-sealant product.
- 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.

## 1.4 Informational Submittals

- A. Product test reports.
- B. Preconstruction laboratory test reports.
- C. Preconstruction field-adhesion-test reports.
- D. Field-adhesion-test reports.
- E. Sample warranties.

# 1.5 Quality Assurance

A. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

# 1.6 Preconstruction Testing

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
  - 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with stone masonry substrates.
- B. 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 X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

## 1.7 Warranty

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## Part 2 Products

## 2.1 Joint Sealants, General

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.2 Silicone Joint Sealants

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

- C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.
- D. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- E. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- F. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.
- G. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
- H. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.
- I. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
- J. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.

# 2.3 Nonstaining Silicone Joint Sealants

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
- D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

## 2.4 Urethane Joint Sealants

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
- D. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 35, Uses T and NT.
- E. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
- F. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
- G. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.
- H. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.
- I. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.
- J. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.
- K. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

## 2.5 Immersible Joint Sealants

- A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, Class 1; tested in deionized water unless otherwise indicated
- B. Urethane, Immersible, S, NS, 100/50, NT, I: Immersible, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT, and I.
- C. Urethane, Immersible, S, NS, 35, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT and I.
- D. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T, NT, and I.
- E. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T, NT, and I.
- F. Urethane, Immersible, S, NS, 25, T, NT, I: Immersible, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T, NT, and I.
- G. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 50, Uses T, NT, and I.
- H. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T, NT, and I.
- I. Urethane, Immersible, M, NS, 50, T, NT, I: Immersible, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T, NT, and I.
- J. Urethane, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T, NT, and I.
- K. Urethane, Immersible, M, P, 25, T, NT, I: Immersible, multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T, NT, and I.

### 2.6 Mildew-Resistant Joint Sealants

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

## 2.7 Joint-Sealant Backing

- A. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), 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.

## 2.8 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

# 3.1 Preparation

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove 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.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

## 3.2 Installation of Joint Sealants

- A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- 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.
- 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 to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated

# 3.3 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 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    - b. Perform one test for each 1000 feet of joint length thereafter or one 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 C1193 or Method A, Tail Procedure, in ASTM C1521.
- 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.

## 3.4 Joint Sealant Schedule

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Control and expansion joints in brick pavers.
    - b. Isolation and contraction joints in cast-in-place concrete slabs.
    - c. Joints between plant-precast architectural concrete paving units.
    - d. Joints in stone paving units, including steps.
    - e. Tile control and expansion joints.
    - f. Joints between different materials listed above.
    - g.
    - h. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
  - 1. Joint Locations:
    - a. Joints in pedestrian plazas.
    - b. Joints in swimming pool decks.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Joints between plant-precast architectural concrete units.
    - c. Control and expansion joints in unit masonry.
    - d. Joints in dimension stone cladding.
    - e. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
  - 1. Joint Locations:

- a. Isolation joints in cast-in-place concrete slabs.
- b. Control and expansion joints in stone flooring.
- c. Control and expansion joints in brick flooring.
- d. Control and expansion joints in tile flooring.
- e. Other joints as indicated on Drawings.
- 2. Joint Sealant: Urethane, S, P, 25, T, NT.
- 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces
  - 1. Joint Locations:
    - Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Tile control and expansion joints.
    - c. Vertical joints on exposed surfaces of unit masonry concrete walls and partitions.
    - d. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, S, NS, 25, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
  - 1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors windows.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Acrylic latex.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

## Joint Sealants

- H. Joint-Sealant Application: Concealed mastics.
  - 1. Joint Locations:
    - a. Aluminum thresholds.
    - b. Sill plates.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Butyl-rubber based.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

**END OF SECTION** 

## Hollow Metal Doors and Frames

## Part 1 General

## 1.1 Summary

### A. Section includes:

- 1. Interior standard steel doors and frames.
- 2. Exterior standard steel doors and frames.

## 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: Include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
- D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

### 1.3 Informational Submittals

- A. Product test reports.
- B. Field quality control reports.

## 1.4 Closeout Submittals

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

# 1.5 Quality Assurance

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
  - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

- B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
  - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

# Part 2 Products

## 2.1 Manufacturers

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door; ASSA ABLOY.
  - 2. Republic Doors and Frames.
  - 3. Steelcraft; an Allegion brand.

## 2.2 Performance Requirements

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits] indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
  - 2. Temperature-Rise Limit: Where indicated on Drawings, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

## 2.3 Interior Standard Steel Doors and Frames

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.
  - 1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches.
- c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
- d. Edge Construction: Model 1, Full Flush.
- e. Core: Manufacturer's standard.
- f. Fire-Rated Core: Manufacturer's standard vertical steel stiffener laminated mineral board core for fire-rated and temperature-rise-rated doors.

#### 2. Frames:

- a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
- b. Construction: Full profile welded.

### 2.4 Exterior Standard Steel Doors and Frames

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

#### 1. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches.
- c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A60 coating.
- d. Edge Construction: Model 1, Full Flush.
- e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
- f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
- g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
- h. Core: Manufacturer's standard.

#### 2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
- b. Construction: Full profile welded.

## 2.5 Frame Anchors

### A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.

- Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
- 3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

## 2.6 Materials

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

## 2.7 Fabrication

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide

alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

- 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
- 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
  - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
  - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surfacemounted door hardware.
  - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

### 2.8 Steel Finishes

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## Part 3 Execution

# 3.1 Preparation

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

## 3.2 Installation

- A. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

## Hollow Metal Doors and Frames

- a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
- b. Install frames with removable stops located on secure side of opening.
- 2. Fire-Rated Openings: Install frames according to NFPA 80.
- 3. Floor Anchors: Secure with postinstalled expansion anchors.
  - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 4. Solidly pack mineral-fiber insulation inside frames.
- 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
- 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. Installation Tolerances: Adjust hollow-metal frames 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 and adjust hollow-metal doors accurately in frames, within clearances specified below.
  - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

# 3.3 Repair

- A. 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.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

#### **END OF SECTION**

## **Access Doors and Frames**

## Part 1 General

# 1.1 Summary

A. Section includes access doors and frames for ceilings.

## 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Samples: For each type of access door and frame and for each finish specified.
- C. Product Schedule: For access doors and frames.

### 1.3 Closeout Submittals

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

## 1.4 Quality Assurance

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
  - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

## Part 2 Products

## 2.1 Access Doors and Frames

- A. Flush Access Doors with Concealed Flanges:
  - 1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
  - 2. Locations: Ceiling.
  - 3. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
  - 4. Frame Material: Same material and thickness as door.
  - 5. Latch and Lock: Cam latch, screwdriver operated.

## 2.2 Materials

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

#### Access Doors and Frames

- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- E. Stainless Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- F. Frame Anchors: Same material as door face.
- G. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

### 2.3 Fabrication

- A. 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.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

## 2.4 Finishes

- A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
  - 2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.
    - a. Color: As selected by Architect from full range of industry colors.

## Part 3 Execution

## 3.1 Installation

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Adjust doors and hardware, after installation, for proper operation.

**END OF SECTION** 

## Part 1 General

# 1.1 Summary

### A. Section Includes:

1. Counter door assemblies.

## 1.2 Action Submittals

- A. Product Data: For each type and size of coiling counter door and accessory.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
  - 1. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
  - 2. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.

### 1.3 Closeout Submittals

- A. Maintenance data.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

# 1.4 Quality Assurance

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

## Part 2 Products

# 2.1 Counter Door Assembly

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Overhead Door Corporation.

### Coiling Counter Doors

- B. Operation Cycles: Door components and operators capable of operating for not less than 10,000.
- C. Door Curtain Material: Galvanized steel.
- D. Door Curtain Slats: Flat profile slats F-158, 22 gauge.
- E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated hot-dip galvanized steel and finished to match door.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- G. Hood: Match curtain material and finish.
  - 1. Mounting: Between jambs.
- H. Integral Frame, Hood, and Fascia: Galvanized steel.
  - 1. Mounting: Between jambs.
- I. Sill Configuration: Integral metal sill.
- J. Locking Devices: Equip door with locking device assembly.
  - 1. Locking Device Assembly: locking bars, operable from outside with cylinder.
- K. Manual Door Operator: Push-up operation.
- L. Curtain Accessories: Equip door with weatherseals push/pull handles pull-down strap.
- M. Door Finish:
  - Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
  - 2. Factory Prime Finish: Manufacturer's standard color.
  - 3. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

## 2.2 Door Curtain Material and Fabrication

- A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
  - Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
  - 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand

loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

## 2.3 Hoods

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surfacemounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
- B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):

## 2.4 Locking Devices

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - 1. Lock Cylinders: As standard with manufacturer and keyed to building keying system.
  - 2. Keys: Three for each cylinder.

## 2.5 Curtain Accessories

- A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- B. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches high.

## 2.6 Counter Door Accessories

- A. Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with ASTM A480/A480M No. 4 finish.
- B. Fire-Rated, Laminate Counter: Fire-door manufacturer's high-pressure, decorative laminate-covered countertop; UL or ITS tested and labeled for 1-1/2-hour fire rating for approved use with fire-door assembly.

### 2.7 Counterbalance Mechanism

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

### **Coiling Counter Doors**

B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

# 2.8 Manual Door Operators

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

## Part 3 Execution

## 3.1 Installation

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

## 3.2 Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

**END OF SECTION** 

## **Aluminum-Framed Storefronts**

## Part 1 General

## 1.1 Summary

- A. Section Includes:
  - 1. Standing-seam metal roof panels.

## 1.2 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

## 1.3 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
  - Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples: For each type of exposed finish required.
- D. Delegated-Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.4 Informational Submittals

- A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.
- B. Product test reports.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Sample warranties.

## 1.5 Closeout Submittals

Maintenance data.

## 1.6 Quality Assurance

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
- C. 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.

## 1.7 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminumframed storefronts 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 Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

# Part 2 Products

### 2.1 Manufacturers

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
  - 1. Kawneer North America, an Arconic company.

## 2.2 Performance Requirements

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, 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. Structural Loads:

- 1. Wind Loads: As indicated on Drawings.
- 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
  - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
    - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
  - 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
    - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
  - 1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures,

### Aluminum-Framed Storefronts

- structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
- 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
  - 1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- G. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
  - 1. Thermal Transmittance (U-factor):
    - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sg. ft. x h x deg F as determined in accordance with NFRC 100.
  - 2. Air Leakage:
    - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
  - 3. Condensation Resistance Factor (CRF):
    - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

# 2.3 Aluminum-Framed Storefront Systems

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  - 1. Exterior Framing Construction: Thermally broken.
  - 2. Glazing System: Retained mechanically with gaskets on four sides.
  - 3. Glazing Plane: Front.
  - 4. Finish: Baked-enamel or powder-coat finish.
  - 5. Fabrication Method: Field-fabricated stick system.
  - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  - 7. Steel Reinforcement: As required by manufacturer.

- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

## 2.4 Glazing

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

#### 2.5 Materials

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
- D. Structural Profiles: ASTM B308/B308M.
- E. Steel Reinforcement:
  - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
  - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
  - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- F. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

### 2.6 Fabrication

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from exterior.

#### Aluminum-Framed Storefronts

- 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

### 2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## Part 3 Execution

## 3.1 Installation, General

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
  - 1. 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.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

# 3.2 Installation of Glazing

A. Install glazing as specified in Section 088000 "Glazing."

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

A. WORK INCLUDED: Furnish complete manual aluminum service window system, as specified, that has been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

### 1.2 References

- A. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA): 101 Appendix Dissimilar Materials.
- B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):Z97.1: Safety Glazing Materials Used in Buildings Methods of Test.
- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM): B221 Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.
- D. THE ALUMINUM ASSOCIATION (AA) Aluminum Finishes Manual.
- E. UNDERWRITERS LABORATORY, INC. (UL) AND UNDERWRITERS LABORATORY OF CANADA (ULC):
  - UL 325: Electrical Door, Drapery, Gate, Louver, and Window Operators and Systems
  - 2. UL 752: Ballistic Resistance Standard, Levels 1-4

### 1.3 Submittals

- A. PRODUCT DATA: Submit manufacturer's complete product and installation data.
- B. SHOP DRAWINGS: Submit drawings showing layout, profiles, product components including anchorage, accessories, finish and glazing details (where required).
- C. QUALITY ASSURANCE AND CLOSEOUT SUBMITTALS: Submit the following:
  - 1. Manufacturer's Operation and Maintenance Data.
  - 2. Warranty document as specified herein.

## 1.4 Quality Assurance

A. INSTALLERS QUALIFICATIONS: Installer shall be experienced to perform work of this section.

B. MANUFACTURER'S QUALIFICATIONS: Manufacturer to have minimum (5) five years successful experience in the fabrication of automatic and manual windows of the type required for this project.

#### 1.5 Warranties

- A. MANUFACTURER'S WARRANTY: Units to be warranted against defect in material and workmanship for a period of one year from the Date of Substantial Completion.
- B. Manufacturer's warranty is in addition to, and not a limitation of, other rights owner may have under Contract Documents.
- C. DISTRIBUTOR'S WARRANTY: One year warranty: Labor & transportation charges for defective parts replacement.

## 1.6 Project Conditions

A. FIELD MEASUREMENTS: Verify actual dimensions/openings by field measurements before fabrication and record on shop drawings. Coordinate with fabrication and construction schedule to avoid construction delays.

## 1.7 Delivery, Storage and Handling

- A. ORDERING AND DELIVERY: Comply with factory's ordering instructions and lead time requirements. Delivery shall be in factory's original, unopened, undamaged containers with identification labels intact.
- B. STORAGE AND PROTECTION: Provide protection from exposure to harmful weather conditions and vandalism.

### Part 2 Products

### 2.1 Manufacturer

A. HORTON AUTOMATICS, a division of Overhead Door Corporation, shall manufacture automatic and/or manual service window(s) of type(s) and size(s) specified on plans and door schedule.

## 2.2 Equipment

- A. MANUFACTURED WINDOW UNITS: Shall include header and track, jambs, sliding panel(s). Units to be mounted within rough opening with sliding panel(s) sliding along sidelite. Units will be single-slide and will be one of the following series:
  - Series 8900 (O-X or X-O): Single slide, flush-mount manual unit with 1" (25 mm) insulated glass. Options: low-profile header

- B. HEADER: Header shall have removable face plate. Manual units have optional low-profile 2 1/2" high header.
- C. HEADER TRACK: Shall be aluminum, nylon covered, and replaceable. Rollers will be steel, high quality ball bearing wheels 1-1/4" (32 mm) diameter. Anti-Derailing shall be accomplished by means of a continuous aluminum extrusion full length of slide panel travel.
- D. SLIDING PANEL(S) AND FIXED SIDELITE(S): Shall be aluminum and glass, 1-3/4" (44 mm) deep with narrow stile or thin stile construction. Glass thickness and glazing as per unit type. Sliding panels shall have concealed guides to stabilize bottom of sliding panel. Mohair weather-strip provided on all strike rails as well as on adjoining vertical rails.
- E. JAMB/FRAME: Shall be aluminum, 1-3/4" (44 mm) deep by 4" (102 mm) wide.
- F. HARDWARE: Shall include the following:
  - 1. Manual Locks: Single slide units equipped with Adams Rite® maximum security MS1850 lock, 1-5/32" (29 mm) cylinder, 6410 standard thumbturn and keeper. Key cylinder optional. Biparting units equipped with Adams Rite® MS1847-06 lock, escutcheon, spindle and lock knob, and keeper.
  - 2. Manual Recessed Pull: On interior side of strike rails of manual units

## 2.4 Materials, Finishes and Fabrication

- A. EXTRUDED ALUMINUM: ASTM B221, 6063-T5 alloy and temper, anodized:
  - 1. Structural Header Sections: Minimum 3/16" (5 mm) thickness.
  - 2. Structural Frame Sections: Minimum 1/8" (3 mm) thickness.
  - 3. Structural Panel Sections: Commercial grade.
- B. FINISHES (for all exposed aluminum surfaces): Match adjacent aluminum and glass system.
- C. PANEL CONSTRUCTION: Corner block type with 3/16" steel backup plate construction, mechanically secured with minimum of four hardened steel screws. Sash consists of snap-in glass stops, snap-in glazing beads and vinyl gaskets.
- D. FRAME CONSTRUCTION: Butt joints, mechanically secured by means of screws and formed aluminum corner brackets.
- E. OPERATOR CONSTRUCTION FOR AUTOMATIC UNITS: Electromechanical modular type construction.

## Part 3 Execution

### 3.1 Examination

A. SITE VERIFICATION OF CONDITIONS: Installer must verify that base conditions previously installed under other sections are acceptable for product installation according to with manufacturer's instructions. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of work. Do not start work until all negative conditions are corrected in a manner acceptable to the installer and manufacturer.

### 3.2 Installation

- A. GENERAL: Install window units plumb, level and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.
- B. DISSIMILAR MATERIALS: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.
- C. WEATHER-TIGHT CONSTRUCTION: Install header and framing members in a bed of sealant or with joint filler or gaskets. Coordinate installation with wall flashings and other components of construction.
- D. ELECTRICAL: General or electrical contractor to install all wiring to operator. Up to five units may be connected to single circuit.

## 3.3 Cleaning, Adjustment and Protection

- A. CLEANING: After installation, installer to take following steps:
  - 1. Remove temporary coverings and protection of adjacent work areas.
  - 2. Remove construction debris from construction site and legally dispose of debris.
  - 3. Repair or replace damaged installed products.
  - 4. Clean product surfaces and lubricate operating equipment for optimum condition and safety.
- B. ADJUSTMENTS & PRECAUTIONS: Installer to adjust units for optimum condition and safety. Advise contractor of precautions required through the remainder of the construction period, to ensure that units will be without damage or deterioration (other than normal weathering) at the time of acceptance.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

#### A. Section Includes:

1. Tubular unit skylight residential daylighting systems.

### 1.2 Reference Standards

- A. General: Applicable edition of references cited in this Section is current edition published on date of issue of Project specifications, unless otherwise required by building code in force.
- B. American Architectural Manufacturers Association/Window & Door Manufacturers Association/Canadian Standards Association: <a href="https://www.aamanet.org">www.aamanet.org</a>, <a href="https://www.wdma.com">www.wdma.com</a>, <a href="https://www.wdma.com">www.csagroup.org/us/en/services</a>:
  - 1. AAMA/WDMA/CSA 101/I.S.2/A440 North American Fenestration Standard/ Specification for Windows, Doors, and Skylights (NAFS)
  - 2. CSA A440S1-09 Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440
  - 3. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
  - 4. AAMA 2603 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

#### C. ASTM International: www.astm.org:

- ASTM A 653/A 653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- 2. ASTM B 209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- 3. ASTM D 635 Test Method for Rate of Burning and/or Extent of Time of Burning of Self-supporting plastics in a Horizontal Position
- 4. ASTM D 2843 Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
- 5. ASTM D 4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free
- 6. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
- 7. ASTM E 108 Standard Test Methods for Fire Tests of Roof Coverings
- 8. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

#### **Tubular Unit Skylights**

- ASTM E 331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- 10. ASTM E 408 Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- 11. ASTM E 1651 Standard Test Method for Total Luminous Reflectance Factor by Use of 30/t Integrating-Sphere Geometry
- 12. ASTM E 1886 Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
- 13. ASTM E 1996 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

### D. Code of Federal Regulations:

- 1. 29 CFR 1910.23 (e) (8) Occupational Safety and Health Standards for Walking-Working Surfaces to Guard Floor and Wall Openings and Holes
- E. Illuminating Engineering Society of North America (IESNA): www.ies.org:
  - 1. IESNA The Lighting Handbook
- F. National Fenestration Rating Council: <a href="www.nfrccommunity.org">www.nfrccommunity.org</a>:
  - 1. NFRC 100 Procedure for Determining Fenestration Product U-factors
  - 2. NFRC 200 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
- G. National Fire Protection Association: www.nfpa.org:
  - 1. NFPA 70 National Electrical Code
- H. The Coatings Society (SSPC): <a href="www.sspc.org">www.sspc.org</a>:
  - 1. SSPC-SP 12/NACE NO. 5 Surface Preparation And Cleaning Of Metal

### 1.3 Coordination

- A. Coordinate dimensions, locations, and details of skylight roof openings with selected tubular unit skylight flashings. Verify requirements for roofing system terminations.
- B. Coordinate tubular unit skylight interior termination locations with structural layout, ceiling layouts, and other ceiling-mounted items.

## 1.4 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site prior to delivery of tubular unit skylight and installation of roof deck.

### 1.5 Action Submittals

- A. Product Data: For tubular unit skylights. Include standard construction details, product performance characteristics, and material descriptions, dimensions of individual components and profiles, and finishes.
  - 1. Include test reports of qualified independent testing agency or third party certificates verifying compliance with performance requirements.
- B. Shop Drawings: For tubular unit skylight work. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

### 1.6 Informational Submittals

A. Warranty: Sample of special warranty.

### 1.7 Closeout Submittals

A. Operation and Maintenance Data.

## 1.8 Quality Submittals

- A. Manufacturer Qualifications: A qualified manufacturer listed in this Section with minimum 30 years' experience in the US manufacturing similar products in successful use on similar projects and able to provide tubular unit skylights meeting requirements.
  - Approval of Manufacturers and Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
    - a. Completed and signed Substitution Request form.
    - b. Product data, including photometric data and independent test data indicating compliance with requirements.
    - c. Sample product warranty.

## 1.9 Warranty

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of tubular unit skylights that fail in materials or workmanship under normal use within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of metals, metal finishes, dome, and other materials beyond normal weathering.
    - b. Breakage of glazing.
  - 2. Warranty Period:

- a. Tubular Unit Skylight Assembly: 10 years from date of purchase.
- b. Tunnel Reflective Coating: 20 years from date of purchase.

## Part 2 Products

### 2.1 Manufacturers

- A. Basis-of-Design Products: Subject to compliance with requirements, provide products of **VELUX America LLC**, Greenwood, SC 29648; <a href="www.VELUXusa.com">www.VELUXusa.com</a>; (800) 888-3589
- B. Substitutions: None allowed by Owner.
- C. Source Limitations: Obtain tubular unit skylights through single source from single manufacturer.

## 2.2 Tubular Daylighting Systems

- A. System Description, General: Tubular unit skylight daylighting kits with exterior glazed opening, glazing retainers and gaskets, exterior flashing assembly with integral adjustable pivot device, reflective tunnel, interior diffuser assemblies, and accessories, as required to meet installation and performance requirements indicated.
  - 1. Pitched flashing dome kit with rigid tunnel.
    - a. Basis of Design: VELUX SUN TUNNEL Skylight Kit Model TMR.
- B. Dome: Transparent, UV-resistant plastic dome.
  - 1. Sizes: 14 inch diameter
  - 2. Dome Glazing: 0.125 inch minimum thickness injection molded transparent impact modified acrylic material; with UV-absorbing additive.
  - 3. Dome Seal: Adhesive-backed foam weatherstrip.
- C. Dome Flashing Assembly:
  - 1. Self-flashed Configuration: One-piece formed, 14 to 60 deg. roof pitch.
  - 2. Curb-flashed Configuration: One-piece formed, minimum 0 to 60 deg. roof pitch.
  - 3. Unit Sizes: As required to fit skylight sizes specified or indicated on Drawings.
  - 4. Material: Galvanized steel sheet, 0.023-inch/24-ga.- thick.
    - a. Finish: Powder coat, gray.
  - 5. Intermediate Ring: High-impact plastic reflective tunnel receiver attached to top of roof flashing serving as mounting base for dome assembly and

providing a thermal break between flashing and reflective tunnel, configured to channel condensed moisture out of assembly.

- a. Intermediate Ring Seal: Santoprene O-ring providing weather tight seal with roof flashing.
- b. Pivot Ring and Reflective Tunnel Collar: High-impact polymer pivoting socket mounted in intermediate ring and secured to factory-installed reflective tunnel collar 3.625 inch (92 mm) in height; adjustable for tunnel section alignment.

### D. Flashing Accessories:

1. Fire Band: Dome edge protection band, as required for installation in fire-resistance-rated roof assemblies; matching flashing metal and finish.

#### E. Reflective Tunnels

- Rigid Reflective Tunnel: Skylight light shaft formed from anodized aluminum sheet, 0.016-inch/26-ga.- thick, with silver specular interior finish surface coated with vacuum-evaporated silicone oxide and titanium oxide protective surface.
  - a. Length: 24 inch.
  - b. Diameter: As required for indicated flashing assembly sizes.
  - c. Reflectance: 99 percent reflectance when measured in accordance with ASTM E 1651 at 30 degrees from vertical. Total reflectance greater than 98 percent when measured in accordance with ASTM E 1651.
  - d. Color Rendition, ASTM E 408: As defined by CIE L\*a\*b\* color model, L equal to 99-100, values a\* and b\* shall not exceed +1 or be less than -1.
  - e. Rigid Tunnel Components:
    - 1) Rigid Tunnel Extension: One reflective tunnel, 24 inch (610 mm) length.
    - 2) Universal Reflective Elbows: Two reflective angle adaptors adjustable to 45 degrees, 11.5 inch length, 0.02 inch/24 ga. thick, and mounted at the top, middle, or bottom of reflective tunnel assemblies as required for application.
  - f. Rigid Tunnel Fastening System: Manufacturer's recommended fastening devices consisting of spring tempered stainless steel pull clip mechanical fasteners allowing tunnel vertical and horizontal joints to be secured without the use of screws or tools, used in conjunction with prelocated punched holes in tunnel sections, that allow for a tight naturally-occurring tapered mating of interconnecting tunnel sections and elbows.
    - 1) Basis of Design: **VELUX Flexi-Loc Fasteners**.
- 2. Flexible Reflective Tunnel: Reflective metalized polyester, fiberglass scrim and spring steel wire.

#### **Tubular Unit Skylights**

- a. Length: 8 foot.
- b. Diameter: As required for indicated flashing assembly sizes.
- F. Reflective Tunnel Accessories: Provide accessories indicated and as required for installation based upon roof, ceiling, and structural member configuration, skylight and diffuser locations indicated on Drawings, and manufacturer's recommendations, selected from the following:
  - 1. Rigid Tunnel Extensions: Reflective rigid extension tunnel, 24 inch lengths fastened as required for application length.
    - a. Basis of Design: VELUX Model ZTR Rigid Reflective Tunnel.
  - 2. Flexible Tunnel Extensions: Reflective flexible extension tunnel, lengths as required for application.
    - a. Basis of Design: VELUX Model ZTF Flexible Reflective Tunnel.
  - 3. Rotating Couplers: Rotating adaptors allowing coupling of two elbows to create 90 deg. transition of tunnels using fastening system connections with rotating joint enabling alignment of tunnel sections.

### 2.3 Diffusers

- A. Round ceiling diffuser assembly attached directly to bottom of reflective tunnel, with dual high visible light transmittance lenses separated by airtight seals providing insulating airspace, and paintable white acrylic trim ring.
  - 1. Size: As required for flashing assembly indicated.
  - 2. Lens Type: Crackle lens above frosted lens, minimum 92 percent visible light transmittance.
- B. Diffuser Accessories:
  - 1. Decorative Diffusers: Ceiling level diffuser consisting of metal trim ring and translucent white glass globe.
    - a. Basis of Design: **VELUX Decorative Diffuser Model ZTB**.
    - b. Metal Trim Finish: White.

## 2.4 Performance Requirements

- A. Daylighting: Provide daylighting photometric performance comparable to basis of design product at layout indicated, based upon daylighting profile of March 21, 9:00 am local time, at Project location by simulation in accordance with IESNA guidelines.
- B. Air Infiltration: Maximum air leakage through unit of 0.09 cfm/sq. ft. of fixed area as determined according to ASTM E 283 at a static-air-pressure differential of 1.57 lbf/sq. ft.

- C. Water Penetration under Static Pressure: No evidence of water penetration through complete unit when tested according to ASTM E 331 at a static-air-pressure differential of 15 lbf/sq. ft..
- D. Thermal Performance Standards: NFRC 100 and 200:
  - a. Rigid tunnel standard tubular unit skylights:
    - 1) U-Factor: 0.55 Btu/hr\*ft.\*deg. F.
    - 2) Solar Heat Gain Coefficient (SHGC): 0.37.
- E. Unit Skylight Performance Grade Standards: AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS-11 or previous):
  - a. Pitched and low-profile dome tubular unit skylights:
    - 1) Performance Grade (Primary Designator): CW-PG90 TDD.
    - 2) Design Pressure (DP): +200/-90 psf.
    - 3) Canadian Air Infiltration/Exfiltration Rating: Fixed.
- F. Surface-Burning Characteristics of Plastic Glazing and other plastic components: Provide plastic glazing meeting NAFS and identical to specimens tested for fire-exposure behavior in accordance with test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Self-Ignition Temperature: 650 deg F or more for plastic glazing in thickness indicated when tested per ASTM D 1929.
  - 2. Smoke-Production Characteristics: Comply with either requirement below:
    - a. Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic glazing in manner indicated for application.
    - b. Smoke Density: 75 or less when tested per ASTM D 2843 on plastic glazing in thickness indicated for application.
  - 3. Burning Characteristics: Tested and labeled in accordance with ASTM D 635.
    - a. Plastic Glazing for Domes: Acrylic Class CC2.
- G. Fall Protection Standard Compliance: 29 CFR 1910.23: Passed.

## 2.5 Materials

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel or forming steel.
- B. Aluminum Sheet: Flat sheet complying with ASTM B 209.
- C. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic, nominally free of sulfur and containing no asbestos fibers.

#### Tubular Unit Skylights

- D. Joint Sealants: As specified in Section 079200 "Joint Sealants."
- E. Mastic Sealants: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- F. Roofing Cement: ASTM D 4586, asbestos free, designed for trowel application or other adhesive compatible with roofing system.

#### 2.6 Finishes

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. 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.

#### C. Galvanized Steel Sheet:

- 1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - a. Color: Neutral gray.

## Part 3 Execution

### 3.1 Examination

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with tubular unit skylight installation only after unsatisfactory conditions have been corrected.

### 3.2 Installation

- A. Install tubular unit skylights in accordance with manufacturer's written instructions and approved shop drawings. Coordinate installation of units with installation of substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that finished installation is weathertight.
  - 1. Anchor tubular unit skylights securely to supporting substrates.
  - 2. For horizontal installation, install tubular unit skylights true to line and without distortion.
  - 3. For sloped roof installation, install tubular unit skylights on curbs specified in another section with tops of curbs parallel to finished roof slope.

- B. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by tubular unit skylight manufacturer.
- C. Install tubular unit skylight curb counter flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.

## 3.3 Field Quality Control

- A. Testing Agency: Engage testing agency to perform tests and inspections.
  - 1. Test for water leaks according to AAMA 501.2 after installation and curing of sealants but prior to installation of interior finishes.
  - 2. Perform test for total area of each tubular unit skylight.
- B. Work will be considered defective if it does not pass tests and inspections.
- C. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

## 3.4 Cleaning and Protection

- A. Clean exposed tubular unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Replace glazing that has been damaged during construction period.
- C. Dimmer Assemblies: Test and adjust dimmer assemblies for proper operation.
- D. Protect tubular unit skylight surfaces from contact with contaminating substances resulting from construction operations.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

- A. This Section includes the following:
  - 1. Commercial door hardware for the following:
    - a. Swinging doors.
    - b. Other doors to the extent indicated.
  - 2. Cylinders for doors as shown on the Drawings.
- B. Related Sections include the following:
  - 1. Section 081113 "Hollow Metal Doors and Frames"
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

### 1.2 Submittals

- A. Submit the following per Section 013300:
- B. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: Details of electrified door hardware, indicating the following:
- D. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.

- d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
- e. Explanation of abbreviations, symbols, and codes contained in schedule.
- f. Mounting locations for door hardware.
- g. Door and frame sizes and materials.
- E. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- F. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Sections 013300.
- G. Warranties: Special warranties specified in this Section.

## 1.3 Quality Assurance

- A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
  - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.
  - D. Regulatory Requirements: Comply with provisions of the following:
    - 1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," as follows:
      - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      - b. Door Closers: Comply with the following maximum opening-force requirements indicated:
        - 1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

- 2) Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
- 3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- c. Thresholds: Not more than 1/2 inch (13 mm) high. Bevel raised thresholds with a slope of not more than 1:2.
- 2. NFPA 101: Comply with the following for means of egress doors:
  - Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
  - b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds.
  - c. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
  - d. Thresholds: Not more than 1/2 inch (13 mm) high.
- E. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
  - 1. Test Pressure: Test at atmospheric pressure.

## 1.4 Delivery, Storage and Handling

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver keys to Owner.

### 1.5 Coordination

- A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

## 1.6 Warranty

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of operators and door hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- C. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

#### 1.7 Maintenance Service

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

### Part 2 Products

### 2.1 Schedule Door Hardware

A. General: Provide door hardware as specified on the Contract Drawings.

## 2.2 Fabrication

- A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.
  - 1. Manufacturer's identification will be permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 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. Steel Machine or Wood Screws: For the following fire-rated applications:
    - a. Mortise hinges to doors.
    - b. Strike plates to frames.
    - c. Closers to doors and frames.
  - 3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
    - a. Surface hinges to doors.
    - b. Closers to doors and frames.
    - Surface-mounted exit devices.
  - 4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
  - 5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

### 2.3 Finishes

- A. Standard: Comply with BHMA A156.18.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### Part 3 Execution

#### 3.1 Examination

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

#### Door Hardware

- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 Preparation

- A. Steel Doors and Frames: Comply with DHI A115 series.
  - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.
- B. Wood Doors: Comply with DHI A115-W series.

### 3.3 Installation

- A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

## 3.4 Adjusting

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

## 3.5 Cleaning and Protection

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

#### 3.6 Hardware Schedule

#### **HARDWARE SET NO. 1:**

Hinges: Hager BB1193SH-32D-10B, 4.5" x 4.5", 3 per door Lockset: Yale Co – 5407/JN-4660L-GF 1106-1/2-26D Entrance

Kick Plates: Baldwin 2008 - 28-103 12" x 34"

Closer: LCN 4114 Threshold: Zero 564-28

Weather Stripping: Zero 328-28

### **HARDWARE SET NO. 2:**

Hinges: Hager BB1193SH-32D-10B, 4.5" x 4.5", 3 per door Lockset: Yale Co-5405 / JN-4648L-10B-26D Storeroom

Kick Plates: Baldwin 2008 – 28-103 12" x 34"

Closer: LCN 4114 Threshold: Zero 564-28

Weather Stripping: Zero 328-28

### **HARDWARE SET NO. 3:**

Hinges: Hager BB 1193 SH-32D-10B, 4.5" x 4.5", 3 per door.

Deadlock: Yale 3212A-26D Pulls: Baldwin 2594-28-10B

Push Plates: Baldwin 2134-28-10B

Kick Plates: Baldwin 2008-28-10B, 12" x 34"

Closer: LCN 4114

Stop (Wall): Baldwin 4274-28-10B

Threshold: Zero 564-28

Weather Stripping: Zero 328-28

### **HARDWARE SET NO. 4:**

Hinges: Hager 1279-26D-10B, 4.5" x 4.5", 3 per door Lockset: Yale Co-5405 / JN-4648L-10B-26D Storeroom

Kick Plates: Baldwin 2008-28-10B. 12" x 34"

Silencers: Baldwin 4035, 3 per door

### **HARDWARE SET NO. 5**

Hinges: BB1193SH-32D-10B, 4.5" x 4.5", 3 per door

Exit Device: Yale 1533-CO-JN-400-32D-10B Kick Plates: Baldwin 2008-28-10B, 12" x 34"

Closer: LCN 4114 Threshold: Zero 564-28

Weather Stripping: Zero-328-28

### **HARDWARE SET NO. 6:**

Hinges: Hager BB1193SH-32D-10B, 4.5" x 4.5", 3 per door Lockset: Yale Co-5405 / JN-4648L-10B-26D Storeroom

Kick Plates: Baldwin 2008 – 28-103 12" x 34"

Flush Bolts: Ives FB457 Threshold: Zero 564-28

Weather Stripping: Zero 328-28

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Glass products.
- 2. Insulating glass.
- 3. Glazing sealants.
- 4. Glazing tapes.
- 5. Miscellaneous glazing materials.

### 1.2 Coordination

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

## 1.3 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

### 1.4 Action Submittals

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

### 1.5 Informational Submittals

- A. Product Certificates: For glass.
- B. Product test reports.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample warranties.

## 1.6 Quality Assurance

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

## 1.7 Warranty

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for 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 obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## Part 2 Products

## 2.1 Performance Requirements

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
  - 1. Design Wind Pressures: As indicated on Drawings.
  - 2. Design Snow Loads: As indicated on Drawings.
  - 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.
  - 1. Large-Missile Test: For glazing located within 30 feet of grade.
  - 2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

- 1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq. ft. x h x deg F.
- 2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.
- 3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

## 2.2 Glass Products, General

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. NGA Publications: "Glazing Manual."
  - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
  - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
  - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heatstrengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.3 Glass Products

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Ultraclear Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
- C. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

#### Glazing

- D. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- E. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- F. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

#### 2.4 Laminated Glass

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  - Construction: Laminate glass with polyvinyl butyral interlayer ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
  - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with one of the following to comply with interlayer manufacturer's written instructions:
  - Construction: Laminate glass with polyvinyl butyral interlayer reinforced with polyethylene terephthalate film ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film to comply with interlayer manufacturer's written instructions.
  - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

## 2.5 Insulating Glass

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
  - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
  - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## 2.6 Glazing Sealants

#### A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel

- substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

## 2.7 Glazing Tapes

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
  - 1. AAMA 804.3 tape, where indicated.
  - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
  - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
  - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.8 Miscellaneous Glazing Materials

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks:
  - 1. EPDM Neoprene with Shore A durometer hardness of 85, plus or minus 5.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- C. Spacers:
  - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
  - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Edge Blocks:

#### Glazing

- 1. EPDM Silicone Neoprene Santoprene with Shore A durometer hardness per manufacturer's written instructions.
- 2. Type recommended in writing by sealant or glass manufacturer.
- E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

### Part 3 Execution

## 2.9 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. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. 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.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. 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 in accordance with requirements in referenced glazing publications.

## 2.10 Tape Glazing

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

## 2.11 Gasket Glazing (Dry)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

## 2.12 Sealant Glazing (Wet)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 2.13 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

#### Glazing

- B. Protect glass from contact with contaminating substances resulting from construction operations. 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.
  - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.

## 2.14 Insulating Glass Schedule

- A. Clear Insulating Glass Type:
  - 1. Overall Unit Thickness: 1 inch.
  - 2. Minimum Thickness of Each Glass Lite: 3 mm.
  - 3. Outdoor Lite: Annealed Heat-strengthened float glass.
  - 4. Interspace Content: Air.
  - 5. Indoor Lite: Heat-strengthened float glass.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

A. Section includes fixed extruded-aluminum louvers.

## 1.2 Action Submittals

- A. Product Data: For each type of product.
  - 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: For each type of metal finish required.
- D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.3 Informational Submittals

- A. Product Test Reports: Based on tests performed according to AMCA 500-L.
- B. Sample warranties.

## 1.4 Quality Assurance

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M, "Structural Welding Code Aluminum."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code Sheet Steel."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code Stainless Steel."

## 1.5 Warranty

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## Part 2 Products

## 2.1 Performance Requirements

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
  - 2. Wind Loads: Determine loads based on a uniform pressure of 20 lbf/sq. ft., acting inward or outward.
- C. 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.

## 2.2 Fixed Extruded-Aluminum Louvers

- A. Horizontal Drainable-Blade Louver:
  - 1. Louver Depth: 4 inches.
  - 2. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
  - 3. Mullion Type: Exposed.
  - 4. Louver Performance Ratings:
    - a. Free Area: Not less than 7.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
    - b. Point of Beginning Water Penetration: Not less than 900 fpm.
    - c. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area exhaust velocity.
    - d. Air Performance: Not more than 0.15-inch wg static pressure drop at 900-fpm free-area exhaust velocity.
  - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

### 2.3 Louver Screens

- A. General: Provide screen at each exterior louver.
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: Insect screening.
- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.

- C. Louver Screening for Aluminum Louvers:
  - 1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.
  - 2. Bird Screening: Stainless steel, 1/2-inch- square mesh, 0.047-inch wire.
  - 3. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch thick.
  - 4. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.
  - 5. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.
- D. Louver Screening for Galvanized-Steel Louvers:
  - 1. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire.
  - 2. Bird Screening: Stainless steel, 1/2-inch- square mesh, 0.047-inch wire.
  - 3. Insect Screening: Galvanized steel, 18-by-14 mesh, 0.011-inch wire.
  - 4. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.
- E. Louver Screening for Stainless-Steel Louvers:
  - 1. Bird Screening: Stainless steel, 1/2-inch- square mesh, 0.047-inch wire.
  - 2. Insect Screening: Stainless steel, 18-by-18 mesh, 0.009-inch wire.

### 2.4 Materials

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.
- D. 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 fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless-steel fasteners.
  - 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
  - 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

### 2.5 Fabrication

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.6 Aluminum Finishes

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 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.
- B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.7 Galvanized-Steel Sheet Finishes

- A. Finish louvers after assembly.
- B. Surface Preparation: Clean surfaces with nonpetroleum solvent, so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A780/A780M.
- C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## Part 3 Execution

### 3.1 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.

## 3.2 Adjusting

A. 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** 

## Part 1 General

## 1.1 Summary

- A. Section Includes:
  - 1. Interior gypsum board.

#### 1.2 Action Submittals

- A. Product Data: For the following:
  - 1. Gypsum ceiling board.
  - 2. Joint treatment materials.

## Part 2 Products

## 2.1 Gypsum Board, General

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

## 2.2 Interior Gypsum Board

- A. Gypsum Ceiling Board: ASTM C1396/C1396M.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.

#### 2.3 Trim Accessories

- A. Interior Trim: ASTM C1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.

### 2.4 Joint Treatment Materials

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:

#### Gypsum Board

- 1. Interior Gypsum Board: Paper.
- 2. Exterior Gypsum Soffit Board: Paper.
- 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

### Part 3 Execution

## 3.1 Installation and Finishing of Panels

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C840.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- E. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Where indicated on Drawings.
  - 3. Level 3: Where indicated on Drawings.
  - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

- a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- 5. Level 5: Where indicated on Drawings.
  - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

#### 3.2 Protection

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

**END OF SECTION** 

#### Resilient Base and Accessories

### Part 1 General

## 1.1 Summary

- A. Section Includes:
  - 1. Thermoset-rubber base.

#### 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

### Part 2 Products

#### 2.1 Thermoset Rubber Base

- A. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
  - 1. Style and Location:
    - a. Style B, Cove: all locations scheduled for floor base.
- B. Thickness: 0.125 inch.
- C. Height: 4 inches.
- D. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- E. Outside Corners: Preformed.
- F. Inside Corners: Preformed.
- G. Colors: As indicated by manufacturer's designations.

#### 2.2 Installation Materials

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer

#### Part 3 Execution

## 3.1 Preparation

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.2 Resilient Base Installation

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

# 3.3 Cleaning and Protection

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Fiber-cement board.
  - 2. Concrete masonry units (CMUs).
  - 3. Steel and iron.
  - 4. Galvanized metal.
  - 5. Aluminum (not anodized or otherwise coated).
  - 6. Wood.

#### 1.2 Definitions

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

#### 1.3 Action Submittals

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and each color and gloss of topcoat.

## 1.4 Quality Assurance

- A. Mockups: Apply mockups 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.

#### **Exterior Painting**

- 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 mockups.
  - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

#### Part 2 Products

#### 2.1 Manufacturers

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. Behr Paint Company; Behr Process Corporation.
  - 2. Benjamin Moore & Co.
  - 3. Sherwin-Williams Company (The).
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Exterior Painting Schedule for the paint category indicated.

## 2.2 Paint, General

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. Colors: As selected by Architect from manufacturer's full range.

#### Part 3 Execution

#### 3.1 Examination

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

- 1. Concrete: 12 percent.
- 2. Fiber-Cement Board: 12 percent.
- 3. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

## 3.2 Preparation

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

## 3.3 Application

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

## 3.4 Cleaning and Protection

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.5 Exterior Painting Schedule

- A. Cement Board Substrates:
  - 1. Latex System:

#### **Exterior Painting**

- a. Prime Coat: Latex, exterior, matching topcoat.
- b. Prime Coat: Primer, alkali resistant, water based.
- c. Intermediate Coat: Latex, exterior, matching topcoat.
- d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4).

#### B. CMU Substrates:

- 1. Latex System:
  - a. Prime Coat: Block filler, latex, interior/exterior.
  - b. Intermediate Coat: Latex, exterior, matching topcoat.
  - c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4).

#### C. Steel and Iron Substrates:

- 1. Alkyd System:
  - a. Prime Coat: Primer, alkyd, anticorrosive, for metal.
  - b. Prime Coat: Shop primer specified in Section where substrate is specified.
  - c. Prime Coat: Primer, metal, surface tolerant.
  - d. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
  - e. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5).

#### D. Galvanized-Metal Substrates:

- 1. Alkyd System:
  - a. Prime Coat: Primer, galvanized, cementitious.
  - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
  - c. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5).

#### E. Aluminum Substrates:

- 1. Alkyd System:
  - a. Prime Coat: Primer, quick dry, for aluminum.
  - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
  - c. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5).
- F. Wood Substrates: Exposed framing.

- 1. Latex over Latex Primer System:
  - a. Prime Coat: Primer, latex for exterior wood.
  - b. Intermediate Coat: Latex, exterior, matching topcoat.
  - c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4).
- G. Wood Substrates: Wood trim.
  - 1. Latex over Latex Primer System:
    - a. Prime Coat: Primer, latex for exterior wood.
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4).

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Concrete.
  - 2. Concrete masonry units (CMUs).
  - 3. Steel and iron.
  - 4. Galvanized metal.
  - 5. Aluminum (not anodized or otherwise coated).
  - 6. Wood.
  - 7. Gypsum board.

#### 1.2 Definitions

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

#### 1.3 Action Submittals

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.

## 1.4 Quality Assurance

- A. Mockups: Apply mockups 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.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  - 2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

### Part 2 Products

#### 2.1 Manufacturers

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. Behr Paint Company; Behr Process Corporation.
  - 2. Benjamin Moore & Co.
  - 3. Sherwin-Williams Company (The).
  - 4. Carboline
  - 5. Tnemec
  - 6. Stonhard
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

## 2.2 Paint, General

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
  - Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

## Part 3 Execution

#### 3.1 Examination

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Fiber-Cement Board: 12 percent.
  - 3. Masonry (Clay and CMUs): 12 percent.
  - 4. Wood: 15 percent.
  - 5. Gypsum Board: 12 percent.
  - 6. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - Application of coating indicates acceptance of surfaces and conditions.

## 3.2 Preparation

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

## 3.3 Application

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

## 3.4 Interior Painting Schedule

- A. Concrete Substrates, Traffic Surfaces:
  - 1. Solvent-Based Concrete Floor Sealer System:
    - a. First Coat: Sealer, solvent based, for concrete floors, matching topcoat.
    - b. Topcoat: Sealer, solvent based, for concrete floors.
  - 2. Epoxy Slip-Resistant flooring by one of the following systems:
    - a. First coat 6.0-10.0 Mils dry film thickness
      - 1) Carboline Flowprime 900
      - 2) Tnemec 238 Primer
      - 3) Sherwin Williams Corobond 100
      - 4) Stonhard Standard Primer
    - b. Second Coat 100-105 Mils dry film thickness
      - 1) Carboline Flowquartz 920 with Broadcast
      - 2) Tnemec Series 238 with Broadcast
      - 3) Sherwin Williams Corobond 100
      - 4) Stonhard Stonshield with Broadcast
    - c. Third Coat 8.0-10.0 Mils Dry film thickness
      - 1) Carboline Flowquartz 920
      - 2) Tnemec Series 284 Clear
      - 3) Sherwin Williams Cor-Cote HP
      - 4) Stonhard Stoneshield Sealer

#### B. CMU Substrates:

- 1. High-Performance Architectural Latex System:
  - a. Block Filler: Block filler, latex, interior/exterior.
  - b. Prime Coat: Primer, alkali resistant, water based.
  - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
  - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3).

#### C. Steel Substrates:

- 1. Alkyd System:
  - a. Prime Coat: Primer, alkyd, quick dry, for metal.
  - b. Prime Coat: Primer, alkyd, anti-corrosive, for metal.
  - c. Prime Coat: Shop primer specified in Section where substrate is specified.
  - d. Intermediate Coat: Alkyd, interior, matching topcoat.

- e. Topcoat: Alkyd, interior (MPI Gloss Level 3).
- 2. Aluminum Paint System:
  - a. Prime Coat: Primer, alkyd, quick dry, for metal.
  - b. Prime Coat: Primer, alkyd, anti-corrosive, for metal.
  - c. Prime Coat: Shop primer specified in Section where substrate is specified.
  - d. Intermediate Coat: Aluminum paint, matching topcoat.
  - e. Topcoat: Aluminum paint.
- D. Galvanized-Metal Substrates:
  - 1. Alkyd over Cementitious Primer System:
    - a. Prime Coat: Primer, galvanized, cementitious.
    - b. Intermediate Coat: Alkyd, interior, matching topcoat.
    - c. Topcoat: Alkyd, interior (MPI Gloss Level 3).
- E. Aluminum (Not Anodized or Otherwise Coated) Substrates:
  - 1. Alkyd System:
    - a. Prime Coat: Primer, vinyl wash.
    - b. Prime Coat: Primer, quick dry, for aluminum.
    - c. Intermediate Coat: Alkyd, interior, matching topcoat.
    - d. Topcoat: Alkyd, interior (MPI Gloss Level 3).
- F. Wood Substrates: Wood trim.
  - 1. Latex over Latex Primer System:
    - a. Prime Coat: Primer, latex, for interior wood.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior (MPI Gloss Level 3).
- G. Wood Substrates: casework.
  - 1. Latex over Latex Primer System:
    - a. Prime Coat: Primer, latex, for interior wood.
    - b. Intermediate Coat: Latex, interior, matching topcoat.

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- c. Topcoat: Latex, interior (MPI Gloss Level 3).
- H. Gypsum Board Substrates:
  - 1. Latex over Latex Sealer System:
    - a. Prime Coat: Primer sealer, latex, interior.
    - b. Prime Coat: Latex, interior, matching topcoat.
    - c. Intermediate Coat: Latex, interior, matching topcoat.
    - d. Topcoat: Latex, interior (MPI Gloss Level 2).

**END OF SECTION** 

## Staining and Transparent Finishing

### Part 1 General

## 1.1 Summary

- A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:
  - 1. Exterior Substrates:
    - Exposed wood beams and columns.
    - b. Exposed framing.
    - c. Dressed lumber (finish carpentry or woodwork).
    - d. Wood decks.
  - 2. Interior Substrates:
    - Dressed lumber (finish carpentry or woodwork).

#### 1.2 Definitions

- A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

#### 1.3 Action Submittals

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of finish system and in each color and gloss of finish required.

## 1.4 Quality Assurance

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

#### Staining and Transparent Finishing

- 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 stain color selections will be based on mockups.
  - If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

### Part 2 Products

#### 2.1 Manufacturers

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. Behr Paint Company; Behr Process Corporation.
  - 2. <u>Benjamin Moore & C</u>o.
  - 3. <u>Sherwin-Williams Company (The)</u>.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in wood finish systems schedules for the product category indicated.

### 2.2 Materials, General

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."
- B. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. Stain Colors: As selected by Architect from manufacturer's full range.

### Part 3 Execution

#### 3.1 Examination

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

- C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with finish application only after unsatisfactory conditions have been corrected.
  - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

## 3.2 Preparation

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
  - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
  - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
  - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

## 3.3 Application

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

## 3.4 Cleaning and Protection

- A. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

## 3.5 Exterior Wood-Finish-System Schedule

- A. Wood Substrates: Beams and Columns.
  - 1. Varnish over Semitransparent Stain System:
    - a. Stain Coat: Stain, exterior, solvent based, semitransparent.
    - b. First Intermediate Coat: Varnish matching topcoat.
    - c. Second Intermediate Coat: Varnish matching topcoat.
    - d. Topcoat: Varnish, with UV inhibitor, exterior, semi-gloss (MPI Gloss Level 5).
- B. Wood Substrates: Exposed framing.
  - 1. Varnish over Stain System:
    - a. Stain Coat: Stain, exterior, solvent based, semitransparent.
    - b. First Intermediate Coat: Varnish matching topcoat.
    - c. Second Intermediate Coat: Varnish matching topcoat.
    - d. Topcoat: Varnish, with UV inhibitor, exterior, semi-gloss (MPI Gloss Level 5).
- C. Wood Substrates: Wood trim architectural woodwork.
  - 1. Varnish over Stain System:
    - a. Stain Coat: Stain, exterior, solvent-based, semitransparent.
    - b. First Intermediate Coat: Varnish matching topcoat.
    - c. Second Intermediate Coat: Varnish matching topcoat.
    - d. Topcoat: Varnish, with UV inhibitor, exterior, semi-gloss (MPI Gloss Level 5).

## 3.6 Interior Wood-Finish-System Schedule

- A. Wood Substrates: Wood trim architectural woodwork and wood board paneling.
  - 1. Semitransparent Stain System:
    - a. Prime Coat: Stain, exterior, solvent based, semitransparent, matching topcoat.
    - b. Topcoat: Stain, exterior, solvent based, semitransparent.

**END OF SECTION** 

### Part 1- General

## 1.1 Summary

A. Section includes metal plaques.

#### 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For plaques.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size.
- C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 Informational Submittals

A. Sample warranty.

#### 1.4 Closeout Submittals

A. Maintenance data.

## 1.5 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### Part 2- Products

## 2.1 Plaques

- A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Plaque Material: Cast aluminum.
  - 2. Plaque Thickness: 0.25 inch.
  - Finishes:
    - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.

#### Plaques

- b. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
- c. Overcoat: Manufacturer's standard baked-on clear coating.
- 4. Background Texture: As selected by Architect from manufacturer's full range.
- 5. Integrally Cast Border Style: Projected bevel.
- 6. Mounting: Countersunk flathead through fasteners.
- B. Provide name of project, date, names and titles provided by owner, A/E name.
- C. Size: 18" x 24"

#### 2.2 Accessories

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish nonferrous-metal stainless-steel or hot-dip galvanized devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
  - 4. Plaque Mounting Fasteners:
    - a. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

#### 2.3 Fabrication

- A. General: Provide manufacturer's standard plaques according to requirements indicated.
  - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
  - 5. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

- B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.
  - 1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.
- C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted plaques to suit plaque construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
  - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match plaque-background color color unless otherwise indicated.

### Part 3- Execution

#### 3.1 Installation

- A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
  - 2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
  - 4. 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.

#### B. Mounting Methods:

- 1. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
- 2. Brackets: Remove loose debris from substrate surface and install bracket supports in position, so that plaque is correctly located and aligned.
- C. Remove temporary protective coverings and strippable films as plaques are installed.

**END OF SECTION** 

## Room-Identification Panel Signage

### Part 1- General

#### 1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For room-identification 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 other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples: For each exposed product and for each color and texture specified.

#### 1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

#### 1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

#### 1.5 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 Substantial Completion.

## Part 2- Products

## 2.1 Performance Requirements

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

## 2.2 Room-Identification Signs

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

#### Room-Identification Panel Signage

- 1. Laminated-Sheet Sign: Sandblasted polymer face sheet with raised graphics laminated over subsurface graphics to acrylic backing sheet to produce composite sheet.
  - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
  - b. Subsurface Graphics: Reverse halftone or dot-screen image.
  - c. Color(s): As selected by Architect from manufacturer's full range.
- 2. Sign-Panel Perimeter: Finish edges smooth.
  - a. Edge Condition: Beveled.
  - b. Corner Condition in Elevation: Square.
- 3. Frame: Entire perimeter.
  - a. Material: Aluminum.
  - b. Profile: Beveled.
  - c. Corner Condition in Elevation: Square.
  - d. Finish and Color: As selected by Architect from manufacturer's full range.
- 4. Mounting: Manufacturer's standard method for substrates indicated with countersunk flathead through fasteners.

## 2.3 Sign Materials

- A. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film with pressure-sensitive, permanent adhesive; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.

#### 2.4 Accessories

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish nonferrous-metal stainless-steel or hot-dip galvanized devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
  - 4. Sign Mounting Fasteners:
    - a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

#### 2.5 Fabrication

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 2. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 3. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

### Part 3- Execution

### 2.6 Installation

- A. General: 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. Install signs so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

#### B. Mounting Methods:

1. 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.

**END OF SECTION** 

## Phenolic-Core Toilet Compartments

## Part 1- General

## 1.1 Summary

#### A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

#### 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.
- C. Samples for each type of toilet compartment material indicated.

#### 1.3 Informational Submittals

Product certificates.

#### 1.4 Closeout Submittals

A. Maintenance data.

#### Part 2- Products

## 2.1 Performance Requirements

- A. Surface-Burning Characteristics: Comply with ASTM E84; 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: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

## 2.2 Phenolic-Core Toilet Compartments

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. Accurate Partitions Corp., an ASI Group Company.
  - 2. Bobrick Washroom Equipment, Inc.
  - 3. Bradley Corporation.

#### Phenolic-Core Toilet Compartments

- B. Toilet-Enclosure Style: Overhead braced Floor anchored.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide minimum 3/4-inchthick doors and pilasters and minimum 1/2-inch-thick panels.
- E. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- F. Brackets (Fittings):
  - 1. Stirrup Type: Ear or U-brackets, clear-anodized aluminum.
  - 2. Full-Height (Continuous) Type: Manufacturer's standard design; aluminum.
- G. Phenolic-Panel Finish:
  - 1. Facing Sheet Finish: One color and pattern in each room.
  - 2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
  - 3. Edge Color: Manufacturer's standard.

#### 2.3 Hardware and Accessories

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
  - 1. Material: Clear-anodized aluminum.
  - 2. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
- B. Hardware and Accessories: Manufacturer's heavy-duty stainless steel operating hardware and accessories.
  - 1. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
- C. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

#### 2.4 Fabrication

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments designated as accessible.

#### Part 3- Execution

#### 3.1 Installation

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.
  - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
    - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
  - 3. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
    - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.

## 3.2 Adjusting

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging

### Phenolic-Core Toilet Compartments

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.

**END OF SECTION** 

### Part 1- General

## 1.1 Summary

- A. Section Includes:
  - Public-use washroom accessories.
  - 2. Hand dryers.
  - 3. Under lavatory guards.
  - Custodial accessories.

#### 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each finish specified, full size.
  - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Delegated-Design Submittal: For grab bars.
  - 1. Include structural design calculations indicating compliance with specified structural-performance requirements.

#### 1.3 Informational Submittals

A. Sample warranties.

#### 1.4 Closeout Submittals

A. Maintenance data.

### 1.5 Warranty

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Hand Dryers: Manufacturer agrees to repair or replace hand dryers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

### PART 2 - Products

## 2.1 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. Structural Performance: Design accessories and fasteners to comply with the following requirements:
  - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

#### 2.2 Public-Use Washroom Accessories

- A. Toilet Tissue (Roll) Dispenser:
  - 1. Description: Single-roll dispenser.
  - 2. Mounting: Surface mounted.
  - 3. Operation: Noncontrol delivery with standard spindle.
  - 4. Capacity: Designed for large diameter tissue rolls.
  - 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

#### B. Soap Dispenser:

- 1. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
- 2. Mounting: Vertically oriented, surface mounted.
- 3. Refill Indicator: Window type.

#### C. Grab Bar:

- 1. Mounting: Flanges with concealed fasteners.
- 2. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
- 3. Outside Diameter: 1-1/2 inches.
- 4. Configuration and Length: As indicated on Drawings.

#### D. Mirror Unit:

- 1. Frame: Stainless steel channel.
  - a. Corners: Manufacturer's standard.
- 2. Size: As indicated on Drawings.
- 3. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

#### E. Hook:

- 1. Description: Double-prong unit.
- 2. Mounting: Concealed.

3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

## 2.3 Hand Dryers

- A. High-Speed Air Dryer:
  - 1. Description: High-speed, warm-air hand dryer for rapid hand drying.
  - 2. Mounting: Surface mounted.
    - a. Protrusion Limit: Installed unit protrudes maximum 4 inches from wall surface.
  - 3. Operation: Infrared-sensor activated with timed power cut-off switch.
    - a. Average Dry Time: 12 seconds.
    - b. Automatic Shut Off: At 60 seconds.
  - 4. Maximum Sound Level: 69 dB.
  - 5. Cover Material and Finish: Steel, with white enamel finish.
  - 6. Electrical Requirements: 115 V, 15 A, 1725 W.

#### 2.4 Childcare Accessories

- A. Diaper-Changing Station:
  - 1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
    - a. Engineered to support minimum of 250-lb static load when opened.
  - 2. Mounting: Surface mounted, with unit projecting not more than 4 inches) from wall when closed.
  - 3. Operation: By pneumatic shock-absorbing mechanism.
  - 4. Material and Finish: HDPE in manufacturer's standard color.
  - 5. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

## 2.5 Underlavatory Guards

- A. Under lavatory Guard:
  - Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
  - 2. Material and Finish: Antimicrobial, molded plastic, white.

#### 2.6 Custodial Accessories

- A. Custodial Mop and Broom Holder:
  - 1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
  - 2. Length: 36 inches.
  - 3. Hooks: Four.
  - 4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
  - 5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

#### Toilet Accessories

- a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
- b. Rod: Approximately 1/4-inch- diameter stainless steel.

#### 2.7 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

#### 3.1 Installation

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
  - 1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.

**END OF SECTION** 

# Part 1- General

# 1.1 Summary

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

# 1.2 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 Action Submittals

A. Product Data: For each type of product.

## 1.4 Informational Submittals

A. Warranty: Sample of special warranty.

#### 1.5 Closeout Submittals

A. Operation and maintenance data.

### 1.6 Coordination

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

# 1.7 Warranty

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Six years from date of Substantial Completion.

### Part 2- Products

# 2.1 Performance Requirements

- 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.

# 2.2 Portable, Hand-Carried Fire Extinguishers

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
  - 1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type: UL-rated **10-B:C, 10-lb** nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

## 2.3 Mounting Brackets

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

# Part 3-Execution

#### 3.1 Instillation

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

Fire Extinguishers

- 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

A. Section includes ground-set flagpoles made from aluminum.

#### 1.2 Action Submittals

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Delegated-Design Submittal: For flagpoles.

### 1.3 Closeout Submittals

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

## Part 2 Products

### 2.1 Manufacturers

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

## 2.2 Performance Requirements

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design flagpole assemblies.
- B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
  - 1. Wind Loads: Determine according to NAAMM FP 1001. Basic wind speed for Project location is 90 mph.

# 2.3 Aluminum Flagpoles

- A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.
- B. Exposed Height: 30 feet.

#### **Ground-Set Flagpoles**

- C. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, 0.060-inch wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch-diameter, steel ground spike; and steel centering wedges welded together. Galvanize foundation tube after assembly. Furnish loose hardwood wedges at top of foundation tube for plumbing pole.
- D. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.

## 2.4 Fittings

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
  - 1. 0.063-inch spun aluminum, finished to match flagpole.
- B. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch-diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
  - 1. Halyards and Cleats: One at each flagpole.
  - 2. Halyard Flag Snaps: Chromium-plated bronze swivel snap hooks. Furnish two per halyard.

#### 2.5 Miscellaneous Materials

- A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- B. Sand: ASTM C33/C33M, fine aggregate.
- C. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

#### 2.6 Aluminum Finishes

- A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44.
  - 1. Color: As selected by Architect from full range of industry colors and color densities.

## Part 3 Execution

## 3.1 Preparation

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- D. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.
- E. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

# 3.2 Flagpole Installation

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

**END OF SECTION** 

# Metal Building Systems

## Part 1 General

## 1.1 Scope of the Work

- A. Refer to the Drawings in other sections of the specifications to determine the full scope of work involved.
- B. Project will be composed of 1 metal building on site:
  - 1. Pavilion Building 30' x 50' Cheyenne by CRS, Inc.

#### 1.2 Submittals

- A. Submit descriptive literature and shop drawings stamped and signed by a registered engineer in the State of Alabama. Submit certification that the proposed building will be furnished to meet or exceed all design load criteria of the referenced standards and that the structural design will be in strict conformance with that prescribed in MBMA's Design Practices Manual or in the AISC Manual of Steel Construction and the Steel Joist Institute's Standard Specifications, Load Tables, and Weight Tables. The manufacturer shall submit complete structural analysis.
- B. Submit all particulars on the metal building, per Section 013300 requirements "Submittals and Substitutions".

# 1.3 Applicable Standards

- A. The building shall be the design of a manufacturer who is regularly engaged in the fabrication of preengineered structures. All materials shall be new, unused, and free from defects
- B. The following standards and criteria shall be used where applicable in the structural design of the building covered by this specification:
  - 1. Recommended Design Practices Manual, MBMA
  - Steel Construction Manual, AISC
  - 3. Cold Formed Steel Design Manual, AISI
  - 4. Aluminum Construction Manual, The Aluminum Association
  - 5. Code for Welding in Building Construction, AWS
  - 6. 2006 IBC.
  - 7. ASCE 7-05.
- C. The following criteria shall also be applicable in other phases of design:
  - SBCCI
  - 2. Structural Steel Painting Council Standards
  - 3. Federal, Military and Commercial Standards
  - ASTM Standards

## D. Ratings by:

- 1. Underwriters' Laboratories, Inc.
- 2. Other recognized testing laboratories

## 1.4 Design Loads

A. The basic design loads shall include snow, live, wind, and earthquake loads as well as dead load as indicated on the drawings. All other design loads, whether they are of a static, dynamic, or kinetic nature, shall be considered auxiliary loads.

#### B. Vertical Live Loads

- 1. The roof covering shall be designed for either a 50 psf load uniformly distributed or a 200 pound concentrated (point) load (over a 1 inch by 1 inch area) located at the center of the maximum roofing (panel) span. The most severe conditions shall govern.
- 2. Purlins shall be designed for a 20 psf live load uniformly distributed over the roof area that they support.
- 3. Primary framing (frames) shall be designed for a non-reducible 20 psf load uniformly distributed over the roof area that it supports.
- C. Wind Loads: The wind load on the structure shall be 90 MPH wind speed proportioned and applied as horizontal, vertical, and uplift forces.

Limit of deflection due to wind, seismic, or other lateral load to H/120. H is equal to eave height.

#### D. Auxiliary (Additional Collateral) Loads

- 1. Design purlins and frames for 4.0 psf collateral load. Other superimposed dynamic and/or static loads shall be considered as part of the design requirements and combined with the normal design (live and/or wind) loads as prescribed by the Drawings.
- 2. Refer to the architectural, mechanical, and electrical drawings for any additional equipment loads, etc.
- E. Combination of Loads: The combining of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the MBMA Design Practices Manual, unless otherwise specified.

# Part 2 Products

# 2.1 Description

A. The pre-engineered metal buildings covered by this specification is to be a single and multi sloped rigid frame solid web structure consisting of tapered or uniform depth rafter beams and uniform depth columns.

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- B. The roof slope shall be 6:12 for the Pavilion Building.
- C. Column spacing at the exterior walls and/or at the valleys shall be as shown on the Drawings.
- D. The eave height at the high side of the building shall be as shown on drawings.

# 2.2 Roof Covering and Supports

- A. The roof construction shall carry a UL construction uplift classification not less than Class 90.
- B. Standing Seam Roof Panels
  - 1. Refer to Architectural Specification 07 41 13
- C. Guarantee: Panel finish and weather tightness shall be guaranteed for a period of 20 years. Materials and workmanship shall be guaranteed for a period of 3 years.
- D. Primary Framing
  - 1. See drawings for primary framing locations. Materials shall be steel as provided by the metal building manufacturer. Tapered main frame columns is permitted in the Maintenance Building only.
  - 2. The vertical deflection of the primary framing shall be limited to a live/snow load deflection of 2 inch maximum.

#### E. Secondary Framing

- 1. The purlin's and girts configuration, thickness, and spacing shall meet the building manufacturer's standard provided all design criteria (including deflection and wind uplift) are met or exceeded. Basic building roof purlins and wall girts are based on an 8" basic depth.
- 2. Structural steel materials shall be in accordance with ASTM 570 and have a minimum yield strength of 55,000 psi.
- 3. The deflection of the purlins shall not exceed the deflection limits of Table 1604.3 of the 2006 IBC.
- 4. Bolts and nuts used with secondary framing shall be minimum ASTM A307.
- 5. Provide cold formed framed opening members designed to meet specified loads at all door, louver, wall openings, and roof openings.

# 2.3 Pavilion Building

- A. Pavilion building shall be based on the Cheyenne by CRS, Inc.
- B. Building shall be 30' x 50' in size with an eave height of 8'-8".
- C. Perimeter columns shall be straight-type, tube columns.

#### Metal Building Systems

- D. Roof pitch shall have a 6/12 type with roof decking composed of 1 x 6 T&G wood decking of fir, select grade with smooth side facing down (field stained by painter) over metal roof purlins.
- E. Shape of roof is identified on the drawings.
- F. Building fascia shall be a steel tube as provided by the metal building manufacturer.
- G. Provide a pre-finished color on all primary members selected from the manufacturer's standard selection of colors.

#### 2.4 Fasteners

- A. Provide self tapping screws, bolts, nuts, self locking rivets, self locking bolts, end welded studs, and other suitable fasteners as standard with the manufacturer, designed to withstand design loads.
- B. Provide metal backed neoprene washers under heads of fasteners bearing on weather side of panels.
- C. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium plated fasteners for interior applications.
- D. Locate and space fastenings in true vertical and horizontal alignment. Use proper type fastening tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
- E. Provide fasteners with heads matching color of roofing or siding sheets by means of plastic caps or factory applied coating.

### 2.5 Structural Steel Primer

A. All uncoated structural steel shall be given 1 shop coat of rust inhibitive (primer) paint that is certified to conform to a recognized authoritative specification such as Federal or Military Standards or the standards of the Structural Steel Painting Council. Color to be manufacturer's standard.

# Part 3 Execution

- 3.1 Erection of the metal building, accessories, insulation, and the interior finish, if applicable, shall be performed by one of the following:
  - A. Authorized dealers or builders of the manufacturer;
  - B. Building manufacturer's crews; or
  - C. Other erectors authorized by the manufacturer as trained and qualified to erect that manufacturer's product with minimum 10 years verifiable experience; in this case, the manufacturer shall inspect the work and certify its correctness.

# **END OF SECTION**

# Plumbing Piping Insulation

## Part 1 General

## 1.1 Summary

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Supplies and drains for handicap-accessible lavatories and sinks.

#### 1.2 Action Submittals

A. Product Data: For each type of product.

## 1.3 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 in accordance with ASTM E84 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.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

#### 1.4 Coordination

A. Coordinate clearance requirements with piping Installer for piping insulation application.

## 1.5 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

### 2.1 Insulation Materials

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.
- G. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Knauf Insulation.
    - c. Manson Insulation Inc.
  - 2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
  - 3. 850 deg F.
  - 4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
  - 5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

#### 2.2 Adhesives

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
  - 1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
  - 2. Wet Flash Point: Below 0 deg F.
  - 3. Service Temperature Range: 40 to 200 deg F.
  - 4. Color: Black.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
- D. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller Construction Products.

# 2.3 Mastics and Coatings

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
  - 1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
  - 2. Service Temperature Range: 0 to plus 180 deg F.
  - 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
  - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on aboveambient services.
  - 1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
  - 2. Service Temperature Range: 0 to plus 180 deg F.
  - 3. Color: White.

#### 2.4 Sealants

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

## 2.5 Factory-Applied Jackets

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

## 2.6 Field-Applied Jackets

- A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

#### C. Metal Jacket:

- 1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - a. Sheet and roll stock ready for shop or field sizing.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
  - d. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

# 2.7 Tapes

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
  - 1. Width: 3 inches.
  - 2. Thickness: 11.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

#### 2.8 Securements

#### A. Bands:

- 1. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

# 2.9 Protective Shielding Guards

- A. Protective Shielding Pipe Covers:
  - Description: Manufactured plastic wraps for covering plumbing fixture hotand cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## Part 3 Execution

# 3.1 Preparation

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

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D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

# 3.2 General Installation Requirements

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vaporbarrier 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 attached to structure with vapor-barrier mastic.
  - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - Cleanouts.

#### 3.3 Penetrations

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.

- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

# 3.4 General Pipe Insulation Installation

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

- Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
  - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
  - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
  - Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

#### Plumbing Piping Insulation

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.5 Installation of Flexible Elastomeric Insulation

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
  - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
  - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.6 Installation of Mineral-Fiber Insulation

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

- 1. Install preformed pipe insulation to outer diameter of pipe flange.
- 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
- 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

### C. Insulation Installation on Pipe Fittings and Elbows:

- 1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
- 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

### D. Insulation Installation on Valves and Pipe Specialties:

- 1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
- 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
- 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- 4. Install insulation to flanges as specified for flange insulation application.

### 3.7 Finishes

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless steel jackets.

# 3.8 Field Quality Control

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three

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locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

## 3.9 Piping Insulation Schedule, General

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

# 3.10 Indoor Piping Insulation Schedule

- A. Domestic Cold Water:
  - 1. NPS 1 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/4 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. All Pipe Sizes: Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
- E. Hot Service Drains:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- F. Hot Service Vents:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- 3.11 Indoor, Field-Applied Jacket Schedule
  - A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
  - B. If more than one material is listed, selection from materials listed is Contractor's option.
  - C. Piping, Concealed:
    - 1. None.
  - D. Piping, Exposed:
    - 1. None.
    - 2. Aluminum, Smooth: 0.016 inch thick.

**END OF SECTION** 

# **Domestic Water Piping**

# Part 1 General

# 1.1 Summary

#### A. Section Includes:

- 1. Copper tube and fittings.
- 2. CPVC piping.
- 3. PEX tube and fittings.
- 4. PVC pipe and fittings.
- 5. Piping joining materials.
- 6. Transition fittings.
- 7. Dielectric fittings.

#### 1.2 Action Submittals

A. Product Data: For transition fittings and dielectric fittings.

#### 1.3 Informational Submittals

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

## Part 2 Products

## 2.1 Piping Materials

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

# 2.2 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 and ASTM B 88, Type L 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.

#### **Domestic Water Piping**

- 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, Brass, or Bronze Pressure-Seal-Joint Fittings:
  - 1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2and larger with stainless steel grip ring and EPDM O-ring seal.
  - 2. Minimum 200-psig working-pressure rating at 250 deg F.

# 2.3 CPVC Pipng

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40 and Schedule 80.
  - 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40 and ASTM F 439 for Schedule 80.
  - 2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

# 2.4 PEX Tube and Fittings

- A. Tube Material: PEX plastic according to ASTM F 876 and ASTM F 877.
- B. Fittings: ASTM F 1807, metal insert and copper crimp rings.
- C. Fittings: ASSE 1061, push-fit fittings.
- D. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 876; with plastic or corrosion-resistant-metal valve for each outlet.

# 2.5 PVC Pipe and Fittings

- A. PVC Pipe: ASTM D 1785, Schedule 40 and Schedule 80.
- B. PVC Socket Fittings: ASTM D 2466 for Schedule 40 and ASTM D 2467 for Schedule 80.
- C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

# 2.6 Piping Joint 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. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- D. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- E. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

# 2.7 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.
- C. Plastic-to-Metal Transition Fittings:
  - 1. Description:
    - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
    - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
  - 1. Description:
    - a. CPVC or PVC four-part union.
    - b. Brass or stainless-steel threaded end.
    - c. Solvent-cement-joint or threaded plastic end.
    - d. Rubber O-ring.
    - e. Union nut.

## 2.8 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.

## Part 3 Execution

# 3.1 Piping Installation

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install water-pressure-reducing valves downstream from shutoff valves.
- F. Install domestic water piping level without pitch and plumb.
- G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.

- O. Install PEX tubing with loop at each change of direction of more than 90 degrees.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.
- R. Install thermostats in hot-water circulation piping.
- S. Install thermometers on inlet and outlet piping from each water heater.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors.
- U. Install sleeve seals for piping penetrations of concrete walls and slabs.
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.2 Joint Construction

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- E. Joint Construction for Solvent-Cemented Plastic Piping: 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. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. PVC Piping: Join according to ASTM D 2855.
- F. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.

- G. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

# 3.3 Transition Fitting Insulation

- 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.

# 3.4 Dielectric Fitting Installation

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

# 3.5 Installation of Hangers and Supports

- A. Provide hangers and supports as follows:
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for copper tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Install vinyl-coated hangers for CPVC and PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

- E. Support horizontal piping within 12 inches of each fitting.
- F. Support vertical runs of copper tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of CPVC and PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- H. Support vertical runs of PEX tubing.

### 3.6 Connections

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 4. 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.

#### 3.7 Indentifications

- Identify system components.
- B. Label pressure piping with system operating pressure.

## 3.8 Field Quality Control

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

#### **Domestic Water Piping**

- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
  - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

#### 2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.9 Adjusting

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

- a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
- b. Adjust calibrated balancing valves to flows indicated.
- 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
- 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
- 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
- 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

# 3.10 Cleaning

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 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.

# 3.11 Piping Schedule

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

#### **Domestic Water Piping**

- 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 3 and smaller, shall be one of the following:
  - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
  - 2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
- E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
  - 2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 2. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
  - 3. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
  - 4. PEX tube, NPS 1 and smaller.
    - a. Fittings for PEX tube:
      - 1) ASTM F 1807, metal insert and copper crimp rings.
      - 2) ASTM F 1960, cold expansion fittings and reinforcing rings.
      - 3) ASSE 1061, push-fit fittings.
- G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 2. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
  - 3. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.

#### **END OF SECTION**

# **Domestic Water Piping Specialties**

### Part 1 General

# 1.1 Summary

#### A. Section Includes:

- 1. Backflow preventers.
- 2. Water pressure-reducing valves.
- 3. Balancing valves.
- 4. Temperature-actuated, water mixing valves.
- 5. Strainers.
- 6. Hose bibbs.
- 7. Wall hydrants.
- 8. Water-hammer arresters.
- 9. Trap-seal primer valves.

## 1.2 Action Submittals

A. Product Data: For each type of product.

### 1.3 Informational Submittals

A. Field quality-control reports.

#### 1.4 Closeout Submittals

A. Operation and maintenance data.

### Part 2 Products

# 2.1 General Requirements for Piping Specialties

- A. Potable-water piping and components shall comply with NSF 61.
- B. Comply with NSF 372 for low lead.

# 2.2 Performance Requirements

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

## Part 3 Execution

#### 3.1 Installation

A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems

#### **Domestic Water Piping Specialties**

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. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
- C. Balancing Valves: Install in locations where they can easily be adjusted.
- D. Temperature-Actuated, Water Mixing Valves: Install 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.
- E. Y-Pattern Strainers: For water, install on supply side of each water pressurereducing valve.
- F. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- G. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

#### 3.2 Connections

- Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

#### 3.3 Identifications

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Reduced-pressure-principle backflow preventers.
  - 2. Water pressure-reducing valves.
  - 3. Calibrated balancing valves.
  - 4. Supply-type, trap-seal primer valves.
  - 5. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

## 3.4 Field Quality Control

- A. Perform the following tests and inspections:
  - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.5 Adjusting

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

**END OF SECTION** 

# Sanitary Waste and Vent Piping

## Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Hub-and-spigot, cast-iron soil pipe and fittings.
- 2. PVC pipe and fittings.
- 3. Specialty pipe fittings.

#### 1.2 Action Submittals

A. Product Data: For each type of product.

#### 1.3 Informational Submittals

A. Field quality-control reports.

# 1.4 Warranty

A. Listed manufacturers to provide labeling and warranty of their respective products.

### Part 2 Products

# 2.1 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.

## 2.2 Piping Materials

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. 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.

# 2.3 Hub-and-Spigot, Cast -Iron Soil Pipe Fittings

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## 2.4 PVC Pipe and Fittings

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- 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.
- E. Solvent Cement: ASTM D 2564.

## 2.5 Specialty Pipe Fittings

- A. Transition Couplings:
  - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 2. Unshielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1173.
    - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

### Part 3 Execution

# 3.1 Piping Installation

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. 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.
  - 1. 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.
  - 2. 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.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
- K. Lay buried building waste piping beginning at low point of each system.
  - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 3. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
  - Building Sanitary Waste: 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.

#### Sanitary Waste and Vent Piping

- 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
- 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Install underground PVC piping according to ASTM D 2321.
- P. Plumbing Specialties:
  - 1. Install backwater valves in sanitary waster gravity-flow piping.
  - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
  - 3. Install drains in sanitary waste gravity-flow piping.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors.
- S. Install sleeve seals for piping penetrations of concrete walls and slabs.
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.2 Joint Construction

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
  - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

# 3.3 Specialty Pipe Fitting Installation

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in ODs.
  - 2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

### 3.4 Valve Installation

#### A. Shutoff Valves:

- 1. Install shutoff valve on each sewage pump discharge.
- 2. Install gate or full-port ball valve for piping NPS 2 and smaller.
- 3. Install gate valve for piping NPS 2-1/2 and larger.
- B. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

# 3.5 Installation of Hangers and Supports

- A. Provide hangers and supports as follows:
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 4. 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.
  - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- E. Support vertical runs of cast iron soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

#### 3.6 Connections

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste 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 waste 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 waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.
    - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

#### 3.7 Identification

A. Identify exposed sanitary waste and vent piping.

# 3.8 Field Quality Control

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. Inspect joints for leaks.
  - Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
    - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    - d. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

# 3.9 Cleaning and Protection

A. Clean interior of piping. Remove dirt and debris as work progresses.

#### Sanitary Waste and Vent Piping

- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

## 3.10 Piping Schedule

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- E. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

#### **END OF SECTION**

# Sanitary Waste Piping Specialties

### Part 1 General

## 1.1 Summary

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Roof flashing assemblies.
  - 3. Miscellaneous sanitary drainage piping specialties.

#### 1.2 Definitions

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. PVC: Polyvinyl chloride.

### 1.3 Informational Submittals

A. Field quality-control reports.

#### 1.4 Closeout Submittals

A. Operation and maintenance data.

# Part 2 Products – Refer to Drawings

# 2.1 Assembly Descriptions

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

#### 2.2 Cleanouts

- A. Refer to drawings.
- 2.3 Roof Flashing Assemblies
  - A. Refer to Drawings.

## 2.4 Miscellaneous Sanitary Drainage Piping Specialties

A. Open Drains:

- 1. Description: Shop or field fabricate from ASTM A74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
- 2. Size: Same as connected waste piping with increaser fitting of size indicated.

### B. Floor-Drain, Trap-Seal Primer Fittings:

- 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trapseal primer valve connection.
- 2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

### C. Air-Gap Fittings:

- 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
- 2. Body: Bronze or cast iron.
- 3. Inlet: Opening in top of body.
- 4. Outlet: Larger than inlet.
- 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

### D. Sleeve Flashing Device:

- Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
- 2. Size: As required for close fit to riser or stack piping.

#### E. Vent Caps:

- 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
- 2. Size: Same as connected stack vent or vent stack.

### Part 3 Execution

#### 3.1 Installation

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.

- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 07 41 13.16, Standing-Seam Metal Roofing Panels.
- E. Assemble open drain fittings and install with top of hub 1 inch above floor.
- F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- H. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- I. Install vent caps on each vent pipe passing through roof.
- J. Install wood-blocking reinforcement for wall-mounting-type specialties.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

#### 3.2 Connections

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

## 3.3 Flashing Installation

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

- 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
- 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

## 3.4 Labeling and Identifying

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

#### 3.5 Protection

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION** 

## Fuel Fired, Domestic Water Heaters

### Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Commercial, atmospheric, gas-fired, storage, domestic-water heaters.
- 2. Domestic-water heater accessories.

#### 1.2 Action Submittals

A. Product Data: For each type of product.

#### 1.3 Informational Submittals

- A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale and coordinated with all building trades.
- B. Seismic Qualification Data: Certificates, for fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of commercial, gas-fired, domestic-water heater.
- D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample warranty.

#### 1.4 Closeout Submittals

A. Operation and maintenance data.

#### 1.5 Coordination

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.6 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace components of fuelfired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Periods: From date of Substantial Completion.

- a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
  - 1) Storage Tank: Three years.
  - 2) Controls and Other Components: One year(s).
- b. Expansion Tanks: Five years.

# Part 2 Products

### 2.1 Performance Requirements

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Component Importance Factor: 1.5.
- C. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.
- D. 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.
- E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

# 2.2 Commercial, Gas-Fired, Storage, Domestic-Water Heaters

- A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. A. O. Smith Corporation.
    - b. Bradford White Corporation.
    - c. Lochinvar, LLC.
    - d. PVI; A WATTS Brand.

- e. Rheem Manufacturing Company.
- 2. Standard: ANSI Z21.10.3/CSA 4.3.
- 3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
  - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
    - 1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
    - 2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
  - b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Lining: Glass complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
- 4. Factory-Installed, Storage-Tank Appurtenances:
  - a. Anode Rod: Replaceable magnesium.
  - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
  - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
  - d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
  - e. Jacket: Steel with enameled finish.
  - f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
  - g. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
  - h. Temperature Control: Adjustable thermostat.
  - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
  - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domesticwater heater. Select one relief valve with sensing element that extends into storage tank.
- 5. Special Requirements: NSF 5 construction.
- 6. Draft Hood: Draft diverter, complying with ANSI Z21.12.
- B. Capacity and Characteristics: Refer to Drawings.

#### 2.3 Domestic-Water Heater Accessories

- A. Domestic-Water Expansion Tanks:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. A. O. Smith Corporation.
    - b. AMTROL, Inc.
    - c. State Industries.
  - 2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
  - 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 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
  - 4. Capacity and Characteristics:
    - a. Working-Pressure Rating: 150 psig.
    - b. Capacity Acceptable: 2 gal. minimum.
    - c. Air Precharge Pressure: 55psig.
- B. Drain Pans: Corrosion-resistant metal with raised edge. 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.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in other sections.
- F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.
- G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.
- H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

- I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
- J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.
  - Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
- K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

## 2.4 Source Quality Control

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### Part 3 Execution

### 3.1 Domestic-Water Heater Installation

- A. Install domestic-water heaters in accordance with manufacturer's requirements, level and plumb, in accordance with 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.
- B. Install gas-fired, domestic-water heaters in accordance with 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, domesticwater heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
- C. Install commercial domestic-water heaters with seismic-restraint devices.
- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-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.
- F. Install thermometer on outlet piping of domestic-water heaters.
- G. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- H. Fill domestic-water heaters with water.
- Charge domestic-water expansion tanks with air to required system pressure.
- J. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.
- K. Identify system components.

## 3.2 Piping Connections

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. 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.

# 3.3 Field Quality Control

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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- D. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

**END OF SECTION** 

# **Commercial Plumbing Fixtures**

## Part 1 General

## 1.1 Summary

- A. Section Includes and applies to all plumbing fixtures and specialties indicated on the schedule on Drawings P001, including but not limited to the following:
  - 1. Water closets.
  - 2. Urinals.
  - Lavatories.
  - Sinks.
  - 5. Flushometer valves and tanks.
  - 6. Toilet seats.
  - 7. Supports.

#### 1.2 Action Submittals

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

#### 1.3 Closeout Submittals

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

# Part 2 Products – Refer to Drawings

## Part 3 Executions

#### 1.4 Installation

- A. General install fixtures at heights to for handicapped/elderly, according to ADA requirements.
- B. Water-Closet and Urinal Installation:
  - 1. Install level and plumb according to roughing-in drawings.
  - 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
  - 3. Install accessible, fixtures at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

#### C. Support Installation:

- 1. Install supports, affixed to building substrate, for fixtures requiring supporting.
- 2. Use carrier supports with waste-fitting assembly and seal.

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3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

#### D. Flushometer-Valve Installation:

- 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
- 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
- 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
- 4. Install actuators in locations that are easy for people with disabilities to reach.
- E. Install toilet seats on water closets.
- F. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.

#### G. Joint Sealing:

- 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
- 2. Match sealant color to water-closet color.

### 1.5 Connections

- A. Connect fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to fixtures, allow space for service and maintenance.

# 1.6 Adjusting

- A. Operate and adjust fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

# 1.7 Cleaning And Protection

- A. Clean fixtures and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Balancing Air Systems:
  - a. Constant-volume air systems.
  - b. Variable-air-volume systems.

### 1.2 Definitions

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- F. TDH: Total dynamic head.

#### 1.3 Action Submittals

A. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

#### 1.4 Informational Submittals

- A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

### 1.5 Quality Assurance

- A. TAB Specialists Qualifications: Certified by AABC.
  - 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. TAB Specialists Qualifications: Certified by NEBB or TABB.

- 1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
- 2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

# Part 2 Products (Not Applicable)

### Part 3 Execution

#### 3.1 Examination

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine 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 strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

# 3.2 Preparation

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

#### 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.

## 3.3 General Procedures For Testing And Balancing

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" 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. After testing and balancing, install test ports and duct access doors.
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

## 3.4 General Procedures For Balancing Air Systems

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

# 3.5 Procedures For Constant-Volume Air Systems

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 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 main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses, close to the fan and prior to any outlets, to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
  - 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 Architect 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.

#### 3.6 Tolerances

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  - Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  - 2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.7 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.
  - 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.
- I. 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.
- I. 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. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
  - 1. Unit Data:
    - a. System identification.
    - b. Location.
    - c. Coil identification.
    - d. Capacity in Btu/h.
    - e. Number of stages.
    - f. Connected volts, phase, and hertz.
    - g. Rated amperage.
    - h. Airflow rate in cfm.
    - i. Face area in sq. ft.
    - j. Minimum face velocity in fpm.
  - 2. Test Data (Indicated and Actual Values):
    - a. Heat output in Btu/h.
    - b. Airflow rate in cfm.
    - c. Air velocity in fpm.
    - d. Entering-air temperature in deg F.
    - e. Leaving-air temperature in deg F.
    - f. Voltage at each connection.
    - g. Amperage for each phase.
- 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. Instrument Calibration Reports:

- 1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

### 3.8 Verification Of Tab Report

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Owner.
- B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. 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."
- D. 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.
- E. 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.
- F. Prepare test and inspection reports.

## 3.9 Additional Tests

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed supply and return located in unconditioned space.
  - 4. Indoor, exposed return located in unconditioned space.
  - 5. Outdoor, concealed supply and return.
  - 6. Outdoor, exposed supply and return.

### 1.2 Action Submittals

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

### 1.3 Informational Submittals

A. Field quality-control reports.

## 1.4 Quality Assurance

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

### Part 2 Products

#### 2.1 insulation Materials

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

#### Duct Insulation

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Knauf Insulation.

### 2.2 Adhesives

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.

## 2.3 Mastics And Coatings

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.

- 1. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
- 2. Service Temperature Range: Minus 20 to plus 180 deg F.
- 3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
- 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  - 1. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Color: White.

### 2.4 Sealants

- A. FSK and 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.
  - Color: Aluminum.

## 2.5 Factory-Applied Jackets

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
  - 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.
  - 5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

# 2.6 Field-Applied Fabric-Reinforcing Mesh

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

## 2.7 Field-Applied Jackets

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

## 2.8 Tapes

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
  - 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.

### 2.9 Securements

- A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
- B. Insulation Pins and Hangers:
  - 1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - b. Spindle: Copper- or zinc-coated, low-carbon steel Aluminum, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.

## Part 3 Execution

# 3.1 Preparation

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

## 3.2 General Installation Requirements

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.

#### Duct Insulation

- 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
- 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
  - a. For below ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

#### 3.3 Penetrations

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.

- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- E. Insulation Installation at Floor Penetrations:
  - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

### 3.4 Installation Of Mineral-Fiber Insulation

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 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.

#### Duct Insulation

- 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 o.c.
- 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.5 Finishes

A. Do not field paint aluminum or stainless-steel jackets.

# 3.6 Field Quality Control

- Perform tests and inspections.
- B. Tests and Inspections:
  - Inspect ductwork, randomly selected by Architect, by removing fieldapplied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

## 3.7 Duct Insulation Schedule, General

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed supply and return located in unconditioned space.
  - 4. Outdoor, concealed supply and return.
  - 5. Outdoor, exposed supply and return.

#### B. Items Not Insulated:

1. Fibrous-glass ducts.

- 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
- 3. Factory-insulated flexible ducts.
- 4. Factory-insulated plenums and casings.
- 5. Flexible connectors.
- 6. Vibration-control devices.
- 7. Factory-insulated access panels and doors.

### 3.8 Indoor Duct And Plenum Insulation Schedule

- A. Concealed and exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- B. Concealed Supply-Air and Return-Air Duct in Unconditioned Spaces (e.g. Attic, Spaces, Mechanical Room, etc.) Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- C. Concealed and exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- D. Concealed, Outdoor-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick and 1.5-lb/cu. ft. nominal density.
- E. Concealed, Exhaust-Air Duct and Plenum Insulation: Uninsulated.
- F. Exposed, Exhaust-Air Duct and Plenum Insulation: Uninsulated.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

A. Section includes insulation for HVAC piping systems.

### 1.2 Action Submittals

A. Product Data: For each type of product.

### 1.3 Informational Submittals

- A. Qualification Data: For qualified Installer.
- B. Material test reports.
- C. Field quality-control reports.

## 1.4 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 in accordance with ASTM E84, 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.

### 1.5 Coordination

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

### 1.6 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

### 2.1 Insulation Materials

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials, Type II for sheet materials.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.
    - b. Armacell LLC.

### 2.2 Adhesives

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
  - 1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
  - 2. Wet Flash Point: Below 0 deg F.

- 3. Service Temperature Range: 40 to 200 deg F.
- 4. Color: Black.

## 2.3 Mastics And Coatings

A. Materials shall be compatible with insulation materials, jackets, and substrates.

#### 2.4 Sealants

- A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:
  - 1. Permanently flexible, elastomeric sealant.
    - a. Service Temperature Range: Minus 150 to plus 250 deg F.
    - b. Color: White or gray.

### Part 3 Execution

## 3.1 preparation

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5
    mils thick and an epoxy finish 5 mils thick if operating in a temperature
    range between 140 and 300 deg F. Consult coating manufacturer for
    appropriate coating materials and application methods for operating
    temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

# 3.2 General Installation Requirements

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

### **HVAC Piping Insultation**

- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vaporbarrier 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 attached to structure with vapor-barrier mastic.
  - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Cut insulation in a manner to avoid compressing insulation more than 25 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 in similar fashion to butt joints.

- O. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.

### 3.3 Penetrations

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

# 3.4 General Pipe Insulation Installation

- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

- Insulate pipe elbows using preformed fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
- 3. Insulate tee fittings with preformed fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
- 4. Insulate valves using preformed fitting insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
- Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and wellshaped contour.
- 7. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

## 3.5 Installation Of Flexible Elastomeric Insulation

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  - 1. Install pipe insulation to outer diameter of pipe flange.
  - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

- 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
- 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install mitered sections of pipe insulation.
  - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
  - When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 3. Install insulation to flanges as specified for flange insulation application.
  - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### 3.6 Finishes

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

# 3.7 Field Quality Control

- A. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- B. All insulation applications will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.8 Piping Insulation Schedule, General

- A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Underground piping.
  - 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

## 3.9 Indoor Piping Insulation Schedule

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1 inch thick.

# 3.10 Outdoor, Aboveground Piping Insulation Schedule

- A. Refrigerant Suction and Hot-Gas Piping:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 2 inches thick. Suitable for outdoor application with UV Resistant Coating.

#### **END OF SECTION**

### Part 1 General

## 1.1 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. Dielectric unions.

### 1.2 Action Submittals

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

## 1.3 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.

## Part 2 Products

## 2.1 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: 2.0 psig or less.

# 2.2 Pipes, Tubes, And Fittings

- A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

### Facility Natural Gas Piping

- 2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
- 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
- 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
  - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

#### B. PE Pipe: ASTM D2513, SDR 11.

- 1. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.
- 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
- 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
  - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet.
  - b. Casing: Steel pipe complying with ASTM A53/A53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering.
  - c. Aboveground Portion: PE transition fitting.
  - d. Outlet shall be threaded or suitable for welded connection.
  - e. Tracer wire connection.
  - f. Ultraviolet shield.
  - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
- 4. Transition Service-Line Risers: Factory fabricated and leak tested.
  - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11 inlet connected to steel pipe complying with ASTM A53/A53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
  - b. Outlet shall be threaded 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.

# 2.3 Piping Specialties

- A. Appliance Flexible Connectors:
  - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.

- 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. Quick-Disconnect Devices: Comply with ANSI Z21.41.
  - 1. Copper-alloy convenience outlet and matching plug connector.
  - Nitrile seals.
  - 3. Hand operated with automatic shutoff when disconnected.
  - 4. For indoor or outdoor applications.
  - 5. Adjustable, retractable restraining cable.

#### C. Y-Pattern Strainers:

- 1. Body: ASTM A126, Class B, cast iron with bolted cover and bottom drain connection.
- 2. End Connections: Threaded ends for NPS 2 and smaller.
- 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
- 4. CWP Rating: 125 psig.
- D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosionresistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

# 2.4 Joining Materials

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

### 2.5 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.

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- 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. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
  - 1. Body: Bronze, complying with ASTM B584.
  - 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.
- D. PE Ball Valves: Comply with ASME B16.40.
  - 1. Body: PE.
  - 2. Ball: PE.
  - 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.
  - Include tamperproof locking feature for valves where indicated on Drawings.

#### E. 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.

## 2.6 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.
- B. 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.
  - Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
  - 11. Maximum Inlet Pressure: 5 psig.
- C. 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.
  - 8. Maximum Inlet Pressure: 2 psig.

### 2.7 Dielectric Unions

#### A. Dielectric Unions:

- 1. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: 125 psig minimum at 180 deg F.
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.

## 2.8 Labeling And Identifying

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

### Part 3 Execution

# 3.1 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.
  - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D2774.
- D. Steel Piping with Protective Coating:
  - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
  - 3. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage downstream from each service regulator.
- G. Paint exterior steel piping with two coats of enamel paint. Color to be safety yellow.

# 3.2 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. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

### Facility Natural Gas Piping

- S. Do not use natural-gas piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gage downstream from each line regulator.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors.
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- X. Paint exposed interior painting with two coats of enamel paint. Color to be safety yellow.

#### 3.3 Valve Installation

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install anode for metallic valves in underground PE piping.

# 3.4 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.
- 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.

- Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

## 3.5 Hanger And Support Installation

- A. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameter, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- B. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameter, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping within 12 inches of each fitting.
- D. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.6 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.

## 3.7 Labeling And Identifying

A. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

## 3.8 Field Quality Control

- A. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.9 Outdoor Piping Schedule

- A. Underground natural-gas piping shall be one of the following:
  - 1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
  - 2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- 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.

# 3.10 Indoor Piping Schedule

- A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Paint exposed indoor piping with two coats of enamel paint. Color to be safety yellow.

## 3.11 Aboveground Manual Gas Shutoff Valve Schedule

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:

- 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.

### **END OF SECTION**

### 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 Action Submittals

A. Product Data: For each type of product

### 1.3 Informational Submittals

- A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Welding certificates.
- C. Field quality-control reports.

### 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.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with 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."
  - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
  - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

- C. Longitudinal Seams: Select seam types and fabricate in accordance with 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." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Ch. 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," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate in accordance with 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 A653/A653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. 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 in accordance with UL 723; certified by an NRTL.
- B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- C. Round Duct Joint O-Ring Seals:
  - Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
  - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.5 Hangers And Supports

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. 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."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.
- D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## Part 3 Execution

### 3.1 duct Installation

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. 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.
- J. Install heating coils, cooling coils, air filters, dampers, and all other ductmounted accessories in air ducts where indicated on Drawings.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.
- L. Elbows: Use long-radius elbows wherever they fit.
  - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
  - Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- M. Branch Connections: Use lateral or conical branch connections.

## 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 arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

## 3.3 Duct Sealing

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
  - Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class C.
  - 4. Outdoor, Return-Air Ducts: Seal Class C.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

# 3.4 Hanger And Support Installation

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

#### Metal Ducts

- 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. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

# 3.6 Painting

A. Paint interior of metal ducts that are visible through registers and grilles. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

# 3.7 Field Quality Control

- Perform tests and inspections.
- B. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## 3.8 Duct Cleaning

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
  - 1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Clean the following components by removing surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
  - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  - 4. Coils and related components.
  - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  - 6. Supply-air ducts, dampers, actuators, and turning vanes.
  - 7. Dedicated exhaust and ventilation components and makeup air systems.

## 3.9 Startup

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.10 Duct Schedule

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

### B. Supply Ducts:

- 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
  - a. Pressure Class: Positive 1-inch wg.
  - b. Minimum SMACNA Seal Class: A.
  - c. SMACNA Leakage Class for Rectangular: 2.

#### Metal Ducts

d. SMACNA Leakage Class for Round and Flat Oval: .

#### C. Return Ducts:

- 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
  - a. Pressure Class: Positive or negative 1-inch wg.
  - b. Minimum SMACNA Seal Class: A.
  - c. SMACNA Leakage Class for Rectangular: 2.
  - d. SMACNA Leakage Class for Round and Flat Oval: 2.

#### D. Exhaust Ducts:

- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
  - a. Pressure Class: Negative 1-inch wg.
  - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
  - c. SMACNA Leakage Class for Rectangular: 2.
- E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive or negative 1-inch wg.
    - b. Minimum SMACNA Seal Class: A.

### F. Elbow Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Velocity 1000 fpm or Lower:
    - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
    - 2) Mitered Type RE 4 without vanes.
- 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "Round Duct Elbows."

- a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90degree change of direction have proportionately fewer segments.
  - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
  - 2) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

## G. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Conical spin in.
- Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical tap.

**END OF SECTION** 

# Part 1 General

# 1.1 Summary

- A. Section Includes:
  - 1. Non-insulated flexible ducts.
  - 2. Insulated flexible ducts.

#### 1.2 Action Submittals

A. Product Data: For each type of product.

# Part 2 Products

# 2.1 Assembly Description

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

# 2.2 Non-Insulated Flexible Ducts – Apply To Uninsulated Duct Systems Only.

- A. Non-Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 10 to plus 160 deg F.
- B. Non-Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.

3. Temperature Range: Minus 20 to plus 210 deg F.

### 2.3 Insulated Flexible Ducts

- A. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 10 to plus 160 deg F.
  - 4. Insulation R-Value: R6.

#### 2.4 Flexible Duct Connectors

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

### Part 3 Execution

### 3.1 Installation

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- D. Install duct test holes where required for testing and balancing purposes.

#### E. Installation:

- 1. Install ducts fully extended.
- 2. Do not bend ducts across sharp corners.
- 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
- 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
- 5. Install flexible ducts in a direct line, without sags, twists, or turns.

### F. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.

- 2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
- 3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
- 4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

**END OF SECTION** 

# Part 1 General

# 1.1 Summary

- A. Section Includes:
  - 1. Inline fans.
  - 2. Sidewall propeller fans.

### 1.2 Action Submittals

A. Product Data: For each type of product.

### 1.3 Closeout Submittals

A. Operation and maintenance data.

### Part 2 Products

### 2.1 Inline Fans

A. Provide as indicated on Drawings.

# 2.2 Sidewall Propeller Fans

- 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. Acme Engineering & Manufacturing Corp.
  - Greenheck.
  - 3. Loren Cook Company.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring, with baked-enamel finish coat applied after assembly.
- C. Fan Wheels: Formed-steel blades riveted to heavy-gauge steel spider bolted to cast-iron hub.
- D. Fan Wheel: Replaceable, cast-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- E. Fan Drive: Direct-drive motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- F. Fan Drive:

- 1. Belt drive.
- 2. Resiliently mounted to housing.
- 3. Statically and dynamically balanced.
- 4. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
- 5. Extend grease fitting to accessible location outside of unit.
- 6. Service Factor Based on Fan Motor Size: 1.4.
- 7. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
- 8. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
  - a. Ball-Bearing Rating Life: ABMA 9, L(10) of 100,000 hours.
- 9. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
- 10. 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.
- 11. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
- 12. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

#### G. Accessories:

- 1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- 2. Dampers: Counterbalanced, parallel-blade, backdraft dampers factory set to close when fan stops.
- 3. Motorized Dampers: Parallel-blade dampers with electric actuator wired to close when fan stops.
- 4. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
- 5. Wall Sleeve: Galvanized steel to match fan and accessory size.
- 6. Weathershield Hood: Galvanized steel to match fan and accessory size.
- 7. Weathershield Front Guard: Galvanized steel with expanded metal screen.

#### 2.3 Motors

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
  - 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.

# 2.4 Source Quality Control

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. AMCA Certification: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.
- C. Fan Sound Ratings: Comply with AMCA 311, and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
- D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency according to AMCA 210/ASHRAE 51.
- E. Operating Limits: Classify according to AMCA 99.
- F. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

### Part 3 Execution

### 3.1 Installation of HVAC Power Ventilators

- A. Install power ventilators level and plumb.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch.
- D. Install units with clearances for service and maintenance.
- E. Label units.

### 3.2 Ductwork Connections

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

### 3.3 Electrical Connections

- A. Connect wiring according to Division 26 requirements.
- B. Ground equipment according to Division 26 requirements.

- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

#### 3.4 Control Connections

A. Install control and electrical power wiring to field-mounted control devices.

# 3.5 Field Quality Control

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 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 there is adequate maintenance and access space.
  - 4. Verify that cleaning and adjusting are complete.
  - 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 quards.
  - 6. Adjust belt tension.
  - 7. Adjust damper linkages for proper damper operation.
  - 8. Verify lubrication for bearings and other moving parts.
  - 9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 10. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 11. Shut unit down and reconnect automatic temperature-control operators.
  - 12. Remove and replace malfunctioning units and retest as specified above.
- D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

# 3.6 Adjusting

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.

- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

**END OF SECTION** 

### Part 1 General

# 1.1 Summary

A. Section Includes: Listed double-wall vents.

### 1.2 Action Submittals

A. Product Data: For each type of product.

# 1.3 Quality Assurance

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
  - 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.
- B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

# Part 2 Products

# 2.1 Listed Type B And BW Vents

- A. <u>Manufacturers:</u> Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. American Metal Products.
  - 2. Cleaver-Brooks.
  - 3. Industrial Chimney Company.
  - 4. M&G DuraVent, Inc.; a member of the M&G Group.
  - 5. Metal-Fab, Inc.
- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.
- D. Inner Shell: ASTM B209, Type 1100 aluminum.
- E. Outer Jacket: Galvanized steel.

#### Gas Vents

- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

# Part 3 Execution

# 3.1 Application

A. Listed Type B and BW Vents: Vents for certified gas appliances.

### 3.2 Installation Of Listed Vents

- A. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- C. Lap joints in direction of flow.
- D. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

**END OF SECTION** 

# Part 1 General

# 1.1 Summary

A. Section includes gas-fired unit heaters.

### 1.2 Action Submittals

- A. Product Data: For each type of gas-fired unit heater.
  - 1. Include rated capacities, operating characteristics, and accessories.

### 1.3 Closeout Submittals

A. Operation and maintenance data.

### 1.4 Quality Assurance

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

# 1.5 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

### Part 2 Products

### 2.1 Manufacturers

- A. <u>Manufacturers:</u> 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. Modine Manufacturing Company.
  - 2. REZNOR, a brand of Nortek Global HVAC.

# 2.2 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. Capacities and Characteristics:

#### Gas-Fired Unit Heaters

1. Refer to the Drawings.

### 2.3 Manufactured Units

- A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.
- B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- C. Type of Venting: Indoor, separated combustion, power vented.
- D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
  - 1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
  - 2. Discharge Louvers: Independently adjustable, horizontal blades.
  - 3. Discharge Nozzle: Discharge at 25 to 65 degrees from horizontal.

#### E. Accessories:

- 1. Four-point suspension kit.
- 2. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.
- F. Heat Exchanger: Aluminized steel.
- G. Burner Material: Aluminized steel with stainless-steel inserts.
- H. Propeller Unit Fan:
  - 1. Formed-steel propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
  - 2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

#### I. Centrifugal Unit Fan:

- 1. Steel, centrifugal fan dynamically balanced and resiliently mounted.
- 2. Belt-Driven Drive Assembly:
  - a. Resiliently mounted to housing, with the following features:
    - 1) Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
    - 2) Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    - 3) Pulleys: Cast-iron, adjustable-pitch motor pulley.

#### J. Motors:

- 1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
- Enclosure Materials: Rolled steel.
- K. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
- L. Electrical Connection: Factory wire motors and controls for a single electrical connection.

# Part 3 Execution

### 3.1 Installation

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

# 3.2 Equipment Mounting

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

### 3.3 Connections

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.
- C. Gas Piping: Comply with Section 231123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- D. Vent Connections: Comply with Section 235123 "Gas Vents."
- E. Ground equipment.
- F. Connect wiring according to electrical specifications.

# 3.4 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 unit heater will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

# 3.5 Adjusting

- A. Adjust initial temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

### 3.6 Demonstration

A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

**END OF SECTION** 

# Part 1 General

# 1.1 Summary

A. Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

### 1.2 Action Submittals

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Identify routing in attic space and coordination of routing with structure.

### 1.3 Informational Submittals

A. Warranty: Sample of special warranty.

#### 1.4 Closeout Submittals

A. Operation and maintenance data.

# 1.5 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### B. ASHRAE Compliance:

- 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
- 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 "Systems and Equipment," Section 6 " Procedures," and Section 7 "Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

# 1.6 Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period:
  - a. For Compressor: Five year(s) from date of Substantial Completion.
  - b. For Parts: One year(s) from date of Substantial Completion.
  - c. For Labor: One year(s) from date of Substantial Completion.

# Part 2 Products

### 2.1 Manufacturers

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carrier Corporation; a unit of United Technologies Corp.
  - 2. Lennox Industries, Inc.; Lennox International.
  - 3. Trane.

# 2.2 Indoor Units (5 Tons Or Less)

- A. Concealed Evaporator-Fan Components:
  - 1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
  - 2. Insulation: Faced, glass-fiber duct liner.
  - 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
  - 4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
  - 5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
  - 6. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements.
    - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
  - 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  - 8. Filters: Permanent, cleanable.
  - 9. Condensate Drain Pans:
    - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

- 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
- 2) Depth: A minimum of 2 inches deep.
- b. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
- c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
  - 1) Minimum Connection Size: NPS 1.
- d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

# 2.3 Outdoor Units (5 Tons Or Less)

- A. Air-Cooled, Compressor-Condenser Components:
  - Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - a. Compressor Type: Scroll.
    - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - c. Refrigerant: R-410A.
    - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
  - 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
  - 4. Fan: Aluminum-propeller type, directly connected to motor.
  - 5. Motor: Permanently lubricated, with integral thermal-overload protection.
  - 6. Low Ambient Kit.
  - 7. Mounting Base: Polyethylene.

#### 2.4 Accessories

- A. Digital, Programmable, Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- B. Automatic-reset timer to prevent rapid cycling of compressor.

- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Drain Hose: For condensate.

#### E. Monitoring:

- 1. Monitor constant and variable motor loads.
- Monitor variable-frequency-drive operation.
- 3. Monitor economizer cycle.
- 4. Monitor cooling load.
- 5. Monitor air distribution static pressure and ventilation air volumes.

# 2.5 Capacities And Characteristics

A. Refer to Drawings.

### Part 3 Execution

### 3.1 Installation

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:
  - 1. Install ground-mounted, compressor-condenser components on cast-inplace concrete equipment base(s).
- D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### 3.2 Connections

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors.

# 3.3 Field Quality Control

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

**END OF SECTION** 

# Common Work Results for Electrical

### Part 1 - General

### 1.1 **Summary**

- A. Section Includes:
  - 1. Supporting Devices for Electrical Components.
  - 2. Electricity-Metering Components.
  - 3. Concrete Equipment Bases.
  - 4. Electrical Demolition.
  - 5. Cutting and Patching For Electrical Construction.
  - 6. Touchup Painting.

### 1.2 References

- A. American Welding Society (AWS) Publications:
  - 1. D1.1 "Structural Welding Code Steel"
- B. ASTM International (ASTM) Publications: (Former American Society for Testing and Materials)
  - 1. A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
- C. National Fire Protection Association (NFPA) Publications:
  - 70 "National Electric Code"
- D. National Electrical Manufacturer's Association (NEMA) Standards Publications:
  - 1. 250 "Enclosures for Electrical Equipment (1000 Volts Maximum)"

#### 1.3 Submittals

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.
- B. Submit "Letter of Conformance" in accordance with Section 01 33 00 Submittals and Substitution Procedures indicating specified items selected for use in project with the following supporting data.
  - 1. Product Data: For electricity-metering equipment.
  - 2. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
  - 3. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

# 1.4 Quality Assurance

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. All work to be in accordance with latest requirements of the N.E.C. and all other applicable codes and regulations of authorities having jurisdiction over the work.

### 1.5 Coordination

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
  - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
  - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate all work with Division 26. Electrical Installer shall provide all wiring and final connection to all line voltage thermostats. Thermostat provided and installed by Division 23.
- E. All electrical drawings are to be read in conjunction with the project specifications and all other related contract drawings.
- F. The contractor shall examine the site and observe the conditions under which the work will be done or other circumstances which will affect the contemplated work. No allowance will be made subsequently in the connection for any error or negligence on the contractor's part.
- G. The contractor shall verify exact location, size and extent of all existing utilities, obstructions and/or other conditions which may affect the proposed work under the project. The contractor shall take every precaution to prevent damage to existing work and shall repair any damage as a result of this work.
- H. The contractor shall verify all door swings in the field and mount switches on knob side of doors or as approved by the engineer.

I. The contractor shall carefully examine all contract drawings/specifications and be responsible for the proper fittings of materials and equipment at each location as indicated without substantial alteration. The drawings are generally diagrammatic and because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Furnishing such fittings that are required to meet such conditions shall be furnished and installed at no cost.

### Part 2 - Products

# 2.1 Supporting Devices

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.
  - 1. Channel Thickness: Selected to suit structural loading.
  - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe Sleeves: ASTM A53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.

# 2.2 Equipment For Utility Company's Electricity Metering

#### A. CONCRETE BASES

1. Concrete Forms and Reinforcement Materials: As specified in Section 03 30 00 - Cast-in-Place Concrete.

# 2.3 Touchup Paint

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

# Part 3 - Execution

# 3.1 Electrical Equipment Installation

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.
- E. Coordinate work with other trades and install conduit and boxes to clear embedded ducts, openings, etc. and all structural features.
- F. Unless otherwise noted, mounting heights, as shown, are from finished floor to top of panelboard and to centerline of other equipment. Coordinate all mounting heights with contract drawings, local code requirements, and all ADA. requirements.
  - 1. Toggle (snap) switch: 4'-0".
  - 2. Enclosed circuit breaker: 5'-0"
  - 3. Disconnect (safety) switch: 5'-0".
  - 4. Motor starter: 5'-0".
  - 5. Panelboard: 6'-6".

# 3.2 Electrical Supporting Device Application

- A. Damp Locations, Pool Equipment Rooms, Storage Rooms and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

# 3.3 Support Installation

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

- 1. Wood: Fasten with wood screws or screw-type nails.
- 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
- 3. New Concrete: Concrete inserts with machine screws and bolts.
- 4. Existing Concrete: Expansion bolts.
- 5. Steel: Welded threaded studs or spring-tension clamps on steel.
  - a. Field Welding: Comply with AWS D1.1.
- 6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
- 7. Light Steel: Sheet-metal screws.
- 8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

# 3.4 Utility Company Electricity-Metering Equipment

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

### 3.5 Concrete Bases

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchorbolt and tie locations, unless otherwise indicated. Use 3000-psi 28-day compressive-strength concrete and reinforcement as specified in Section 03 30 00 - Cast-in-Place Concrete.

### 3.6 Demolition

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

# 3.7 Cutting And Patching

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved. B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

# 3.8 Field Quality Control

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Supporting devices for electrical components.
  - 2. Electricity-metering components.
  - 3. Concrete bases.
  - 4. Electrical demolition.
  - 5. Cutting and patching for electrical construction.
  - 6. Touchup painting.

# 3.9 Refinishing And Touchup Painting

A. Refinish and touch up paint. Paint materials and application requirements are specified in Section 09 91 00 - Painting.

# 3.10 Cleaning And Protection

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

**END OF SECTION** 

### Part 1 General

- 1.1 Reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may use any article, device, product, material, fixture, form, or type of construction that, in the judgment of the Engineer, expressed in writing, is equal to that specified unless otherwise indicated. The Contractor shall be responsible for all costs associated with changes from the basis-of-design, even if reviewed as electrically equivalent and acceptable.
- 1.2 Electrical drawings are diagrammatic and shall not be scaled for exact sizes or locations.
- 1.3 Conduit routed through the building that interferes with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit, and fixtures shall fit into available spaces in the building; do not introduce these into the building at such times or in such a manner as to cause damage to the structure. Equipment that requires servicing shall be readily accessible.
- 1.4 Keep cutting and patching to an absolute minimum. Insofar as possible, determine in advance the proper chases and openings for the work.
- 1.5 Where cutting and patching are required due to an error of the Contractor, or where the Contractor has not been given enough advance notice of the need for holes, recesses, and chases, patching shall be performed by those trades skilled in the use of the materials involved and shall be done at the Contractor's expense.
- 1.6 The approximate location of fixtures, receptacles, and wall switches is indicated on the drawings. Exact locations shall be determined by the Engineer as building work progresses. The indicated locations of outlets may be changed by 10 feet in any direction without additional cost before the outlets are installed.
- 1.7 Maintain one set of electrical white prints on the job site, marked to show asbuilt conditions and installations. At job completion, give this set of drawings to the Owner's representative and obtain written acknowledgment of receipt.

# Part 2 Products

2.1 The materials, appliances, fixtures, and equipment shall be new and of the quality specified and shall bear the UL label when such labels are available.

2.2 Metal parts of conduit, boxes, fittings, enclosures, hangers, straps, screws, etc., shall be made of corrosion resistant materials or protected by corrosion resistant materials.

### 2.3 Identification:

- A. Identify the electrical equipment listed below with nameplates that correspond to the markings shown on the drawings. Equipment shall be provided with nameplates made of black bakelite engraved with white letters 1/4 inch high and core-screw attached to the equipment:
  - 1. Panelboards
  - 2. Safety Switches
  - 3. Junction Boxes
  - 4. Pull Boxes
  - 5. Main Switchgear with Automatic Transfer Switch

# Part 3 Execution

- Provide the bracing, shoring, rails, guards, and covers necessary to prevent damage or injury. Do not leave energized electrical items unnecessarily exposed or unprotected. Protect personnel from exposure to contact with electricity. Protect work and materials from damage by weather and the entrance of water or dirt. Cap conduit during installation. Avoid damage to materials and equipment in place. Satisfactorily repair or remove and replace damaged work and materials. Deliver equipment and materials to the job site in their original, unopened, labeled containers. Store ferrous materials so as to prevent rusting. Store finished materials and equipment so as to prevent staining and discoloring.
- All sheathing, shoring, and cleaning necessary to keep trenches and their grades in proper condition for the work to be carried on, including the removal of water by mechanical means, shall be the Contractor's responsibility. Excavate trenches 3 inches below the elevation of the bottom of conduit. Then fill the trench to the proper elevation, and tamp in layers 6 inches deep until firm and even. During backfilling, the final layer of fill shall be topsoil. Backfill carefully, and restore the surface to its original condition. The backfill used may be earth up to the final topsoil layer, but in no case shall it contain large rocks, tree roots, trash, or debris. Omit topsoil under paved areas.
- Arrange for and include in the Bid the cost of the temporary electrical service necessary for the entire project during construction. Provide a minimum of one 100W lamp and one duplex receptacle for each 1,500 square feet of floor area. Arrange for electrical service to be taken from Owner's existing electrical distribution system.

- 3.4 Make electrical connections to transformers, mechanical equipment, and controls with approximately 2 feet of liquid tight flexible conduit. Determine the requirements from the drawings, these specifications, and the approved manufacturer drawings. Where conflicts occur between the bidding instruments and the manufacturer's recommendations, request a ruling from the Engineer.
- 3.5 Provide inserts, hangers, supports, braces, and anchor bolts as necessary for all work called for under this division.
- 3.6 Turn equipment over to the Owner in lubricated condition. Include instructions on further lubrication in the operating instructions.
- 3.7 At the termination of work under this division, furnish the Owner with 3 complete bound sets of operating instructions on equipment furnished under this division.
- As work progresses and once it is completed, remove from the premises all dirt, debris, rubbish, and waste materials resulting from this work.
- Remove all tools, scaffolding, and surplus materials after completion and acceptance of the work.
- 3.10 Turn the entire job over to the Owner in a complete and satisfactory condition.
- 3.11 The Contractor shall furnish a written guarantee of his work and materials for a period of one year from the date of final payment for his work, and shall repair and make good any defects occurring during this period due to defective materials or workmanship.
- 3.12 In the event that the project is occupied or systems placed in operation in several phases at the request of the Owner, then the guarantee of each system or piece of equipment so used shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such by the Owner.

**END OF SECTION** 

### Part 1 General

# 1.1 Summary

- A. This section covers the general and administrative requirements for testing of electrical systems, materials, and equipment.
  - 1. The Contractor shall engage the services of a recognized independent testing firm for the purpose of performing inspections and tests as herein specified and in other Division 26 Sections. The Contractor shall submit the name and qualifications of the testing firm to the Engineer for approval within 30 days after Notice to Proceed.
  - 2. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
  - 3. It is the purpose of these specifications to ensure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.
  - 4. The tests and inspections shall determine suitability for energization.
  - 5. Refer to individual Division 26 sections for equipment and systems to be tested and detailed test requirements.

# 1.2 Quality Assurance

#### A. Testing Firm

- The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- 2. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- 3. The testing firm shall meet the criteria for Full Membership or be a Full Member company of the International Testing Association (NETA).
- 4. The lead, on site, technical person shall be currently certified by the International Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.
- 5. The testing firm shall utilize technicians who are regularly employed by the firm for testing services.

#### **Electrical Testing**

6. The testing firm shall submit proof of the above qualifications for approval from the Engineer.

### B. Suitability of Test Equipment

- 1. All test equipment shall be in good mechanical and electrical condition.
- 2. Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked.
- 3. Accuracy of metering in test equipment shall be appropriate for the test being performed but not in excess of 2 percent of the scale used.
- 4. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

#### C. Test Instrument Calibration

- 1. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
- 2. Instruments shall be calibrated in accordance with the following frequency schedule:
  - a. Field Instruments: Analog, 6 months maximum; Digital, 12 months maximum
  - b. Laboratory Instruments: 12 months
  - c. Leased Specialty Equipment: 12 months where accuracy is guaranteed.
- 3. Dated calibration labels shall be visible on all test equipment.
- 4. Records, which show date and results of instruments calibrated or tested, must be included in the test report.
- 5. Calibrating standard shall be of higher accuracy than that of the instrument tested.

# 1.3 Division Of Responsibility

- A. The Contractor shall perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.
- B. The Contractor shall supply electrical power to each test site. The testing firm shall specify the specific power requirements.

- C. The Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
- D. The Engineer will supply coordination settings prior to completion of testing. The Contractor shall provide a complete set of electrical plans, specifications and change orders, as well as pertinent shop drawings, and manufacturer's instructions to the testing firm prior to commencement of testing.
- E. The testing firm shall notify the Construction Manager and Engineer two weeks prior to commencement of any testing.
- F. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported. The Construction Manager will direct the Contractor to repair or replace the defective materials or equipment depending upon the effect.
- G. The testing firm shall maintain a written record of all tests and shall assemble and certify a final test report.

#### 1.4 Submittals

- A. Submittals for approval.
  - 1. Submit qualifications of testing firm for Engineer's approval.
- B. Submittals for project closeout.
  - 1. Test Reports: The test reports shall include the following:
    - a. Summary of project
    - b. Description of equipment tested
    - c. Description of test and identification
    - d. Test results
    - e. Analysis and recommendations and remedial actions taken.

### Part 2 Products

(NOT USED)

### Part 3 Execution

# 3.1 Testing

A. The Contractor shall perform all tests required by individual Division 26 sections and as follows.

### 3.2 Tests On Wire And Cable In 480 Volt And Lower Service

- A. General: Give each 480 volt power feeder and subfeeder cable a continuity test and a megger test. Verify phase identification for each power feeder and subfeeder cable. Verify identification of all lighting circuits and 120 volt circuits on panel directories and make operational checks on all lighting circuits and 120 volt circuits to prove that the circuits perform all functions for which they are designed. Check all power feeder and subfeeder cable connections for workmanship and conformance with standard practice by visual inspection.
- B. Connections: Isolate power cables to be megger tested by opening switches or breakers at each end of cable prior to testing where such disconnecting means exists. Where cables are direct connected without a disconnecting means, do not disconnect cables; test as connected after verifying that the connected equipment can safely withstand the applied test voltage.

#### C. Megger Tests

- 1. Use a 1 000 volt megger for each megger test.
- 2. Apply megger tests between each conductor and ground with the other two conductors in the conduit or cable grounded to the same ground. Test each conductor in the same manner.
- 3. Minimum acceptable reading. For disconnected cables, 100 megohms; for connected cables, 1 megohm if conductor size is No. 14 or No. 12 AWG; 250,000 ohms for conductors No. 10 and larger.
- 4. Record all megger readings. Testing of cables having megger readings lower than average, even though meeting minimum requirements, shall be stopped and await further instructions from the Owner's Representative.
- D. Acceptance: Cable must pass all inspections and tests.
- E. Records: Include the following information in test report on each 480 volt power cable:
  - 1. Complete cable identification and description of isolation means.
  - 2. Megger readings, including converted values.
  - 3. Approximate average cable temperature.

# 3.3 Tests On Control Wiring

- A. General: Give each single conductor and multi-conductor control wire or cable a continuity test and an insulation strength test. Verify identification of conductors.
- B. Connections: Disconnect and fan out conductors to be tested.

### C. Insulation Strength Tests:

- 1. Subject each control wire to a 1000 volt, 60 hertz test.
- 2. Apply test between each conductor in a wire group and ground with all other conductors in the wire group grounded to the same ground. Use a test set having an accurate means of insuring 1000 volt test voltage and provide a series resistance to limit fault when a ground is found. Hold test voltage only long enough to read instruments. Test each conductor in the same manner.
- 3. In lieu of the above insulation strength test, megger each control wire as specified for 480 volt power conductors.
- D. Acceptance: Wires must pass all tests.
- E. Records: Include the following information in test report on each wire group.
  - 1. Wire and group identification.
  - 2. Type of test, insulation strength or megger.
  - 3. When megger testing is selected, include information as specified for 480 volt power cables.

#### F. Instrument Transformer Ratio Tests

- 1. Perform ratio tests on each potential transformer with proper voltmeters and approximately normal secondary burden connected.
- 2. Perform a two point ratio test on each current transformer applying onehalf and rated primary current to the primary of the transformer and measuring both primary and secondary currents for each point. For high ratio transformers, primary current may be reduced to capabilities of test equipment available but no lower than 500 amperes.

### G. Operational Tests On Each Breaker

- 1. Inspect each breaker for correct alignment, freedom from binding, and good contact.
- Check each breaker for ease of rack-in and rack-out Check interlocking to determine that the breaker cannot be racked-out-of or into operating position with the main contacts closed. Check position indicating target operation.
- Operate each breaker through three open-close-open cycles in both the operating and test position by both manual and automatic operation if applicable, as follows:

### **Electrical Testing**

- Manually operate the breaker from both the local switchgear mounted control means and remote control switches, if applicable.
   Observe indicating lights and position indicating target for correct operation as applicable.
- b. Manually close each breaker by the local switchgear mounted control means and trip automatically. Observe indicating lights, alarms, and targets for proper operation, including remote devices if applicable.
- c. Where individual breakers are electrically interlocked for automatic closing or opening of another breaker, operate breakers to determine that operation is proper.
- H. Acceptance: Equipment must pass all inspections and tests.
- I. Records: Make complete and accurate records of each test. Include the following in each test report:
  - 1. Megger readings versus time data, including converted values and ambient temperature at time of test.
  - 2. Voltage and current readings on instrument transformer ratio tests.

### 3.4 Tests On Distribution Transformers

- A. General: Check continuity and correctness of connections of windings and give each winding a megger test.
- B. Connections: Isolate transformer by opening the line side switch or circuit breaker and disconnect secondary conductors at panels. Tie conductors together on each winding.
- C. Megger Tests
  - 1. Apply 1000 volts for megger tests on 480 volt windings and 500 volts megger tests on lesser voltage windings.
  - 2. Apply a megger test between each transformer winding tied together and ground. Ground all windings not included in the test to the same ground.
  - 3. Minimum acceptable readings. 480 volt winding to ground, 45 megohms; lesser voltage winding to ground, 30 megohms.
  - 4. Hold all megger tests for at least one minute or until the reading maintains a constant value for 15 seconds.
- D. Acceptance: Transformers must pass all inspections and tests.

- E. Records: Make complete and accurate records of each test. Include the following in each test report:
  - 1. Complete identification of transformer.
  - 2. Megger readings, including converted values and ambient temperature at time of test.

# 3.5 Tests On Rotating Equipment

A. General: Inspect all motors installed under all other Contracts for damage, moisture, alignment, proper lubrication, oil leaks, phase identification and cleanliness. Check for proper rotation. Coordinate uncoupling of motors where reverse rotation would damage equipment. Give each motor a megger test.

#### B. Connections

- 1. For three phase motors, include cable back to the open starter.
- 2. For single phase motors, disconnect motor from service.

### C. MeggerTests

- 1. Apply megger tests on three phase motors between all phases tied together and ground, with motor at ambient temperature.
- 2. For single phase motors, apply megger test between phase and neutral conductor tied together and ground, with motor at ambient temperature.
- 3. Hold all megger tests for one minute or until the reading maintains a constant value for 15 seconds.
- 4. Minimum acceptable megger readings and megger voltage are listed below:

Equipment	Megger Volts Minimum Megger Re	Reading-Megohms		
	460 volt, 3 phase induction motor	1000	20	
	230 volt, 3 phase induction motor	500	20	
	200 volt, 3 phase induction motor	500	20	
	115 volt, 1 phase induction motor	500	5	

- D. Operating Tests: Run motor long enough to prove satisfactory performance including operating temperature, lubrication, vibration.
- E. Acceptance: Motor must pass all inspections and tests.
- F. Records

#### **Electrical Testing**

- 1. Make complete and accurate records of all tests and inspections. Include the following in each test report:
  - a. Megger readings, including converted values.
  - b. Ambient temperature at time of test.

## 3.6 Tests On Grounding

A. General: Inspect ground conductors and connections for conformance with design specifications and for satisfactory workmanship. Test resistance to earth of each ground rod and each ground grid.

#### B. Connections

- 1. Maintain each ground rod isolated from the associated ground grid for tests on individual rods for resistance to earth.
- 2. Include associated ground rods and interconnecting wiring in tests on each grid system for resistance to earth.
- C. Tests on Individual Ground Rods: Test each ground rod for resistance to earth by a standard method. Use a Biddle ground tester or the method of using two auxiliary ground rods as described in IEEE Standard No. 118, paragraph 5.5.2. The IEEE method requires the use of AC test current. Place auxiliary test rods sufficiently far away from the rod under test so that the regions in which their resistance is localized do not overlap. Calculate ground resistance from the readings taken.
- D. Tests On Total Ground System: In tests on total ground systems, the maximum acceptable resistance to earth is two ohms. If this resistance is greater than two ohms, advise the Owner's field representatives immediately so that appropriate action may be taken.
- E. Acceptance: Grounding materials and connections must pass all inspections and must meet all specified maximum and minimum values.
- F. Records: Make complete records of all tests. Include resistance values obtained, calculations of same, and methods of test and calculation.

**END OF SECTION** 

## Part 1 - General

## 1.1 Summary

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
  - 3. Sleeves and sleeve seals for cables.

### 1.2 Submittals

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

## 1.3 Quality Assurance

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Comply with NFPA 70.

### 1.4 Coordination

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

## Part 2 - Products

#### 2.1 Conductors

- A. Specified gauge sizes refer to American Wire Gauge, copper conductors.
- B. All wire and cable shall be of soft drawn, annealed, copper having a conductivity of not less than 98% of that of pure copper; each wire continuous without weld, splice, or joint throughout its length; uniform in cross section and free from flaws, scales and other imperfections.
- C. Sizes specified are AWG through No. 4/0 and circular mils above No. 4/0. Conductor No. 10 and smaller shall be solid; No. 8 and larger stranded.

- D. Conductors No. 4 and smaller shall be Type "THHN/THWN"; larger conductors shall be type "THW".
- E. All conductors shall be of the same name brand and shall be in the original wrapping.
- F. All conductors shall be Anaconda, Diamond, General Electric, General Cable, Paranite, Phelps-Dodge, Simplex, Triangle, or Southwire.

#### 2.2 Branch Circuit Conductors

- A. Minimum wire size for lighting and power circuits shall be #12. #10 shall be used where the run to the first outlet exceeds 75' for 120V circuit and 150' for 277V circuit.
- B. Branch circuit conductors shall be color-coded as follows:

208Y/120 Volt System
Phase A -Black
Phase B -Red
Phase C -Blue
Phase A -Brown
Phase B -Orange
Phase C -Yellow

Neutral -White Neutral -White with Black Stripe

Ground -Green Ground -Green

- C. The feeder and service entrance conductors shall be color-coded by the use of colored plastic tape applied within 6" of each conductor end. Color-coding conductor markers shall be Brady or approved equal.
- D. Branch circuit wiring, which supplies more than one LED fixture through the wireway of other fixtures, shall be rated for use at 150 degrees C.

### 2.3 Metal Clad Cable

- Not allowed except internal to casework.
- B. Metal-clad cable type AC having THW wires, for size #8 AWG or smaller. Note the requirements of NEC Article 344.

## 2.4 Splices & Terminations

- A. Splices for #10 AWG and smaller wire used on Branch circuits and fixtures shall be of the "Live Spring" pressure type, Ideal Co. wing nut and/or wire nut type connectors or approved equal. Splices shall be rated 600 volts or 1000 volts when enclosed in a fixture or sign.
- B. Solderless, mechanical type lugs shall be used for terminal connections for copper conductors of #8 AWG or larger.

## Part 3 - Execution

### 3.1 Wire And Cable

- A. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with "Live Spring" pressure type connectors, by "IDEAL CO." or approved equal. Tape shall be "Scotch" No. 33 for indoor and NO. 88 for outdoor or approved equal. Where connection is made to any material, copper terminal lugs shall be bolted or compression fitted to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used.
- B. Wire shall not be drawn into a conduit until all work on the conduit system, which might cause damage to the wiring, is complete. Ideal, Wire-Ease or approved equal may be used as lubricant.
- C. Where two or more circuits run to a single outlet box, tag each circuit with linen tags as a guide to the fixture hanger in making fixture connections.
- D. All stranded conductors shall be furnished with copper connecting lugs drilled or reamed the full diameter of the bare conductors.
- E. Mains and feeders shall be run their entire length in continuous pieces without joints or splices. If the runs are too long for a single conductor piece, then joint and/or splices installed per these specifications shall be used.
- F. All splices, taps, terminations, etc. in the conductors shall be kept where they are fully accessible for inspection and maintenance.
- G. All wiring in cabinets, boxes, gutters, etc., shall be neatly tied and held in place by nylon cable ties and mounting brackets.
- H. At each fixture outlet a loop or end or wire not less than 8" long shall be left for connection to fixtures.
- I. The number of crosses hatches, where indicated, designates the number of conductors to be installed when the number exceeds minimum of two (2). Where crosshatches are not indicated, the number of conductors shall be as determined by switching, homeruns, etc. This does not apply to conduit provided for telephone or other special systems.
- J. Branch circuits shall contain the necessary number of conductors to afford the switch control indicated.
- K. Splices, etc. in signal and/or communication conductors shall be made with crimp-on or soldered connections, which are properly insulated.
- L. The Contractor shall not permit conductor bends to a radius less than 10 diameters or thickness on circuits of 600 volts or less.
- M. Conductors, when installed, shall not have dents, cuts, and scars, pressure indentation, abraded areas, etc. The Contractor will be responsible for replacement of conductors so damaged, at his expense.

### Wires and Cables

- N. Lubricants used to ease conductor-pulling operations shall be specifically manufactured for that purpose. TALC only shall be used on isolated branch circuit wiring.
- O. An UL approved non-oxidation compound or grease (PENETROX by Burndy) is to be applied at all terminations of panel feeders, secondary service conductors, and primary (high voltage) service conductors prior to connection.

**END OF SECTION** 

# Grounding and Bonding for Electrical Systems

## Part 1 - General

- 1.1 Ground all electrical equipment as shown on the drawings and in accordance with Article 250 of NEC and the requirements of the local authorities having jurisdiction and as specified herein or detailed on the drawings.
- 1.2 Only a direct connection with copper wire to either or both of the following will be considered as a direct ground:
  - A. A 1 inch or larger mechanically and electrically continuous, underground, iron or steel cold water line.
  - B. A 3/4 inch diameter, copper weld rod 10 feet long, driven vertically into the ground.
- 1.3 All ground connections, where buried or otherwise inaccessible, shall be brazed or welded.
- 1.4 Provide bonding bushings and jumpers to grounded bus for all metallic conduit entering switchboard from below. Jumper size shall conform to NEC requirements.
- 1.5 Do not use flexible metal conduit and fittings as a means of grounding. Pull a green ground wire with lugs on both ends in or around each piece of flexible conduit, and screw it to the conduit system.
- 1.6 Install green bonding jumpers in flush mounted receptacles, boxes, and attached them to the receptacle grounding terminal. Install green bonding jumpers with lugs between outlet box and wall bracket mounted lighting fixtures. Screw jumpers to the fixture chassis (NEC 250-74).
- 1.7 Install a ground network where shown on the drawings, around structures, switchgear, and other electrical installations. The ground network shall consist of a main cable loop, ground rods, branch cables from loop to individual grounds, above ground connecting points, and necessary inspection points on ground rods. The cable for the main loop shall be not less than No. 4/0 AWG stranded bare copper, and branch runs shall be not less than No. 2 stranded bare copper.
- 1.8 Install code size green ground conductors in all branch circuits feeding receptacles, permanently wired fixed equipment, and lighting fixtures. Bond conductors to chassis of fixed equipment and light fixtures and to ground lug on receptacles. All ground conductors shall be bonded to multi-terminal ground bus in panelboard. Grouping of ground conductors under a single lug is not acceptable.

Grounding and Bonding for Electrical Systems

- 1.9 Insofar as possible, lay conductor directly in the ground without breaks or joints and provide a minimum cover of 30 inch below grade or 36" under roads. Where underground joints are unavoidable, connect them with Cadweld SS or AMP Ampact connectors that are suitable covered and protected.
- 1.10 Attach ground rods to the main cable loop at the intervals necessary to obtain resistance to earth not exceeding 25 ohms at any point in the ground network, provided the intervals between rods are not greater than 75 feet. Cable between ground rods shall be slack. Ground rods shall be copperweld 3/4 inch x 10 feet minimum length.
- 1.11 Measure the resistance of each ground rod or ground field before connecting to the ground network. Make measurements with ground network tied together, and add additional ground rods as necessary to obtain resistance to earth not exceeding 25 ohms at any point in the ground network system.

## Part 2 Products

(NOT USED)

Part 3 Execution

(NOT USED)

**END OF SECTION** 

# Hangers and Supports for Electrical Systems

## Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Steel slotted support systems.
- 2. Conduit and cable support devices.
- 3. Support for conductors in vertical conduit.
- 4. Structural steel for fabricated supports and restraints.
- 5. Mounting, anchoring, and attachment components, including powderactuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
- 6. Fabricated metal equipment support assemblies.

### 1.2 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. Slotted support systems, hardware, and accessories.
    - b. Clamps.
    - c. Hangers.
    - d. Fasteners.
    - e. Anchors.
    - f. Saddles.
    - g. Brackets.
    - h. Cable clamps.
    - i. Cable ties.
  - 2. Include rated capacities and furnished specialties and accessories.

### 1.3 Informational Submittals

- A. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Welding certificates.

## 1.4 Quality Assurance

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2/D1.2M.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.2/D1.2M.

## Part 2 Products

## 2.1 Support, Anchorage, And Attachment Components

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. B-line, an Eaton business.
    - b. Flex-Strut Inc.
    - c. GS Metals Corp.
    - d. Thomas & Betts Corporation; A Member of the ABB Group.
    - e. Unistrut: Part of Atkore International.
  - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 3. Material for Channel, Fittings, and Accessories: Galvanized steel.
  - 4. Channel Width: 1-5/8 inches.
  - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. 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.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

- Powder-Actuated Fasteners: Not permitted without specific approval from Structural Engineer and Owner.
- 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) B-line, an Eaton business.
    - 2) Empire Tool and Manufacturing Co., Inc.
    - 3) Hilti, Inc.
    - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
    - 5) MKT Fastening, LLC.
- 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.

## Part 3 Execution

# 3.1 application

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA 101
- B. Comply with requirements in Section 260500 for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 3/8 inch in diameter.
- E. 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 50 percent in future without exceeding specified design load limits.

- 1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
- F. 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.

# 3.2 Support Installation

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC 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 standardweight 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: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  - 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 by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

# 3.3 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

Hangers and Supports for Electrical Systems

used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

- 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 Painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION** 

## Part 1 General

## 1.1 Summary

A. Unless otherwise noted on the drawings, install all wiring in conduit, ¾ inch minimum size.

### 1.2 Definitions

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. RGS. Rigid metallic conduit
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquid-tight flexible metal conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. IAC. Interlock armored cable
- H. MC Cable. Metal Clad Cable
- I. SMR. Surface Metal Raceway

### 1.3 Submittals

- A. Product Data: For surface raceways, wireways and fittings.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

# 1.4 Quality Assurance

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

## Part 2 Products

2.1 Rigid conduit shall be rigid, hot dip galvanized steel.

#### Raceways

- Use rigid galvanized steel (RGS) conduit in or under concrete slabs on grade and all exposed areas to 10 feet 0 inches above the finished floor.
- Use electrical metallic tubing (EMT) where the drawings call for conduit to be concealed in walls, run exposed and subject to damage, 10 feet or higher above the floor (or to bottom of equipment served), or installed above suspended ceiling. EMT may be installed at lower levels only where exposure occurs in electric equipment rooms. Connectors and couplings shall be of the steel compression type.
- 2.4 Use Schedule 40 PVC heavy wall conduit unless otherwise noted for underground circuits beginning 5 feet outside of the building, pads, or other structure. Make transitions between rigid galvanized steel conduit and PVC conduit with the manufacturer's standard adaptors designed for this purpose. Where rigid steel conduits turn up through concrete protect with bituminous material. All joints shall be solvent welded in accordance with the manufacturer's recommendations. Conduit fittings, elbows, and cement shall be produced by the same manufacturer.
- Where conduit enters or leaves cabinets and boxes, use standard locknuts on the outside of the box and a locknut and bushing on the inside. Use OZ insulated bushings, Type B, OZ Steel City No. B1-900, or matching insulating grounding bushings on conduit inside boxes instead of standard pipe bushings.

## Part 3 Execution

- 3.1 Install branch circuit and feeder wiring in conduit unless otherwise noted on the drawings. Comply with the requirements of NEC and local authorities having jurisdiction, including requirements concerning grounding and supporting arrangements.
- Install conduit to avoid trapping moisture and with as few bends as practicable. Running thread couplings are not permitted.
- 3.3 Use expansion fittings, properly bonded, to ensure ground continuity across expansion joints in floors and ceilings. Use double lock nuts and bushings on panel feeders at panel tubs.
- For bends made in the field, use a radius of not less than that allowed in Section 346-10 of NEC. Keep bends free from dents and flattening. Use no more than the equivalent of 4 bends at 90 degrees between any 2 outlets, counting bends at outlets. Do not heat metal conduit.
- 3.5 Conduit shall be continuous from outlet or cabinet, with no wires spliced in conduit, and shall be secured to the building structure. Stuff boxes and cork fittings to prevent

the entrance of water during concrete pouring and at other times during construction prior to completion of conduit installations.

3.6 Support conduit vertically and horizontally in accordance with NEC Article 344-12. Do not exceed these intervals:

3/4 inch	5 feet
1 inch through 1-1/2 inches	7 feet
2 inches and larger	10 feet

- 3.7 Install grounding bushings on all conduits that enter or leave the main switchgear.
- Where conduit is installed in groups on common supports, angles, or channels, secure each conduit to each support with U or J bolts. Unistrut fittings are acceptable. All hardware shall be galvanized.
- 3.9 Unless otherwise noted on the drawings, use only rigid galvanized conduit when conduit is to be run underground, exposed to severe mechanical damage, or used for panel board feeders.
- 3.10 In concrete slabs, block conduit up from forms, and securely fasten in place. All conduit in slabs shall have a minimum of 1-1/2 inch concrete coverage where concrete is exposed to earth or weather, and 3/4 inch where not exposed to earth or weather.
- 3.11 Seal conduit that passes through floor slabs (except ground floor) with concrete grout. The grout shall be 3 inches on sides of conduit at the bottom surface of the slab and shall taper in conical form to the conduit surface at a point 4 inches below the bottom of the slab. Seal around conduit or other wiring materials passing through partitions that extend to the underside of the slab above and around those passing through fire rated walls. Use grout or drywall cement to prevent the passage of smoke or fire.
- 3.12 Underground duct lines under paved areas or concrete slabs (2 or more conduits) and single conduit larger than 2 inches shall be encased in 3 inches of concrete and shall have a minimum earth cover of 24 inches above the top of the concrete.
- 3.13 Install a plastic, detectable, magnetic, 4 inches wide tape 12 inches below grade above all underground conduit or duct lines. Tape shall be printed continuously with "Electric Line," or equal.
- Run exposed conduit parallel to, or at right angles with, the lines of the structure. When exposed, make right angle bends with standard conduit ells by bending conduit as specified or by using screw jointed conduit fittings.

#### Raceways

- 3.15 Exercise particular care in cutting conduit to the proper length in order to ensure that the ends fit exactly in outlet boxes, couplings, and cabinets. All threads shall be clean cut and no longer than necessary. Ream and file conduit ends to remove burrs and fins. Make up threaded joints with aluminum paint applied to the male threads only.
- 3.16 Support exposed conduit work with hot dip galvanized steel clamps, straps, or pipe hangers.
- 3.17 At each motor, transformer, mechanical equipment, water heater, etc., use a short section (approximately 2 feet to 6 feet) of watertight, PVC jacketed, galvanized flexible conduit of proper size for connection to the building wiring system. This connection shall be arranged to prevent vibration from being transferred to the structure and to allow for expansion and contraction of the equipment and structure.
- 3.18 For pulling, use soapstone, Yellow 77, Yer-Eas, or equal.
- 3.19 Leave No. 12 Type TW or THWN copper pull wire in each conduit when permanent wiring is not installed.
- 3.20 Follow the manufacturer's recommendations regarding the handling, bending, coupling, and installation of PVC conduit.

**END OF SECTION** 

### **Outlet Boxes and Junction Boxes**

## Part 1 General

### 1.1 SUMMARY

A. This Section includes outlet, junction, and floor boxes for electrical wiring.

#### 1.2 SUBMITTALS

A. Product Data: For fittings and floor boxes.

### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Unless specifically indicated otherwise, outlets are located diagrammatically on the Electrical Drawings. Reference shall be made to the Architectural and Mechanical Drawings for the exact location of all outlets.
- D. Locate outlets so that they will be symmetrical with Architectural details and power outlets shall be located to properly serve the equipment.
- E. Provide junction and pull boxes as required to facilitate installation of the various conduit systems and as required by the NEC.

### Part 2 Products

#### 2.1 Pull Boxes

- A. All pull boxes shall be constructed of code gauge galvanized steel of the dimensions required by Article 370 of the NEC, according to the number, size, and position of conduits entering the box.
- B Pull boxes installed in vertical runs of conductors shall be provided with Red Seal type VVC or approved equal cable supports as required by Table 300-19 of the NEC.
- C Pull boxes for horizontal runs of feeder conductors which contain more than one feeder shall be provided with reinforced flange and removable 12 gauge 1-1/2" by 1-1/2" galvanized channel for support of conductors. Wood supports shall not be used.
- D Pull boxes installed in finished spaces shall be flush mounted and shall be provided with trim, hinged door, and flush latch with lock to match trims for flush mounted panelboards.

#### 2.2 Outlet Boxes

- A. All outlet boxes shall be constructed of code gauge galvanized steel.
- B. Outlet boxes specified herein are minimum size boxes. Larger boxes of the same type shall be provided if required by the NEC in consideration of the number and size of conductors installed.
- C. Outlet boxes for surface mounted and pendant mounted lighting fixtures shall be four inch octagon boxes, 1-1/2 inches deep. Fixtures studs shall be provided for support of fixtures if required.
- D. Outlet boxes for flush mounted lighting fixtures shall be four inch square boxes, 1-1/2 inches deep with blank cover.
- E. Outlet boxes for switches, receptacles, and wall mounted junction boxes shall be four inch square boxes, 1-1/2 inches deep. Where only one conduit enters box, 3-1/2 inch deep single gang switch boxes may be used. Outlet boxes for GFCI receptacles shall be 2-3/4 inches deep.
- F. Outlet boxes recessed in concrete lock walls and partitions shall be designed especially for installation in concrete block and tile walls and partitions. Single gang or multi-gang square cornered masonry boxes shall be used for one or more devices at the termination of a conduit run. Conventional four inch octagonal or 4-11/16 inch square boxes fitted with square tile covers of proper depth for concrete block shall be used where two or more conduits enter a box.
- G. Where specialty equipment such as fire alarm components, security components, etc., are installed provide outlet boxes suitable in size for these devices.
- H. Outlet boxes to be used in exposed conduit run shall be cast ferrous alloy type. Outlet boxes for vapor-tight lighting fixtures shall be cast corrosion resistant type.

### 2.3 Floor Boxes

A. Floor outlet boxes shall be of the types noted on the drawings.

## Part 3 Execution

### 3.1 Pull Box Installation

- A. Pull boxes shall be provided where indicated on the drawings and/or where required to facilitate the installation of all required conductors or as required by NEC.
- B. Pull boxes shall be installed exposed only in unfinished spaces. They shall be accessible.
- C. Feeders within pull boxes shall be individually laced with nylon tie straps of the type with enlarged tab to permit identification of each feeder.

D. Conductors shall not be spliced inside pull boxes except with the approval in writing of the Architect. Where splices are permitted they shall be made with splicing sleeves attached to the conductors with hydraulic crimping tools. Split bolt connectors shall not be permitted.

### 3.2 Outlet Locations

- A. Furnish and install outlet, junction, and pull boxes as required to facilitate the installation of the electrical systems as required.
- B. All outlet, junction, and pull boxes shall be accessible with covers designed for quick removal. Where boxes are located above non-accessible ceilings, in walls, etc., in finished areas, the removable cover shall be flush with the finished surface. Cover finish and the exact location of the boxes shall be approved by the Architect.
- C. The drawings are intended to show the locations of outlets, devices, fixtures and arrangement and control of circuits only. Exact locations shall be determined by actual measurement at the building and/or reference to the Architectural Drawings.
- D. The location of any outlet may be moved ten feet with the prior approval of the Architect and before it is installed without any additional expense to the Owner.
- E Installer shall check the location of all wall outlets including light fixtures, receptacles and switches, to verify that the outlets will clear any wall fixture, shelving, work tables, sinks or similar equipment that will be installed.
- F. Outlets occurring in architectural features shall be accurately centered in same. Install wall switch outlets on the STRIKE SIDE of doors with cover plate clearing door trim.
- G. Outlet boxes in non fire rated partitions shall NOT be set back to back. Boxes set side by side facing separate rooms or spaces, shall be connected together by offset nipple; after conductors are pulled, the nipples shall be tightly packed with mineral wool to prevent sound transmission.
- H. Outlet boxes in fire-rated partitions shown to be mounted on the opposite side of the partition at the same height, shall be separated horizontally by a minimum of 24 inches.
- I. The mounting height of all wall outlets is indicated on the architectural or Electrical Drawings. The height is from the finished floor to the center line of the device or outlet. The Contractor may with the Architect's approval vary the mounting heights to correspond to masonry joints.
- J. Were outlets are shown as being adjacent and different mounting heights are indicated for each, they shall be mounted one directly over the other at the heights specified.

### 3.3 Outlet Boxes

#### **Outlet Boxes and Junction Boxes**

- A. All outlet boxes shall be flush mounted within the wall regardless of wall construction, unless they are specifically shown as being used with exposed conduit. Cuts for outlet boxes in masonry walls shall be made so that the cover plate will completely cover the cut. The edge of all boxes shall be flush with the surface in which they are installed.
- B. The devices that are to be installed in the boxes shall be screwed tight before cover plates are installed. Plates shall not be used as a means for tightening the devices or holding them in place.
- C. Provide extension rings for all boxes when required by wall finish.
- D. Junction boxes shall be provided with blank covers. Covers on ceiling outlets shall be round, and shall be painted to match ceilings. Covers on wall junction boxes shall be of size and finish as used on switch and receptacle outlets.
- E. Where outlets are shown as being adjacent and different mounting heights are specified for each, they shall be mounted ONE DIRECTLY over the other, on the center line of the group or on the center line of the room or wall.
- F. The mount height of all wall outlets is indicated on the architectural or electrical plans. The mounting height is from finished floor to the centerline of the device or outlet. The Contractor may, with the Architect's approval on the job, slightly vary the mounting height of wall outlet so that the outlet box, top or bottom, will occur at a masonry joint.
- G. Outlet boxes shall be provided with 3/8" fixture stud to support light fixture. Outlet boxes shall be firmly anchored to structural member of the building, using wood screws for wood construction, bolts for steel construction, and expansion bolts secured in place with cement mortar for masonry construction. Ceiling outlet flush in furred acoustical tile ceiling construction for surface or pendant mounted lighting fixtures shall be in 4" square or octagonal pressed steel boxes supported from stud and rod, bars or hangers supported from the building structure independent of the ceiling construction. For outlet boxes located between steel studs, provide Caddy No. BHA; and adjacent to studs, provide Caddy No. MSC.
- H. Where drawings indicate ganged installation of switches controlling 277 volt lighting circuits of opposite phase, switches shall be separated by one full gang width, or separated with a permanently installed barrier between phase and/or different voltages.
- I. Outlet boxes shall not be used as support for LED lighting fixtures.

**END OF SECTION** 

# Raceway for Electrical Systems

## Part 1 General

## 1.1 Summary

A. This Section includes raceways and fittings for electrical wiring.

## Part 2 Products

### 2.1 Secondary Service Duct

A. Secondary service duct shall be galvanized rigid steel conduit, IMC or schedule 40 PVC.

## 2.2 Telephone Service Entrance Duct

A. Telephone service duct shall be schedule 40 PVC conduit. Where penetrations through slabs occur, use long sweep rigid steel conduit elbows.

#### 2.3 Feeders & Branch Circuits

A. Rigid conduit or IMC shall be used for all feeders and sub-feeders and branch circuits, where exposed to possible physical damage. EMT shall be permitted in protected areas.

## 2.4 Rigid Conduit:

- A. Rigid conduit shall be of the best quality steel of standard dimensions, hot dip galvanized, threads included, clean and smooth inside. Conduit shall be manufactured as Electrical Conduit with the manufacturer's trademark or stamp on each length of conduit.
- B. Fittings for rigid conduits shall be steel or malleable iron as manufactured by Thomas and Betts or equal. DIE CAST FITTINGS OF ANY MATERIAL SHALL NOT BE USED.

# 2.5 Electric Metallic Tubing (Emt)

- A. EMT conduit shall be of the best quality steel of standard dimensions, hot dip galvanized, clean and smooth inside. Conduit shall be manufactured as Electrical Conduit with the manufacturer's trademark or stamp on each length of conduit.
- B. Fittings for all EMT conduit shall be compression type, made of steel, with case hardened locknuts, and nylon insulated throats; or steel setscrew fillings with case hardened locknuts, and nylon insulated throats. DIE CAST FITTINGS OF ANY MATERIAL SHALL NOT BE USED. Fittings shall be manufactured by Thomas and Betts or equal.

# 2.6 Rigid Nonmetallic Conduit(Pvc)

A. PVC conduit shall be produced by the same manufacturer, be schedule 40, and manufactured as Electrical Conduit with the manufacturer's trade mark or stamp on each length of conduit.

- B. All PVC conduit fittings and cement shall be secured from the conduit manufacturer.
- C. All PVC conduit shall meet the following standards:
  - 1. Rated for 90 degrees centigrade.
  - 2. Shall have a tensile strength of 7,000 psi @ 73 degrees F.
  - 3. Shall have a flexural strength of 11,000 psi.
  - 4. Shall have a compressive strength of 8,600 psi.
- D. PVC not allowed above grade.

### 2.7 Flexible Conduit:

- A. Flexible Steel Conduit (No Cover) shall be constructed of reduced wall galvanized steel, and shall be manufactured as Electrical Conduit with the manufacturer's trademark or stamp.
- B PVC Extruded Cover Flexible Conduit shall be used in all outdoor applications. It shall be UL listed for outdoor use.
- C. Connectors and fittings for flexible conduit shall be steel type with nylon insulated throats. Connectors shall "bite" into the conduit under pressure of the connector bolt. All connectors and fittings shall be manufactured by Thomas and Betts or equal.

### 2.8 Below Grade Conduit And Cable Seal

A. Seals for either conduit or cable below grade shall form a reliable lasting seal between building and the outside and shall be able to withstand pressures to a minimum head of 50 feet of water. The below grade seals shall be as manufactured by O.Z./Gedney and sized for the particular application.

# 2.9 Threaded Joint Compound

A. Threaded joint compound shall be a corrosive inhibiting compound that is electrically conductive under pipe joint pressure. The compound shall be Thomas and Betts "KOPR-HIELD" or approved equal.

# 2.10 Conduit Identification Tape

A. Conduit identification tape for use in marking underground conduit runs shall be inert polyethylene, resistant to acids, alkalis, etc., which might be in the soil. The tape shall be a minimum of 4 mils thick, 6 inches wide, and yellow in color. It shall have the words "CAUTION – ELECTRIC LINE BURIED BELOW" imprinted along its entire length with a contrasting color permanent ink. The tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, Texas; or equal.

## Part 3 Execution

# 3.1 Raceway Application

A. Unless otherwise specifically noted on the drawings, conductors installed on this project shall be installed in conduit as specified herein.

- B. Any conduit installed on this project shall be no smaller than 3/4 inch, except as otherwise noted on the drawings. Where desirable for ease of installation, larger sizes than those called out on the drawings may be used. The contractor is responsible for resolution of any conflicts arising from the use of larger sizes.
- C. Conduit shall be continuous from outlet to outlet, from outlet to panelboard cabinet, junction box, and/or pull box. Conduit shall enter and be secured to all boxes, etc., in such a manner that each raceway system will be electrically continuous from the service entrance to all outlets. All conduit from panelboard cabinets and junction boxes shall terminate in approved outlet boxes or conduit fittings. Conduit connection to any box, which has no threaded hub for its reception, shall be installed with two locknuts.
- D. In general, the conduit installation shall follow the layout shown. However, this layout is diagrammatic only; and where changes are necessary due to structural conditions, other apparatus, or other causes, such changes shall be made without any additional cost to the Owner. Offsets in conduit are not indicated, and must be provided as required.
- E. Junction boxes and pull boxes shall be provided and installed as required to facilitate the systems shown on the drawings. "AX" expansion fittings shall be installed in all conduit runs wherever they cross building expansion joints.
- F. At couplings, conduit ends shall be threaded so they meet in the coupling. Right and left couplings shall not be used; conduit couplings of the Erickson type or approved equal shall be used at locations requiring such joints.
- G. Connections in conduit installed in outdoor or indoor locations where exposed to continuous or intermittent moisture, shall provide a liquid-tight seal. The sealing hub fittings shall be of steel or malleable iron, with recessed sealing "0" ring and a nylon insulated throat, Thomas and Betts Series 370. All conduit and cable, telephone or otherwise, which extend from the interior to the exterior below grade shall be sealed with a fitting designed for that particular use so as to be watertight.
- H. No bends will be permitted with a radius less than size (6) times the diameter of the conduit nor more than 90 degrees.
- I. All conduits shall be concealed in the wall, in or below floors or above ceilings unless otherwise directed or indicated. Concealed conduit shall be supported from the building construction at intervals not exceeding 8'-0". Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of the lay-in type are used, conduit must be installed high enough to permit removal of ceiling panels and lighting fixtures.
- J. Where conduit is expressly shown to be run exposed, the conduit shall be supported at intervals not exceeding 8'-0" with straps and wood screws for wood construction, machine screws for metal construction, and expansion bolts for masonry construction. Exposed conduit in finished spaces that pass through walls or ceilings shall be provided with chrome plated escutcheons. Run exposed conduit, where permitted by this specification, parallel or at right angles to the building with approved galvanized iron clamps or hangers. Devices attached to masonry or slabs shall be secured with inserts and bolts or lead expansion sleeves. Provide a support at each outlet box, at each

- conduit elbow, and at each junction box. Wooden plugs inserted in drilled holes are not acceptable as support bases.
- K. Where two (2) or more conduits are run parallel and adjacent, they shall be installed on gang hangers.
- L. Where connections are made to motors more than 2'-0" away from walls or columns, a vertical conduit, minimum size 3/4", securely attached to floor and ceiling shall be installed and the wiring carried into and out of this conduit by means of condulets and flexible conduit.
- M. Conduit embedded in concrete, which is in contact with the earth, and conduit installed outside the building below grade shall be rigid steel conduit, IMC or PVC.
- N. Conduit shall be located 6" minimum from surfaces with temperature ranges above 140 degree F.
- O. Conduit shall not be installed in any manner, which will result in the accumulation of condensation in the pipe.
- P. In masonry construction, wooden plugs inserted in drilled holes are NOT acceptable as bases for supports for conduit. The Contractor shall use approved types of galvanized wall brackets, beam clamps, strap hangers, or pipe straps secured by means of toggle bolts in hollow masonry units, expansion bolts in concrete or brick, machine screws or bolts and nuts in metal surfaces, and wood screws in wood surfaces.
- Q. Conduit runs left for future use shall be checked for unblocked passage by the use of a ball mandrel. Contractor shall leave a non-mildewing polyolefin pull line in each such conduit. The line shall have an average tensile strength of 200 lbs. for 1 inch or smaller conduit and 500 lbs. for conduit larger than 1". Pull lines shall be based on the standard set by Ideal Co. product 31-343 for 200-lb. line and 32-244 for 500-lb. line.
- R. Electrical contractor to furnish and install all conduit for controls systems. Coordinate with Steve Greeson of ALC for requirements.

### 3.2 Conduit Protection

- A. Conduit shall not be installed in any manner that will result in the accumulation of water inside the pipe.
- B. Conduit shall be located a minimum of 6 inches away from any surfaces which will reach surface temperatures of 140°F. or above.
- C. All conduit installed in the ground outside of the building shall be buried a minimum of 36 inches below finished grade, but in no case shall it be buried more than 48 inches deep without the written consent of the Engineer.
- D. Conduit run inside the building below floor slabs shall be included within the concrete pour of the slab, located between the reinforcing steel vertically.
- E. For all conduit installed in the ground outside of the building, provide identifying marker tape over the entire length of the conduit run. Place tape below finished grade between 12 inches and 18 inches absolute.

- F. All conduit shall be secured in place and protected to prevent damage to work during construction. The ends of all conduit and conduit fittings shall be plugged to avoid filling with dirt, plaster, gypsum, etc. Plugs shall be Thomas and Betts series 1470.
- G. All conduit shall be blown out and swabbed clear of water and trash prior to the installation of any conductors in the conduit.

## 3.3 Grounding And Terminations

- A. Connections to all panelboards, cabinets, pull boxes, etc., shall be installed with a grounding wedge lug between the bushings and the box; or with locknuts designed to "bite" into the metal of the box.
- B. To insure continuity of electrical ground and to improve conductivity, use Kopr-Shiel compound, series CP-8 as manufactured by Thomas and Betts on all rigid conduit threaded joints.
- C. Conduit runs, rigid or otherwise provide a green colored insulated grounding conductor inside the conduit with the phase conductors.

### 3.4 Penetrations

- A. Where any electrical item such as conduit, cable, telephone cable, busway, etc., penetrates a wall, floor, or ceiling, the original integrity for the respective wall, floor, or ceiling shall be restored. The opening around the item making the penetration shall be sealed airtight. If the surface penetrated is fire rated, the sealant shall have a fire rating equal to the original surface. In no case shall the penetration result in a lessening of the fire rating of the surface penetrated.
- B. Any openings in surfaces left for future routing of electrical work shall be left sealed as noted in Item A above.
- C. Provide sleeves for conduit, cables, busway, etc., accurately before concrete floors are poured; or set boxes in the forms so as to leave openings in the floors so the required sleeves can be subsequently located.
- D. Sleeves shall be rigid conduit with bushings installed on each end. Sleeves shall extend 6 inches beyond the surface they penetrate.

#### 3.5 Flexible Conduit

- A. Non-covered flexible steel conduit shall be used in making short connections from outlet boxes to recessed lighting fixtures. Such conduit runs shall be no longer than 72-inches.
- B. Flexible conduit runs to other equipment shall be kept as short as possible, but shall have a minimum length of 12 inches.
- C. Flexible conduit connections to dry type transformers, rotating or vibrating machinery, kitchen equipment, or any other equipment, which may result in the conduit being exposed to moisture, shall be PVC covered.

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## 3.6 PVC Conduit

- A. PVC conduit shall not be used above grade under any circumstances.
- B. All PVC conduit joints of any type shall be solvent welded in accordance with the manufacturer's recommendations.

**END OF SECTION** 

## Underground Ducts and Raceways for Electrical Systems

## Part 1 General

1.1 Underground duct lines shall be encased in 3 inches of reinforced concrete. Use conduit spacers or separators to secure uniform spacing between conduits as indicated. Concrete shall be Class A. Aggregate for duct line shall have a maximum size of 3/4 inch.

# Part 2 Products

- 2.1 Conduit spacers or separators shall be precast concrete, steel, or high impact polystyrene, or any combination of these, and shall be specifically designed for the intended use.
- 2.2 Conduit in and under buildings and structures to a point 5 feet outside the building or structure shall be rigid galvanized conduit.
- 2.3 Underground conduit shall be Schedule 40, heavy wall, PVC conduit. Solvent cement and fittings for PVC shall be furnished by the same manufacturer.
- 2.4 Caulking compound for sealing conduit entering buildings shall be Duct Seal, Permagum, or equal.

## Part 3 Execution

- 3.1 Underground duct lines shall be of individual conduit encased in concrete. Except where rigid metallic conduit is indicated or specified, the conduit shall be PVC. Elbows and risers shall be RGSC. The concrete encasement surrounding the duct shall be rectangular in cross section and have a minimum thickness of 3 inches Conduit shall be separated by a minimum concrete thickness of 2 inches, except that light and power conduit shall be separated from control, signal and conduit by a minimum concrete thickness as indicated.
- 3.2 Duct lines shall have a continuous slope downward and away from building with a pitch of not less than 4 inches in 100 feet. Make changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, with long sweep bends having a minimum radius of curvature of 25 feet. Manufactured bends may be used at ends of short runs of 100 feet or less, but only at or close to the end of the run. Manufactured bends shall have a minimum radius of 18 inches for use with duct of less than 3 inches in diameter and a minimum of 36 inches for duct of 3 inches in diameter or larger.
- 3.3 Use separators. Stagger the joints of the conduit by rows and layers so as to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand, and dirt by means of suitable conduit plugs. As each section of the duct line is completed, draw a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the

Underground Ducts and Raceways for Electrical Systems

size of the conduit through each conduit; after this, draw a brush with stiff bristles through the conduit until it is clear of all particles of earth, sand, or gravel. Then immediately install conduit plugs.

**END OF SECTION** 

# Identification for Electrical Systems

## Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
- 2. Labels.
- 3. Bands and tubes.
- 4. Tapes and stencils.
- 5. Tags.
- 6. Signs.
- 7. Cable ties.
- 8. Paint for identification.
- 9. Fasteners for labels and signs.

### 1.2 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

## 2.1 Performance Requirements

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E.

#### Identification for Electrical Systems

- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

# 2.2 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. Color-Coding for Phase and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
  - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Neutral: White.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
    - d. Neutral: Gray.
  - 4. Color for Equipment Grounds: Green.
- C. Raceways and Cables Carrying Circuits at More Than 600 V:
  - 1. Black letters on an orange field.
  - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
  - 1. Identify system voltage with black letters on an orange background.
- E. 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."

- F. Equipment Identification Labels:
  - 1. Black letters on a white field.
  - 2. Panelboards, transformers, disconnect switches, contactors, starters, cabinets.

### 2.3 Labels

- A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- thick, polyester flexible label with acrylic pressure-sensitive adhesive.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Ideal Industries, Inc.
    - b. Marking Services, Inc.
    - c. Panduit Corp.
  - 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  - 3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  - 4. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- B. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. <u>Brady Corporation</u>.
    - b. Ideal Industries, Inc.
    - c. Panduit Corp.
    - d. Seton Identification Products.
  - 2. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches for raceway and conductors
    - b. 3-1/2 by 5 inches for equipment.
    - c. As required by authorities having jurisdiction.

## 2.4 Bands And Tubes

A. Snap-around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.

#### Identification for Electrical Systems

- 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Marking Services, Inc.
  - c. Ideal Industries, Inc.
  - d. Panduit Corp.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machineprinted identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Panduit Corp.

# 2.5 Tapes And Stencils

- A. Underground-Line Warning Tape:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. <u>Brady Corporation</u>.
    - b. Ideal Industries, Inc.
    - c. Marking Services, Inc.

#### 2. Tape:

- a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications 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.
- 3. 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".
- 4. Tag: Type ID:

- a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
- b. Width: 3 inches.
- c. Overall Thickness: 5 mils.
- d. Foil Core Thickness: 0.35 mil.
- e. Weight: 28 lb/1000 sq. ft..
- f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.
- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.6 Tags

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. <u>Marking Services, Inc.</u>
    - d. Seton Identification Products.

# 2.7 Signs

- A. Baked-Enamel Signs:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Carlton Industries, LP.
    - b. Champion America.
    - c. Marking Services, Inc.
  - 2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 3. 1/4-inch grommets in corners for mounting.
  - 4. Nominal Size: 7 by 10 inches.
- B. Laminated Acrylic or Melamine Plastic Signs:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. <u>Brady Corporation</u>.
    - b. Carlton Industries, LP.
    - c. Marking Services, Inc.

Identification for Electrical Systems

- 2. Engraved legend.
- 3. Thickness:
  - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
  - b. For signs larger than 20 sq. in., 1/8 inch thick.
  - c. Engraved legend with black letters on white face.
  - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
  - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

### 2.8 Cable Ties

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. HellermannTyton.
  - 2. Ideal Industries, Inc.
  - 3. Marking Services, Inc.
  - 4. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and 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.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and 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.

#### 2.9 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

## 3.1 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.

### 3.2 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. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- J. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- K. Self-Adhesive Labels:

#### Identification for Electrical Systems

- 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
- 2. 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.
- L. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- M. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
  - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- O. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- P. Underground Line Warning Tape:
  - 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 or concrete envelope exceeds 16 inches overall.
  - 2. Limit use of underground-line warning tape to direct-buried cables.
  - 3. Install underground-line warning tape for direct-buried cables and cables in raceways.

#### Q. Metal Tags:

- 1. Place in a location with high visibility and accessibility.
- 2. Secure using UV-stabilized cable ties.

#### R. Baked-Enamel Signs:

- 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.
- S. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

- 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high sign; where two lines of text are required, use labels 2 inches high.
- T. Cable Ties: General purpose, for attaching tags, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.

### 3.3 Identification Schedule

- A. 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.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- high, black letters on 20-inch centers.
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
  - 1. Locate identification 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.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- G. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- H. Workspace Indication: Apply tape and stencil to finished surfaces. 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. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

### Identification for Electrical Systems

- 1. Apply to exterior of door, cover, or other access.
- 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
  - a. Controls with external control power connections.
- K. Arc Flash Warning Labeling: Self-adhesive labels.
- L. Operating Instruction Signs: Self-adhesive labels.
- M. Equipment Identification Labels:
  - Indoor Equipment: Laminated acrylic or melamine plastic sign.
  - 2. Outdoor Equipment: Laminated acrylic or melamine sign.
  - 3. 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 an 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 indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    - e. Substations.
    - f. Enclosed switches.
    - g. Contactors.
    - h. Remote-controlled switches, dimmer modules, and control devices.

**END OF SECTION** 

# Low Voltage Distribution Transformers

### Part 1 General

## 1.1 Summary

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 150 kVA.

### 1.2 Action Submittals

- A. Product Data: For each type of product.
  - Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
  - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

### B. Shop Drawings:

- Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
- 3. Include diagrams for power, signal, and control wiring.

### 1.3 Informational Submittals

- A. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
  - 4. Certification: Indicate that equipment meets equipment seismic requirements.
- B. Source quality-control reports.
- C. Field quality-control reports.

### 1.4 Closeout Submittals

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

## 1.5 Delivery, Storage, And Handling

- A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
  - If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

### Part 2 Products

### 2.1 Manufacturers

- A. Manufacturers: Subject to compliance with requirements, provide products for example by:
  - 1. Eaton.
  - 2. General Electric Company.
  - 3. Hammond Power Solutions Inc.
  - 4. Powersmiths International Corp.
  - 5. SIEMENS Industry, Inc.; Energy Management Division.
  - 6. Sola/Hevi-Duty; a brand of Emerson Electric Co.
  - 7. Square D; by Schneider Electric.
- B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

## 2.2 Performance Requirements

- A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event."

## 2.3 General Transformer Requirements

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
  - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
  - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
  - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

#### 2.4 Distribution Transformers

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
  - 1. One leg per phase.
  - 2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
  - 3. Grounded to enclosure.
- D. Coils: Continuous windings without splices except for taps.
  - 1. Coil Material: Copper.
  - 2. Internal Coil Connections: Brazed or pressure type.
  - 3. Terminal Connections: Welded.
- E. Enclosure (Indoor): Ventilated.
  - NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.
  - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
  - 3. Wiring Compartment: Sized for conduit entry and wiring installation.
  - 4. Finish: Comply with NEMA 250.

- a. Finish Color: ANSI 49 gray weather-resistant enamel.
- F. Enclosure (Outdoor): Ventilated.
  - 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
  - 2. Wiring Compartment: Sized for conduit entry and wiring installation.
  - 3. Finish: Comply with NEMA 250.
    - a. Finish Color: ANSI 49 gray weather-resistant enamel.
- G. Taps for Transformers 3 kVA and Smaller: One 5 percent tap above normal full capacity.
- H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature unless otherwise scheduled.
- J. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- K. Electrostatic Shielding (where scheduled): Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
  - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
  - 2. Include special terminal for grounding the shield.
- L. Wall Brackets: Wall brackets fabricated from design drawings signed and sealed by a licensed structural engineer.
- M. Sound-Level Requirements: NEMA ST20 or better.

### 2.5 Identification

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

# 2.6 Source Quality Control

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

- 1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
- 2. Ratio tests at rated voltage connections and at all tap connections.
- 3. Phase relation and polarity tests at rated voltage connections.
- 4. No load losses, and excitation current and rated voltage at rated voltage connections.
- 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
- 6. Applied and induced tensile tests.
- 7. Regulation and efficiency at rated load and voltage.
- 8. Insulation-Resistance Tests:
  - a. High-voltage to ground.
  - b. Low-voltage to ground.
  - c. High-voltage to low-voltage.
- 9. Temperature tests.
- B. Factory Sound-Level Tests: Conduct prototype sound-level tests on production-line products.

### Part 3 Execution

### 3.1 examination

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 Installation

A. Install wall-mounted transformers level and plumb with wall brackets fabricated from design drawings signed and sealed by a licensed structural engineer.

#### Low Voltage Distribution Transformers

- 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Construct concrete bases according to Section 033000 "Concrete Work" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
  - Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base according to manufacturer's written instructions.
- E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

### 3.3 Connections

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519.10 "Wires and Cables."
- C. 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.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

## 3.4 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. Dry-Type Transformer Field Tests:
  - 1. Visual and Mechanical Inspection.

- a. Inspect physical and mechanical condition.
- b. Inspect anchorage, alignment, and grounding.
- c. Verify that resilient mounts are free and that any shipping brackets have been removed.
- d. Verify the unit is clean.
- e. Perform specific inspections and mechanical tests recommended by manufacturer.
- f. Verify that as-left tap connections are as specified.
- g. Verify the presence of surge arresters and that their ratings are as specified.

#### 2. Electrical Tests:

- a. Measure resistance at each winding, tap, and bolted connection.
- b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
- c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
- d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- D. Remove and replace units that do not pass tests or inspections and retest as specified above.
- E. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
  - Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - 2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
  - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

# 3.5 Adjusting

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage

### Low Voltage Distribution Transformers

minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

# 3.6 Cleaning

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

#### A. Section Includes:

- 1. Distribution panelboards.
- 2. Lighting and appliance branch-circuit panelboards.

### 1.2 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.

### 1.3 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.

# 1.4 Informational Submittals

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards.

### 1.5 Closeout Submittals

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," 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.

#### 1.6 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: Two spares for each type of panelboard cabinet lock.
  - 2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

# 1.7 Quality Assurance

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

# 1.8 Delivery, Storage, And Handling

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

### 1.9 Field Conditions

#### A. Environmental Limitations:

- Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.

- b. Altitude: Not exceeding 6,600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6,600 feet.
- C. 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 Construction Manager no fewer than five days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Construction Manager's written permission.
  - 3. Comply with NFPA 70E.

# 1.10 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

- 2.1 Power distribution panelboards shall be rated 480/277V, 3 phase, 4 wire, as indicated on the drawings, and shall be Eaton, General Electric Type Spectra, or Square D.
- 2.2 Distribution panel-boards shall have a main circuit breaker and circuit breaker branch circuits, as shown on the drawings.
- 2.3 Provide handle pad locking devices for each breaker.
- 2.4 Circuit breakers shall be of the indicating type, providing "on," "off," and "tripped" positions on the operating handle, and shall have an interrupting capacity as shown on the drawings. All multipole breakers shall be common trip type. All breakers used to switch lighting shall be rated SWD.
- 2.5 Circuit breaker ratings shall be at least 10,000 AIC for 208/120V panel boards and 14,000A for 480/277V branch panelboards; 65kA for distribution panelboards. Refer

#### Panelboards

to schedules on the drawings. Confirm incoming utility KAIC prior to ordering panels, if found above 65kA notify engineer of record.

- 2.6 For circuit breaker panelboards, use bolt-in thermal-magnetic molded case circuit breakers of the frame and trip ratings shown on the drawings. Number breakers consecutively down the left row and continue similarly down the right row.
- 2.7 Gutter space shall be a minimum of 4 inches or larger as required by code. Where noted on the Panelboard Schedule, panels shall have an extra wide gutter for feed-through feeders and taps.
- 2.8 Cabinets for panelboards shall be galvanized sheet steel of NEC thickness, properly reinforced. Cabinets shall be for surface or flush mounting as indicated on the drawings. The door and trim shall be steel (not galvanized) with adjustable trim clamps, semiflush hinges, and inside rabbet.
- 2.9 Furnish doors with a lock and 2 keys. Key all doors alike.
- 2.10 Provide space with provisions in panel boards for devices noted as "(space only or provisions only)" on the drawings.

### Part 3 Execution

- 3.1 Submit shop drawings on all panel-boards and cabinets for the Engineer's approval before fabrication.
- 3.2 Provide and install panelboards as noted on the drawings. Equip panelboards with the devices noted in the schedules.
- 3.3 The holes for entrance of conduit shall be knockouts or be drilled in the field. Burned holes will not be permitted.
- 3.4 Cards listing the locations of the circuits controlled shall be typewritten and inserted with a plastic cover into the directory frames on the door of each panelboard. List numbers to coincide with the position on the panel.
- Unless otherwise indicated on the drawings, mount protective devices with top of cabinet or enclosure 6 feet 6 inches above the finished floor, properly align, and adequately support independently of the connecting raceways. Furnish and install all steel shapes, etc., necessary for the support of equipment where the building structure is not suitable for mounting the equipment directly thereon.

**END OF SECTION** 

## Part 1 General

- 1.1 Secondary service will be 480/277V, 3 phase, 4 wire, from pad mounted transformer furnished and installed by the Electric Board of Guntersville.
- 1.2 Secondary metering will be installed on frame adjacent to the transformer as shown on the drawings. The Contractor shall provide the frame, mount the meter base and route a conduit to the transformer secondary compartment. Electric Board of Guntersville will provide the meter.
- 1.3 The existing primary metering will be removed by local utility.
- 1.4 Power shall be distributed throughout the plant at 480/277V, 3 phase, 4 wire. Small dry type transformers shall be provided, if necessary, at the specified locations to step voltage down to 120/208V, 3 phase, 4 wire for receptacles and specified applications.
- 1.5 The existing pole mounted transformers, pole and overhead line serving the Intake Structure will be removed by Electric Board of Guntersville.

### Part 2 Products

(NOT USED)

## Part 3 Execution

- 3.1 Meet with a representative of Electric Board of Guntersville prior to starting work to determine the exact requirements for service installation. Carefully coordinate all service work with Electric Board of Guntersville.
- Furnish and install any equipment in connection with metering that is required by Electric Board of Guntersville.
- 3.3 Furnish and install the transformer and switchgear pad according to the requirements of Electric Board of Guntersville and the structural drawings. Coordinate primary conduit routing and requirements from utility pole to pad mounted transformer.
- Open and close all trenches for service. Furnish backfill for service conduit wherever designated by Electric Board of Guntersville. Provide the new primary service duct bank from the riser pole to the new pad mounted transformer.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Wall-box motion sensors.
  - 3. Wall-switch and exterior occupancy sensors.

### 1.2 Definitions

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

### 1.3 Submittals

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

## 1.4 Quality Assurance

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### Wiring Devices

- D. All devices used by the contractor shall be UL approved and certified as meeting federal specifications as well as NEMA performance standards.
- E. Materials provided under this Section shall be manufactured and tested under the following standards:
  - 1. NEMA WD-1 General Wiring Devices
  - 2. ANSI/UL 498 Electrical Attachment Plugs and Receptacles
  - 3. ANSI/UL 20 General Use Snap Switches

#### 1.5 Coordination

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

#### 1.6 Extra Materials

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Service/Power Poles: One for every 10, but no fewer than one.
  - 2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one.
  - 3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
  - 4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

### Part 2 Products

### 2.1 Manufacturers

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

#### 2.2 Switches

- A. Control switches for general lighting shall be quiet action, flush mounted, toggle handle type. Terminals shall be wire-wrap screw type. Switches shall be rated for 120-277 volt service, 20 amperes unless otherwise noted on drawings.
- B. Pilot light switches, where called for on the drawings, shall be the same as in "A" above complete with an internally lighted toggle. Toggle light shall be "LINE VOLTAGE".
- C. Switches shall be specification grade and as follows unless specifically noted otherwise, and as manufactured by P&S as follows:

- 1. Single pole P&S 20AC1.
- 2. Three way P&S 20AC3.
- 3. Four way P&S 20AC4.
- D. Wall box dimmer switches shall be of the slide dimmer type as follows:
  - 1. Single pole or 3 way rated at 2000 watts

### 2.3 Receptacles

- A. Convenience receptacles, either single or duplex type, for general-purpose use shall be, rated 125 volts, 20 ampere. They shall have wire-wrap screw type terminals, straight non-locking blade slots, and U-ground as by NEMA 5-20R configuration. They shall be constructed of two-piece molded housing with a wrap around type mounting strap and shall have double-wiping bronze contacts. Devices are to have finder grooves or as noted on drawings.
- B. Plug receptacles shall be of the color as noted on the drawings.
- C. Plug receptacles shall be commercial specification grade as manufactured by P&S unless otherwise noted on the drawings:
  - 1. Duplex rated at 20 amps P&S CRB5362
  - 2. Ground fault interrupter duplex rated at 20 amps P&S 2094.
- D. Plug receptacles for special purposes or of special construction shall be so stated and specifications given on the Drawings.

# 2.4 GFCI Receptacles

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; GF20.
    - b. Pass & Seymour; 2084.

# 2.5 Coverplates

- A. Coverplates shall be commercial specification grade nylon plates unless otherwise noted. Plates shall match the device or combination of devices in question. Stainless coverplates to be 320SS where indicated to be provided. See Drawings for more specific information and colors.
- B. Covers for weatherproof outlets protected from weather shall be gasketed and have flip covers for each device. Exposed devices to have in use covers.

# Part 3 Execution

#### 3.1 Installation

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Where more than one device is indicated at a location, the devices shall be mounted in combined sectional gang boxes and covered jointly by a common plate.
- C. Light switches shall be installed on the strike side of doors as actually installed; advise Architects where drawings contradict.
- D. The Architect reserves the right to relocate any wiring device up to a distance of ten feet from the location shown, before rough in, without additional cost.
- E. All junction boxes, outlet boxes, sectional switch boxes, utility boxes, etc. shall be covered with a finished coverplate unless specifically noted otherwise.
- F. Device plates shall be securely fastened using all required screws. All four (4) edges shall be in continuous contact with finished wall surfaces.
- G. Coverplates shall be mounted with vertical orientation, unless otherwise noted or shown on drawings.

### 3.2 Identification

- A. Comply with Division 26 Section 26 05 53 Identification for Electrical Systems.
  - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black, white, or red-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

## 3.3 Field Quality Control

- A. 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 not acceptable.
  - 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. The 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.

**END OF SECTION** 

### **Enclosed Switches and Circuit Breakers**

# PART 1 GENERAL

# 1.1 Summary

#### A. Section Includes:

- 1. Fusible switches.
- Non-fusible switches.
- 3. Molded-case circuit breakers (MCCBs).
- 4. Molded-case switches.
- Enclosures.

#### 1.2 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. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF format.
- B. Shop Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include wiring diagrams for power, signal, and control wiring.

### 1.3 Informational Submittals

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
- C. Field quality-control reports.

### 1.4 Closeout Submittals

A. Operation and maintenance data.

### 1.5 Quality Assurance

- A. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise onsite testing.

## 1.6 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 from date of Substantial Completion.

## Part 2 Products

- 2.1 20A SP TOGGLE SWITCHES: Hubbell No. 1221-GRY, Bryant No. 4901-GRY; 3 way, 4 way, or 2 pole switches to be the same series
- 2.2 MANUAL MOTOR STARTERS: 120V, single pole with overload protection; Square D Class 2510 or Westinghouse equivalent, with enclosure or stainless steel plate as required by the drawings
- 2.3 SAFETY SWITCHES: Heavy duty, HP rated, quick-make/quick-break, with arc shields, enclosed construction, and cover interlock; fusible or nonfusible as indicated on the drawings. Switches shall be rated for either 250V AC or 600V AC service as necessary. Switches shall be capable of interrupting the locked rotor current of each motor for which they are to be used. Enclosures shall be NEMA 1 for the interior, and NEMA 4 stainless steel or 4X for exterior locations
- 2.4 START/STOP/GREEN PILOT PUSHBUTTON STATIONS: surface mounted, NEMA 1, heavy duty, oiltight, 120V, as manufactured by Square D, Westinghouse, General Electric, or approved equal.
- 2.5 WALL PLATES, INDOORS: stainless steel, Type 302 Alloy 18-8, satin finish. Use galvanized pressed steel in unfinished areas.

## Part 3 Execution

- 3.1 Provide and install switches with coverplates as noted on the drawings.
- 3.2 Provide and install safety switches with the number of poles and fuses noted on the drawings.
- 3.3 Use Type R dual element fuses and fuse rejection kit in any safety switch serving a motor circuit. Use nonfusible disconnects at remote motor locations.
- 3.4 Mount all switches 4 feet 0 inches above the finished floor unless otherwise noted on the drawings. Where switches are mounted in gang boxes and the voltage exceeds 120V to ground, install partitions between switches.
- 3.5 Install all plates in full contact with the wall surface; do not allow them to project out from the wall.

#### **END OF SECTION**

# Surge Protection for Low-Voltage Electrical Power Circuits

### Part 1 General

## 1.1 Summary

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

#### 1.2 Action Submittals

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

### 1.3 Informational Submittals

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

### 1.4 Closeout Submittals

A. Maintenance data.

# 1.5 Warranty

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### Part 2 Products

## 2.1 General SPD Requirements

- A. SPD with 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. Comply with UL 1449.

Surge Protection for Low-Voltage Electrical Power Circuits

D. MCOV of the SPD shall be the nominal system voltage.

# 2.2 Service Entrance Suppressor

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Current Technology Inc.
  - 2. Eaton.
  - 3. Siemens Industry, Inc., Energy Management Division.
  - 4. Square D; by Schneider Electric.
- B. SPDs: Comply with UL 1449, Type 1
  - 1. SPDs with the following features and accessories:
    - a. Integral disconnect switch.
    - b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
    - c. Indicator light display for protection status.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V three-phase, four-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 1200 V for 480Y/277 V.
  - 2. Line to Ground: 1200 V for 480Y/277 V.
  - 3. Line to Line: 2000 V for 480Y/277 V.
- E. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V.
  - 2. Line to Ground: 700 V.
  - 3. Line to Line: 1000 V.
- F. SCCR: Equal or exceed 200 kA.
- G. Inominal Rating: 20 kA.

# 2.3 Panel Suppressors

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Current Technology Inc.
  - 2. Eaton.
  - 3. Siemens Industry, Inc., Energy Management Division.

- 4. Square D; by Schneider Electric.
- B. SPDs: Comply with UL 1449, Type 1
  - 1. Include LED indicator lights for power and protection status.
  - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
- C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V three-phase, four-wire circuits shall not exceed the following:
  - Line to Neutral: 1200 V for 480Y/277 V
  - 2. Line to Ground: 1200 V for 480Y/277 V
  - 3. Neutral to Ground: 1200 V for 480Y/277 V Line to Line: 2000 V for 480Y/277 V.
- E. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
  - 1. Line to Neutral: 700 V.
  - 2. Line to Ground: 700 V.
  - 3. Neutral to Ground: 700 V.
  - 4. Line to Line: 1200 V.
- F. SCCR: Equal or exceed 100 kA.
- G. Inominal Rating: 20 kA.

### 2.4 Enclosures

- A. Indoor Enclosures: NEMA 250, Type 1.
- B. Outdoor Enclosures: NEMA 250, Type 3R.

#### Part 3 Execution

### 3.1 Installation

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

Surge Protection for Low-Voltage Electrical Power Circuits

- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Complete startup checks according to manufacturer's written instructions. Energize SPDs after power system has been energized, stabilized, and tested.

## 3.2 Field Quality Control

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
  - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
  - 2. Inspect anchorage, alignment, grounding, and clearances.
  - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.3 Demonstration

A. Train Owner's maintenance personnel to operate and maintain SPDs.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

A. All fixtures provided shall be LED luminaires.

### 1.2 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.

### 1.3 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, complying with IESNA.
    - 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.
    - 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. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
- D. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
  - 1. Include Samples of luminaires and accessories involving color and finish selection.
- E. Samples for Verification: For each type of luminaire.
  - 1. Include Samples of luminaires and accessories to verify finish selection.
- F. Product Schedule: For luminaires and lamps.

### 1.4 Informational Submittals

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Luminaires.
  - 2. Suspended ceiling components.
  - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
  - 4. Structural members to which luminaires will be attached.
  - 5. Initial access modules for acoustical tile, including size and locations.
  - 6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Ceiling-mounted projectors.
  - 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

- 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. Sample warranty.

### 1.5 Closeout Submittals

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  - Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

### 1.6 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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

# 1.7 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. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. 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.

## 1.8 Delivery, Storage, And Handling

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

### Part 2 Products

### 2.1 Performance Requirements

- A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
  - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
- B. Ambient Temperature: 41 to 104 deg F or up to 60 deg C where shown on plans.
  - 1. Relative Humidity: Zero to 95 percent.
- C. Altitude: Sea level to 1000 feet.

## 2.2 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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. California Title 24 compliant.

## 2.3 Lamps

- 1. CRI of 80. CCT of 4000 K.
- 2. Rated lamp life of 50,000 hours to L70.
- 3. Dimmable from 100 percent to 0 percent of maximum light output.

- 4. Internal driver.
- B. Lamp:
  - 1. Bulb shape complying with ANSI C78.79.
  - 2. Lamp base complying with ANSI C81.61 or IEC 60061-1.

#### 2.4 Fixture

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product by Lithonia Lighting or equal.
- B. Nominal Operating Voltage: 277 V ac.
- C. Housings:
  - 1. Extruded-aluminum housing and heat sink.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
  - Acrylic Diffusers: One hundred 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. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- F. With integral mounting provisions.
- G. Standards:
  - 1. ENERGY STAR certified.
  - 2. RoHS compliant.
  - 3. UL Listing: Listed for damp location.

### 2.5 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. Steel:
  - 1. ASTM A 36/A 36M for carbon structural steel.

2. ASTM A 568/A 568M for sheet steel.

#### C. Stainless Steel:

- 1. Manufacturer's standard grade.
- 2. Manufacturer's standard type, ASTM A 240/240 M.
- D. Galvanized Steel: ASTM A 653/A 653M.
- E. Aluminum: ASTM B 209.

### 2.6 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.

# 2.7 Luminaire Support

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as 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

### 3.1 Examination

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 Temporary Lighting

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

### 3.3 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 a vertical force of 400 percent of luminaire weight.

#### E. Flush-Mounted Luminaires:

- 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. Wall-Mounted Luminaires:

- 1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
- 2. Do not attach luminaires directly to gypsum board.

#### G. Suspended Luminaires:

#### 1. Ceiling Mount:

- a. Two 5/32-inch- diameter aircraft cable supports adjustable to 10 feet in length.
- b. Pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 10 feet in length.
- c. Hook mount.
- 2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
- 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and

- provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
- 4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and rod wire support for suspension for each unit length of luminaire chassis, including one at each end.
- 5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### 3.4 Identification

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

## 3.5 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.

# 3.6 Startup Service

A. Illuminance Levels will be tested after installation.

**END OF SECTION** 

## **Emergency and Exit Lighting**

### Part 1 General

### 1.1 Summary

#### A. Section Includes:

- 1. Emergency lighting units.
- 2. Exit signs.
- 3. Luminaire supports.

### 1.2 Definitions

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

### 1.3 Action Submittals

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 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 for power, signal, and control wiring.

### 1.4 Informational Submittals

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, coordinated with each other, using input from installers of the items involved:
- B. Product Certificates: For each type of luminaire.
- C. Seismic Qualification Data: Certificates, for luminaires, accessories, and components, from manufacturer.

**Emergency and Exit Lighting** 

D. Sample Warranty.

### 1.5 Closeout Submittals

Operation and maintenance data.

## 1.6 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.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

## Part 2 Products

# 2.1 Performance Requirements

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. Luminaires and lamps shall be labeled vibration and shock resistant.
  - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

# 2.2 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.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for recessed luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body

- Emergency Connection: Operate LED fixtures continuously upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture.
- Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deepdischarge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
  - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
  - c. Humidity: More than 95 percent (condensing).
  - d. Altitude: Exceeding 3300 feet.
- 4. Test Push-Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
  - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
- 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
- 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

# 2.3 Emergency Lighting

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Luminaires:
- C. Manufacturers: Subject to compliance with requirements, provide basis of design product by the following or equal product as approved by Auburn University:
  - 1. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 2. Emergency Luminaires: E9.0 as indicated on Interior Luminaire Schedule, with the following additional features:

#### **Emergency and Exit Lighting**

- a. Operating at nominal voltage of 277 V ac Internal emergency power unit
- b. UL 94 flame rating.
- D. Emergency Lighting Unit:
- E. Manufacturers: Subject to compliance with requirements, provide basis of design product by the following or equal product as approved by Auburn University:
  - 1. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 2. Emergency Lighting Unit: E9.0 as indicated on Interior Luminaire Schedule.
  - 3. Operating at nominal voltage of 277 V ac. Wall with universal junction box adaptor.
  - 4. Two LED lamp heads.
  - 5. Internal emergency power unit.

# 2.4 Exit Signs

- A. Internally Lighted Signs:
- B. Manufacturers: Subject to compliance with requirements, provide basis of design product by the following or equal product as approved by Auburn University:
  - 1. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 2. Operating at nominal voltage of 277 Vac.
  - 3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
  - 4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

#### 2.5 Materials

#### 2.6 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.

# 2.7 Luminaire Support Components

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

### Part 3 Execution

#### 3.1 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 and emergency power unit weight.
- 2. Able to maintain luminaire position when testing emergency power unit.
- 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
- 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of fixture weight.

#### E. Wall-Mounted Luminaire Support:

 Attached to structural members in walls. Do not attach fixtures directly to gypsum board.

#### F. Ceiling Grid Mounted Luminaires:

- 1. Secure to any required outlet box.
- 2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
- G. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

# 3.2 Field Quality Control

- A. Perform the following tests and inspections:
  - 1. 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.

#### **END OF SECTION**

# Part 1 General

# 1.1 Summary

#### A. Section Includes:

 Installation of the Musco Sports lighting LLC system only. The Musco Sports Lighting LLC system will be owner provided, contractor installed. The contractor shall include in his bid all cost for accepting the delivery of equipment and miscellaneous materials. Any items not included in the Bill Of Materials included at the end of this section shall be provided by the contractor.

# 1.2 Electrical System Requirements

- A. Contractor Responsibility: The installing contractor shall be responsible for the installation of the owner furnished lighting system for a complete and operational system.

  The contractor shall provide the transformer and switchgear per the contract drawings.
- B. Electric Power Requirements for the Sports Lighting Equipment:

Electric power: 480 Volt, 3 Phase, 60 hertz.

C. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles has been designed to not exceed three (3) percent of the rated voltage. Contractor shall increase wire size if alternate routings are used that increase voltage drop.

#### D. System Design:

 Underground wiring shall be all copper wire and shall be installed in PVC Schedule 40 conduit and shall be buried to a depth meeting the NEC and local electrical codes per Division 26 sections. Where above ground conduit is used, provide rigid galvanized steel. Conduit elbows located at the electrical panel shall be rigid galvanized steel.

#### E. Trenching or Directional Boring:

- 1. The installing contractor shall be responsible for locating all underground utilities including, but not limited to: natural gas, electric, water, sewer, cable TV, and telephone.
- 2. The contractor shall be responsible for locating and staking any underground facilities. The contractor is responsible for identification, protection, including repair and replacement of any items damaged during construction.
- 3. Trenching depth and width shall be adequate to install appropriately sized conduit and to meet local and National Electrical Codes and other Division 26 specifications.
- 4. Trenches shall be back-filled with excavated soil and compacted to approximately the same density of the surrounding soil to minimize settlement per Division 32 and 33 specifications.

5. No trench line or feeder circuit shall cross the playing area.

#### F. Design Standards:

- 1. All circuits have been designed so that the voltage at the safety disconnect in the electrical enclosure near the base of each pole is within 3% of nominal.
- All work shall meet local and National Electrical Codes. It shall be the installing contractors' responsibility to correct any work deemed unacceptable by local electrical inspectors.
- 3. All electrical components shall be UL Listed for the appropriate application.
- 4. Each pole shall be on a dedicated circuit(s). If common poles are used, or a pole is to have fixtures on separate circuits, multiple dedicated circuits shall be run to that pole. Similarly, poles with area flood lights shall have separate circuits for field lighting and flood lighting. Consult lighting equipment specifications and lighting manufacturer for special circuitry information.

# 1.3 Warranty

A. The successful contractor shall, upon completion of the project, protect the owner against defective materials or faulty workmanship for a period of two (2) years. The contractor, at the Owner's request, shall furnish a maintenance bond for the above outlined maintenance term. This bond shall be in an amount not to exceed one hundred percent (100%) of the contract price.

### Part 2 Products

# 2.1 SPORTS LIGHTING FURNISHED BY OWNER; INSTALLED BY CONTRACTOR

- A. Musco Sports Lighting, LLC (indicated on drawings as "Field Lighting Pole, Musco designation")
  - 1. See manufacturer installation details on the drawings.
  - 2. Contact Jimmy Jumper (jimmy.jumper@musco.com) 256-483-5433 for all Musco installation manuals and details.
- 2.2 Approved Materials: All materials not owner supplied but supplied by the contractor under the provisions of these specifications and plans shall be new materials of the kind and character called for by the specifications. Defective equipment or material damaged in the course of installation or tests shall be replaced or repaired in a manner satisfactory to the owner. All materials and equipment to be furnished under these specifications shall be the standard product of a manufacturer regularly engaged in the production of such material and shall be the manufacturer's current standard design.

# Part 3 Execution

#### 3.1 General

- A. All work performed under this contract shall be performed in accordance with all provisions of these specifications and drawings. Any deviations from the specifications or plans must be approved in writing by the Architect.
- B. Initial site inspection: The contractor shall make an inspection of the premises prior to the time of bidding and shall be responsible for all information available through such inspection. The contractor shall immediately upon discovery, bring to the attention of the architect any conflicts that may occur among the various provisions of the specifications and plans. The architect shall resolve such conflicts and shall be responsible for any costs reasonably incurred by the contractor due to such conflict. Failure of the contractor to bring conflicts or exceptions to the attention of the architect shall allow the architect to require any change deemed necessary before acceptance by the owner.
- C. Codes, Permits and Licenses: All work shall comply with the applicable rules of the National Electrical Code, the National Electrical Safety Code, the National Fire Codes, (published by the National Fire Protection Association), state and local codes and ordinances, and the terms and conditions of the services of the electrical utility, as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations or requirements of these authorities. The contractor shall procure all necessary permits or licenses to carry out his work, and shall pay the lawful fee therefore, as well as for any inspection fee or the cost of a certificate of approval.

In any instance where these specifications call for materials for construction of a better quality or larger size than required by the codes, the provisions of these specifications shall take precedence. The codes shall govern in the case of direct conflict between the codes and the plans and the specifications.

# 3.2 Replacement Of Damaged Property

A. The contractor shall replace all property damaged by him including fences, trees, plants, grass, walks, drives, building surfaces, etc.

#### 3.3 Installation

- A. Manufacturer's Instructions: Written instructions for the installation of the sports lighting equipment shall be provided by the manufacturer. The contractor shall review the instructions prior to beginning installation and review any areas of concern with the manufacturer.
- B. Installation of Equipment: Contractor shall install owner furnished lighting equipment per manufacturer's stated requirements to ensure lighting performance is achieved.

#### **Exterior Athletic Lighting**

- C. Manufacturer Representative: A qualified representative from the sports lighting manufacturer shall be available to provide installation guidance if required by the contractor.
- D. Handling of Equipment: The lighting equipment shall be handled in an appropriate manner to ensure safe installation and prevent damage to the equipment. Repair or replacement of damaged component shall be the responsibility of the installing contractor.
- E. Rigging: Use the appropriate rated web fabric slings to lift components into position. Chains or cables shall not be allowed due to potential failure and damage to components.
- F. The contractor shall be responsible for scheduling the work in accordance with the contract and Division 01 requirements.
- G. Clean-up: Upon completion of the work and before acceptance and final payment is made, the contractor shall clean and remove from the site of the work, surplus and discarded materials, temporary structures and debris of every kind. The contractor shall leave the site of work in a neat and orderly condition equal to that which originally existed. Surplus and waste materials removed from the site of the work shall be disposed of at locations satisfactory to the owner.
- H. The installing contractor shall be responsible for accepting delivery of Owner furnished materials as well as for proper storage of equipment until installed.

# 3.4 Field Quality Control

- A. Illumination Measurements: Upon substantial completion of the project illumination measurements shall be taken by the contractor and verified by a representative of the lighting manufacture and architect. The illumination measurements shall be conducted in accordance with IESNA RP-6-01, Appendix B.
- B. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the lighting system is not installed as per the lighting manufactures requirements the contractor will be responsible for correcting any identified install issues only.

#### 3.5 Bill Of Materials

A. The contractor shall provide all requirements for installation of exterior athletic lighting not included in this Bill Of Materials.

#### Civitan Park Recreation Fields: Bill of Materials

Equipment Description	
4	Light-Structure System™ Total Light Control™ TLC-LED-400 luminaires
4	Light-Structure System™ Total Light Control™ TLC-LED-900 luminaires
8	Light-Structure System™ Total Light Control™ TLC-LED-1200 luminaires

16	Light-Structure System™ Total Light Control™ TLC-LED-1500 luminaires
8	Light-Structure System™ Total Light Control™ TLC-BT-575 luminaires
3	60 ft galvanized steel poles
4	70 ft galvanized steel poles
7	Pre-cast concrete foundations (9,500 PSI) with integrated grounding
✓	Factory wired and assembled pole top luminaire assemblies
✓	Factory wired electrical component enclosures
✓	Factory built wire harnesses with plug-in connections
Controls	
1	24" X 72" Control and monitoring cabinet
✓	High/medium/low dimming
12	30-amp contactors
3	On-Off-Auto (OOA) switches
Warranty	
<b>√</b>	Musco's Constant 25 <sup>™</sup> product assurance and warranty program that eliminates 100% maintenance costs for 25 years, including labor, materials, monitoring and guaranteed light levels.

**END OF SECTION** 

### Part 1 General

### 1.1 Summary

#### A. Section Includes:

1. Poles and accessories for support of luminaires.

#### 1.2 Definitions

- A. EPA: Equivalent projected area.
- B. Luminaire: Complete luminaire.
- C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.
- D. Standard: See "Pole."

#### 1.3 Action Submittals

- A. Product Data: For each pole, accessory, and luminaire-supporting device.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 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. Detail fabrication and assembly of poles and pole accessories.
  - 4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
  - 5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
  - 6. Method and procedure of pole installation. Include manufacturer's written installations.

#### 1.4 Informational Submittals

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.
- B. Seismic Qualification Certificates: For poles, accessories, and components, from manufacturer.

- C. Material test reports.
- D. Field quality-control reports.
- E. Sample warranty.
- F. Soil test reports.

#### 1.5 Closeout Submittals

A. Operation and maintenance data for pole-mounted accessories.

# 1.6 Warranty

- A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

#### Part 2 Products

# 2.1 Performance Requirements

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design pole foundation and pole power system.
- B. Seismic Performance: Foundation and pole shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
  - 2. Component Importance Factor: 1.5
- C. Structural Characteristics: Comply with AASHTO LTS-6-M.
- D. Dead Load: Weight of luminaire and its horizontal and vertical supports, and supporting structure, applied according to AASHTO LTS-6-M.
- E. Live Load: Single load of 500 lbf distributed according to AASHTO LTS-6-M.
- F. Ice Load: Load of 3 lbf/sq. ft., applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.

- G. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
  - 1. Basic wind speed for calculating wind load for poles 50 feet high or less is 90 mph.
    - a. Wind Importance Factor: 1.0.
    - b. Minimum Design Life: 25 years.
    - c. Velocity Conversion Factor: 1.0.
- H. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.
- I. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

# 2.2 Aluminum Poles (Parking/Roadway)

- A. Manufacturers: Subject to compliance with requirements, provide basis of design product by the following or equal product as approved by Auburn University:
  - 1. KIM (Hubbell Lighting Group) Series as indicated.
- B. Poles: Seamless, extruded structural tube with access handhole in in pole wall.
  - 1. Shape: Round, tapered.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- D. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
  - 1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
  - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- E. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- F. Finish: Manufacturer's standard finish.

1. Color: Match Auburn University Design and Construction Standard.

# 2.3 Aluminum Poles (Pedestrian Lights)

- A. Manufacturers: Subject to compliance with requirements, provide basis of design product by the following or equal product as approved by Auburn University:
  - 1. Holophane Lighting.
- B. Poles: Seamless, extruded structural tube complying with ASTM B 221, Alloy 6061-T6, with access handhole in in pole wall.
  - 1. Shape: Round, tapered.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
  - 1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with stainless-steel bolts.
  - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- F. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
  - 1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
  - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- G. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" 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 of 0.018 mm or thicker), complying with AAMA 611.
- Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium; 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.
- J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
  - Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
  - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
  - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: Dark Bronze

#### 2.4 Pole Accessories

- A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.
- B. Transformer-Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and to accept indicated accessories. Include removable flanged access cover secured with bolts or screws.

# 2.5 Mounting Hardware

- A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.
  - 1. Galvanizing: Hot dip galvanized according to ASTM 36, Class C Bent rods 3/4 inches in diameter by 15 inches in length.
  - 2. Threading: Uniform National 8, Class 2A.
- B. Nuts: ASTM A 563, Grade A, Heavy-Hex

- 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
- 2. Four nuts provided per anchor bolt, shipped with nuts pre-assembled to the anchor bolts.
- C. Washers: ASTM F 436, Type 1.
  - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
  - 2. Two washers provided per anchor bolt.

### 2.6 General Finish Requirements

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: 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.

#### Part 3 Execution

#### 3.1 Pole Foundation

- A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Anchor Bolts: Install plumb using manufacturer-supplied steel or plywood template, uniformly spaced.

#### 3.2 Pole Installation

- A. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
- C. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.
- D. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

#### 3.3 Corrosion Prevention

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.
- B. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

# 3.4 Grounding

- A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole unless otherwise indicated.
  - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

**END OF SECTION** 

# **LED Exterior Lighting**

#### Part 1 General

# 1.1 Summary

#### A. Section Includes:

- 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
- 2. Luminaire supports.
- 3. Luminaire-mounted photoelectric relays.

#### B. Related Requirements:

1. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

#### 1.2 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.

#### 1.3 Action Submittals

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

#### 1.4 Informational Submittals

- A. Coordination Drawings: Plans, drawn to scale and coordinated.
- B. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of the following:

#### **LED Exterior Lighting**

- 1. Luminaire.
- 2. Photoelectric relay.
- D. Sample warranty.

#### 1.5 Closeout Submittals

- Operation and maintenance data.
  - 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.

#### 1.6 Field Conditions

A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

# 1.7 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: Five (5) years from date of Substantial Completion.

### Part 2 Products

# 2.1 Performance Requirements

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
  - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

# 2.2 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. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598 and listed for wet location.
- E. CRI of 80, CCT of 4000 K.
- F. L70 lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Nominal Operating Voltage: 277 V ac.
- I. In-line Fusing: Separate in-line fuse for each luminaire.
- J. Provide Surge Protection Devices in luminaire.
- K. Lamp Rating: Lamp marked for outdoor use.
- L. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- M. 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.

# 2.3 Luminaire Types

- A. Area and Site:
  - Manufacturers: Subject to compliance with requirements, provide basis of design product by the following or equal product as approved by Auburn University:
    - a. KIM Lighting.
    - b. Luminaire Shape: Square.
    - c. Mounting: Pole Luminaire-Mounting Height: 20'
    - d. Distribution: Type II or Type IV. See Fixture Schedule.

#### B. Decorative Post Top:

- 1. Manufacturers: Subject to compliance with requirements, provide basis of design product by the following or equal product as approved by Auburn University:
  - a. Holophane Lighting.
  - b. Mounting Type: Tenon.
  - c. Distribution: Type II or Type IV.

#### 2.4 Materials

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Extruded Die-cast Aluminum. Form and support to prevent warping and sagging.
- C. 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.
- 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.

#### 2.5 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.

- 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.

# Part 3 Execution

# 3.1 General Installation Requirements

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. 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.
- F. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- G. Install luminaires at height and aiming angle as indicated on Drawings.
- H. Coordinate layout and installation of luminaires with other construction.
- Adjust luminaires that require field adjustment or aiming. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260537 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

#### 3.2 Corrosion Prevention

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260537 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inchthick, pipe-wrapping plastic tape applied with a 50 percent overlap.

#### 3.3 Identification

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 Field Quality Control

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Verify operation of photoelectric controls.

#### C. 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.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

#### 3.5 Demonstration

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

#### **END OF SECTION**

### Part 1 General

# 1.1 Summary

#### A. Section Includes:

- 1. Protecting existing vegetation to remain.
- 2. Removing existing vegetation.
- 3. Clearing and grubbing.
- 4. Stripping and stockpiling topsoil.
- 5. Stripping and stockpiling rock.
- 6. Removing above- and below-grade site improvements.
- 7. Disconnecting, capping or sealing, and removing site utilities.
- 8. Temporary erosion and sedimentation control.

#### 1.2 Definitions

- A. Retain definitions remaining after this Section has been edited.
- B. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- C. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.
- E. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

# 1.3 Preinstallation Meetings

A. Preinstallation Conference: Conduct conference at Project site.

# 1.4 Material Ownership

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

#### 1.5 Informational Submittals

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
  - 1. Use sufficiently detailed photographs or video recordings.
- B. Topsoil stripping and stockpiling program.
- C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

# 1.6 Quality Assurance

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

#### 1.7 Field Conditions

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify 811 Call Before You Dig for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

### Part 2 Products

#### 2.1 Materials

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

### Part 3 Execution

# 3.1 Preparation

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

# 3.2 Temporary Erosion and Sedimentation Control

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

#### 3.3 Tree and Plant Protection

A. Protect trees and plants remaining on-site according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

#### Site Clearing

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

# 3.4 Existing Utilities

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Landscape Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

# 3.5 Clearing and Grubbing

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Entirely removal all stumps and roots.
  - 3. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

# 3.6 Topsoil Stripping

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 2 to 4 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

- 1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects larger than 1 inch (25 mm) in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
  - 1. Do not stockpile topsoil within protection zones.
  - 2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

# 3.7 Site Improvements

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove paving, curbs and aggregate base as indicated.
  - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

### 3.8 Disposal of Surplus and Waste Materials

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Burning tree, shrub, and other vegetation waste is not permitted.
- C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

**END OF SECTION** 

# Part 1 General

# 1.1 Summary

#### A. Section Includes:

- 1. Excavating and filling for rough grading the Site.
- 2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses and plants.
- 3. Excavating and backfilling for buildings and structures.
- 4. Subbase course for concrete walks and pavements.
- 5. Subbase course and base course for asphalt paving.
- 6. Subsurface drainage backfill for walls and trenches.
- 7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

#### 1.2 Definitions

- A. Retain definitions remaining after this Section has been edited. Revise to suit office or local earth-moving practices.
- B. Backfill: Soil material or controlled low-strength 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.
- C. Base Course: Aggregate layer placed between the subgrade course and hot-mix asphalt paving.
- D. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- F. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- H. Fill: Soil materials used to raise existing grades.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the

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- following in size and performance ratings, without systematic drilling, ram hammering or ripping.
- J. 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.
- K. 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.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

# 1.3 Preinstallation Meetings

- A. Pre-installation Conference: Conduct pre-excavation conference at Project site.
  - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
    - a. Personnel and equipment needed to make progress and avoid delays.
    - b. Coordination of Work with utility locator service.
    - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
    - d. Dewatering.
    - e. Field quality control.

#### 1.4 Action Submittals

- A. Product Data: For each type of the following manufactured products required:
  - 1. Geotextiles.
  - 2. Warning tapes.

#### 1.5 Informational Submittals

- A. Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as supplemented in "Quality Assurance" Article.
- B. Qualification Data: For qualified testing agency.
- C. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D 2487.
  - 2. Laboratory compaction curve according to ASTM D 698.

# 1.6 Quality Assurance

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

#### 1.7 Field Conditions

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify "811 Call Before You Dig" for area where Project is located before beginning earth-moving operations.
- C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and Section 311100 "Clearing and Grubbing" are in place.
- D. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.
- E. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - 3. Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- F. Do not direct vehicle or equipment exhaust towards protection zones.
- G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

#### Part 2 Products

#### 2.1 Soil Materials

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

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- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
  - 1. Liquid Limit: Less than 50.
  - 2. Plasticity Index: Less than 25.
- C. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 3 inches.
- D. Cohesionless and Cohesive Materials: Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic (plasticity index equals zero). Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.
- J. Sand: ASTM C 33/C 33M; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

#### 2.2 Geotextiles

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Survivability: As follows:
    - a. Grab Tensile Strength: 157 lbf (700 N); ASTM D 4632.
    - b. Sewn Seam Strength: 142 lbf (630 N); ASTM D 4632.
    - c. Tear Strength: 56 lbf (250 N); ASTM D 4533.
    - d. Puncture Strength: 56 lbf (250 N); ASTM D 4833.
  - 3. Apparent Opening Size: **No. 70 (0.212-mm)** sieve, maximum; ASTM D 4751.
  - 4. Permittivity: 0.1 per second, minimum; ASTM D 4491.
  - 5. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

#### 2.3 Accessories

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

### Part 3 Execution

# 3.1 Preparation

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

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C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

# 3.2 Dewatering

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  - 2. capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

### 3.3 Excavation, General

- A. Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches (600 mm) outside of concrete forms other than at footings.
    - b. 12 inches (300 mm) outside of concrete forms at footings.
    - c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
    - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    - e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
    - f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

#### 3.4 Excavation for Structures

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete

- reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- 2. Pile Foundations: Stop excavations 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
- 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
  - Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  - 2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

#### 3.5 Excavation for Walks And Pavements

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

# 3.6 Excavation for Utility Trenches

- A. Coordinate this article with utility Sections in other Divisions.
- B. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: As indicated.
- D. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
- E. Trench Bottoms: Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

#### F. Trenches in Tree- and Plant-Protection Zones:

- 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
- 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
- 3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

# 3.7 Subgrade Inspection

- A. Notify Geotechnical Engineer when excavations have reached required subgrade.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavement with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes) to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
  - Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Reconstruct subgrades damaged by rain, accumulated water, or construction activities, as directed by Geotechnical Engineer.

# 3.8 Storage of Soil Materials

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

#### 3.9 Backfill

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.

- 3. Testing and inspecting underground utilities.
- 4. Removing concrete formwork.
- 5. Removing trash and debris.
- 6. Removing temporary shoring, bracing, and sheeting.
- 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

# 3.10 Utility Trench Backfill

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing.

#### D. Initial Backfill:

- 1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
  - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- Controlled Low-Strength Material: Place initial backfill of controlled lowstrength material to a height of 12 inches (300 mm) over the pipe or conduit. Coordinate backfilling with utilities testing.

#### E. Final Backfill:

- 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- 2. Controlled Low-Strength Material: Place final backfill of controlled lowstrength material to final subgrade elevation.
- F. Warning Tape: Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

#### 3.11 Soil Fill

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:

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- 1. Under grass and planted areas, use satisfactory soil material.
- 2. Under walks and pavements, use satisfactory soil material.
- 3. Under steps and ramps, use engineered fill.
- 4. Under building slabs, use engineered fill.
- 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

#### 3.12 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 3 percent and is too wet to compact to specified dry unit weight.

# 3.13 Compaction of Soil Backfills And Fills

- A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by handoperated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - Under structures and building slabs, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 98 percent.
  - 2. Under pavements scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 3. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent
  - 4. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 5. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

# 3.14 Grading

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
  - 2. Walks: Plus or minus 1 inch (25 mm).
  - 3. Pavements: Plus or minus 1/2 inch (13 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

# 3.15 Subsurface Drainage

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 2-inch (50-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

#### 3.16 Base Courses Under Pavements and Walks

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
  - 1. Shape base course to required crown elevations and cross-slope grades.
  - 2. Place base course 6 inches (150 mm) or less in compacted thickness in a single layer.
  - 3. Place base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

- Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent of maximum dry unit weight according to ASTM D 698.
- C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

# 3.17 Field Quality Control

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Geotechnical Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556 and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.
  - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

## 3.18 Protection

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

- 1. Scarify or remove and replace soil material to depth as directed by Geotechnical Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

# 3.19 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** 

## Part 1 General

# 1.1 Work Included

- A. Provide the necessary plant, labor, materials and equipment to restore and maintain the various streets and driveway surfaces of all type, pavement and driveway bases, curbs, curb and gutter, and sidewalks disturbed, damaged, or demolished during the performance of the work.
- B. Repair damaged base on either side of a trench wherever necessary. Trim the oxidation surface to neat lines outside of the trench wall, and repave the entire area as specified below and as shown on the Drawings or on the standard drawings.

# 1.2 Quality Assurance

A. Both these specifications and the Drawings make reference to the current edition of the Standard Specifications of the Alabama Department of Transportation (ALDOT). Even though the weather limitations, construction methods, and materials specifications contained in the ALDOT specifications may not be explicitly repeated in these specifications, they shall, wherever applicable to the work called for by this section, be considered as implied and therefore adhered to. However, the various subsections "Basis for Payment" contained in the ALDOT specifications shall not be considered applicable.

# Part 2 Products

### 2.1 Concrete

A. Concrete shall be Class A air-entrained Portland cement type as specified in ALDOT Standard Specifications, Current Edition.

# 2.2 Mineral Aggregate Base

A. Type A Base, Grading pugmill mix ALDOT Specifications.

### 2.3 Bituminous Materials

- A. Prime Coats: Cutback asphalt, Grade RC-250, or material emulsified asphalt, Grade AE-P per ALDOT Specifications.
- B. Crushed Stone Chips: Size 7 or 8 per ALDOT Standard Specifications.
- C. Bituminous Plant Mix Base (Hot Mix): Grading A, B or C, AS or CW, as directed by the A/E per ALDOT Specifications.

#### Pavement Repair

- D. Asphaltic Concrete Binder: Grading B, BM, BM-s, or CW as directed by the A/E per ALDOT Standard Specifications.
- E. Tack Coat: Grade AE-3 per ALDOT Specification Sections.
- F. Asphaltic Concrete Surface: Grading D or E per ALDOT Specifications.

## Part 3 Execution

### 3.1 Excavation

- A. Upon completion of installation of utility or other work if a temporary patch is to be used, placement of compacted backfill or mineral aggregate base or grading D crushed stone (6" layers) and temporary asphalt patch (2" cold mix) shall be placed and rolled or mechanically compacted until such time that the permanent repair will be constructed.
- B. Full lane or roadway width milling and paving shall be required for all excavations. If two (2) or more excavations are made within a street block less than or equal to 1500 feet the entire roadway lane impacted shall be milled and paved for the entire block. If a street block is greater than 1500 feet, any excavations made less than 500 feet apart the entire roadway lane impacted shall be milled and paved patch to patch. If a continuous longitudinal trench is made in the roadway, the entire length of the trench shall be milled and paved the width of the lane impacted. If an excavation is within 100 feet of an intersection, the restoration limits shall extend to the radius points of the intersection. If an excavation falls between the edge of pavement and a construction joint, milling and paving can be completed to the existing construction joint. New utility cuts shall be milled and paved to any existing cuts or damaged pavement within 10 feet to eliminate checker boarding. If the existing cut or damaged pavement is less than 10 feet in length, the existing cut shall also be milled and paved.

# 3.2 Subgrade

- A. Before any base material is installed, compact the subgrade of the area to be paved to 98 percent of optimum density as determined by ASTM D698 (Standard Proctor).
- B. The backfill material shall contain no topsoil or organic matter. For all areas where subgrade has been prepared, test for uniformity of support by driving a loaded dump truck at a speed of 2 to 3 mph over the entire surface. Make further improvements on all areas that show a deflection of 1 inch or more. When completed, the finished subgrade shall be hard, smooth, stable, and constructed in reasonably close conformance with the lines and grades that existed prior to beginning construction.
- C. When a base course is compacted, cut back the surface course of the existing pavement a minimum of 1 foot beyond the limit of the joint between the old and new base course, except at the edge of pavement and except where a flow-able fill application is used to fill the trench, or as shown on the standard drawings.

Take special care to ensure good compaction of the new base course at the joint. Apply and compact the surface to conform to the existing pavement so that it will have no surface irregularity.

#### 3.3 Base

A. Install a mineral aggregate base of the type specified above in accordance with ALDOT Specifications. The maximum compacted thickness of any one layer shall be 6 inches and the total thickness of the base shall match the existing base thickness unless indicated otherwise on the Drawings.

### 3.4 Prime Coat

A. Uniformly apply a bituminous prime coat over the entire width of the area to be surfaced at a rate of 0.3 gallon per square yard. Immediately after application, uniformly cover the entire area with size 7 crushed stone chips at a rate of 12 pounds per square yard.

#### 3.5 Cover Coat

A. Use only if traffic is expected on base stone or if base stone will not receive asphalt for an extreme period.

## 3.6 Bituminous Plant Mix Base

- A. For all areas of more than 1,000 square yards, spread and strike off the asphalt binder course with a paver. Correct any irregularities in the surface of the pavement course directly behind the paver. Remove excess material forming high spots with a shovel or lute. Fill indented areas with hot mix, and smooth with a lute or the edge of a shovel being pulled over the surface. Casting of mix over such areas will not be permitted.
- B. If it is impracticable to use a paver or spread box in areas of 1,000 square yards or less, the asphalt binder course may be spread and finished by hand. Carefully place by hand to avoid segregation of the mix. Broadcasting of the material will not be permitted. Remove any lumps that do not readily break down.

# 3.7 Asphaltic Concrete Surface

A. If the asphaltic concrete surface course is to be placed directly on the mineral aggregate base, place a bituminous prime coat as described above. If, however, the surface course is to be placed on a binder course, then apply a bituminous tack coat of the sort specified above under PRODUCTS at a rate of 0.10 gallon per square yard. Take care to prevent the bituminous material's splashing on exposed faces of curbs, gutters, walls, walks, trees, etc.; if such splashing does occur, remove it immediately. After the prime or tack coat has been properly cured, apply the asphaltic concrete to the thickness and width shown on the Drawings. Apply the surface course as described above for the binder course.

## 3.8 Smoothness

A. The finished surfaces shall conform to the lines and grades that existed prior to construction. No deviations, variations, or irregularities exceeding 1/4 inch in any direction when tested with a 12 foot straightedge will be permitted in the finished work, nor will any depressions that will not drain. Correct all such defects.

# 3.9 Sampling And Testing

- A. Submit to the Owner's Representative a certification that the crushed mineral aggregate, bituminous materials, and asphaltic concrete design mixes, and obtain his approval of these reports before starting paving operations. Meet requirements of ALDOT Specifications.
- B. The Owner has the right but not the obligation to make tests on the competed elements of the pavement to ascertain the compacted thickness of the base and surface courses. If sections with deficient thicknesses are found, the full section for a reasonable distance on each side of deficiency shall be refused. Remove and reinstall all such sections. Patch all test holes in connection with thickness tests. The Owner will pay for initial test. If test results in failure, any additional testing is at the Contractor's expense.
- C. When making surface tests, furnish one man to mark all surface defects for corrections.

### 3.10 Other Work

- A. Sidewalks shall be restored as required to match existing construction. Replace damaged sections with complete new sections from expansion joint to expansion joint. Patching curb, gutter, or sidewalk will not be permitted.
- B. When a manhole top or other utility casting requires adjustment to an elevation one inch or more above the existing pavement grade a temporary ramp shall be constructed by feathering bituminous concrete 360 degrees around the casting. A taper slope of not less than two feet per inch shall be used. Taper shall be removed prior to placement of bituminous concrete surface course.

**END OF SECTION** 

# Part 1 General

# 1.1 Work Included

A. Aggregate base courses for sidewalk construction, including materials, placement, and quality control

## 1.2 References

- A. American Association of State Highway and Transportation Officials (AASHTO):
  - 1. T11, Standard Method of Test for Materials Finer than 75 μm (No 200) Sieve in Mineral Aggregates by Washing.
  - 2. T27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.
  - 3. T89, Standard Specification for Determining the Liquid Limit of Soils.
  - 4. T90, Standard Specification for Determining the Plastic Limit and Plasticity Index of Soils.
  - 5. T96, Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - 6. T99, Standard Specification for the Moisture-Density Relations of Soils Using a 2.5 kg (5.5 pound) Rammer and 305 mm (12 in) Drop.
  - 7. T180, Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18-in) Drop.
  - 8. T 190, Standard Specification for Resistance R-Value and Expansion Pressure of Compacted Soils.
  - 9. T265, Standard Method of Test for Laboratory Determination of Moisture Content of Soils.
  - 10. T310, Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

#### B. ASTM International (ASTM):

- 1. C88, Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- 2. D1883, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
- 3. D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- 4. D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- C. Alabama Department of Transportation, Current Edition Test Methods.

### 1.3 Definitions

A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross-section.

### Aggregate Base Courses

B. Completed Lift: Compacted with uniform cross-section thickness.

#### 1.4 Submittals

- A. Informational Submittals:
  - Certified Test Results on Source Materials: Submit copies from commercial testing laboratory 14 days prior to delivery of materials to Project showing materials meeting the physical qualities specified.
  - 2. Certified results of in-place density tests from independent testing agency.

## Part 2 Products

## 2.1 Base Course

A. As specified Alabama Department of Transportation Standard Specifications for Highway Construction, Current Edition.

# 2.2 Source Quality Control

- A. Perform tests necessary to locate acceptable source of materials meeting specified requirements.
- B. Final approval of aggregate material will be based on test results of installed materials.
- C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

## Part 3 Execution

# 3.1 Subgrade Preparation

- A. As SPECIFIED IN Section 31 20 00 Earth Moving.
- B. Obtain A/E's acceptance of subgrade before placing base course or surfacing material.
- C. Do not place base course or surfacing materials on soft, muddy, or frozen subgrade.

# 3.2 Equipment

A. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

# 3.3 Hauling and spreading

#### A. Hauling Materials:

- 1. Do not haul over surfacing in process of construction.
- 2. Loads: Of uniform capacity.
- 3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

### B. Spreading Materials:

- 1. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.
- 2. Produce even distribution of material upon roadway or prepared surface without segregation.
- 3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

### 3.4 Construction of courses

### A. Untreated Aggregate Base Course:

- 1. Maximum Completed Lift Thickness: 6 inches.
- 2. Completed Course Total Thickness: As shown in the design Drawings.
- 3. Lightly blade and roll surface until thoroughly compacted.
- 4. Blade or broom surface to maintain true line, grade, and cross-section.

# 3.5 Rolling and compaction

- A. Roll each layer of material until material does not creep under roller before succeeding layer is applied.
- B. Apply water as needed to obtain specified densities.
- C. Remove floating or loose stone from surface of preceding course before placing leveling course.
- D. Surface Defects: Remedy by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.
- E. Finished surface shall be true to grade and crown before proceeding with surfacing.

#### 3.6 Surface tolerances

A. Blade or otherwise work surfacing as necessary to maintain grade and crosssection at all times, and to keep surface smooth and thoroughly compacted.

### Aggregate Base Courses

- B. Finished Surface of Untreated Aggregate Base Course: Within plus or minus 0.04 foot of grade shown at any individual point.
- C. Overall Average: Within plus or minus 0.02 foot from crown and grade specified.

# 3.7 Field quality control

- A. In-Place Density Tests:
  - 1. Provide Engineer and testing laboratory at least 24 hours advance notification prior to testing.
  - 2. Show proof that areas meet specified requirements before requesting that Engineer identify density test locations.
  - 3. Refer to Table 1 for minimum sampling and testing requirements for aggregate base course and surfacing.

# 3.8 Cleaning

A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate.

**END OF SECTION** 

## Part 1 General

### 1.1 Section Includes

A. The Work of this Section includes providing prime coats, tack coats, asphaltic concrete pavement, and associated materials.

### 1.2 References

- A. Alabama Department of Transportation (ALDOT)Standard Specifications for Highway Construction. Current Edition.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - 1. M17, Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
  - 2. M81, Standard Specification for Cut-Back Asphalt (Rapid Curing Type).
  - 3. M82, Standard Specification for Cut-Back Asphalt (Medium Curing Type).
  - 4. M140, Standard Specification for Emulsified Asphalt.
  - 5. M208, Standard Specification for Cationic Emulsified Asphalt.
  - 6. T166, Standard Method of Test for Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens.
  - 7. T176, Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.
  - 8. T230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
  - 9. T245, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
  - 10. T246, Standard Method of Test for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
  - 11. T247, Standard Method of Test for Preparation of Test Specimens of Bituminous Mixtures by Means of California Kneading Compactor.
  - 12. T283, Standard Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.
  - 13. T304, Standard Method of Test for Uncompacted Void Content of Fine Aggregate (Method A).

#### C. ASTM International (ASTM):

- 1. D2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
- 2. D4318, Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- 3. D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- 4. D5821, Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
- 5. E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

### 1.3 Definitions

#### Asphalt Paving

- A. Combined Aggregate: All mineral constituents of asphalt concrete mix, including mineral filler and separately sized aggregates.
- B. RAP: Reclaimed asphalt pavement.

# 1.4 Design Requirements

A. Prepare asphalt concrete mix design, meeting Alabama Department of Transportation Standard Specifications for Highway Construction, Current Edition.

### 1.5 Submittals

- A. Informational Submittals:
  - 1. Asphalt Concrete Mix Formula:
    - a. Submit minimum of 10 days prior to start of production.
    - b. Submittal to include the following information:
      - 1) Gradation and portion for each aggregate constituent used in mixture to produce a single gradation of aggregate within specified limits.
      - 2) Bulk specific gravity for each aggregate constituent.
      - 3) Measured maximum specific gravity of mix at optimum asphalt content determined in accordance with ASTM D2041.
      - 4) Asphalt Content. Asphaltic material (PG-76) shall form from 5.0 to 8.0 percent of the mixture by weight.
      - 5) Percent of asphalt lost due to absorption by aggregate.
      - 6) Index of Retained Strength (TSR) at optimum asphalt content as determined by AASHTO T283.
      - 7) Percentage of asphalt cement, to nearest 0.1 percent, to be added to mixture.
      - 8) Optimum mixing temperature.
      - 9) Optimum compaction temperature.
  - 2. Manufacturer's Certificate of Compliance, in accordance with Section 01 33 00, for the following materials:
    - a. Aggregate: Gradation, source test results as defined in this Section.
    - b. Asphalt for Binder: Type, grade, and viscosity-temperature curve.
    - c. Prime Coat: Type and grade of asphalt.
    - d. Tack Coat: Type and grade of asphalt.
    - e. Additives.
    - f. Mix: Conforms to job-mix formula.
  - 4. Test Results:
    - a. Mix design.
    - b. Asphalt concrete core.
    - c. Gradation and asphalt content of uncompacted mix.

# 1.6 Quality Assurance

A. Perform All Work In Accordance With State Standard Specification Requirements.

# 1.7 Environmental Requirements

- A. Temperature: Do not apply asphalt materials or place asphalt mixes when ground temperature is lower than 60 degrees F or air temperature is lower than 40 degrees F. Measure ground and air temperature in shaded areas away from heat sources or wet surfaces.
- B. Moisture: Do not apply asphalt materials or place asphalt mixes when application surface is wet.

# 1.9 Warranty

A. The Contractor shall provide Owner with a two-year unconditional maintenance free warranty on the asphaltic concrete pavement. The warranty time shall begin on the date of final acceptance of the pavement by the Owner. The warranty shall be executed by the paving contractor and co-signed by the General Contractor.

## Part 2 Products

# 2.1 Asphalt Concrete Mix

#### A. General:

- 1. Meeting Alabama Department of Transportation Standard Specifications for Highway Construction, Current Edition.
- 2. Mix formula shall not be modified except with written approval of Engineer.
- 3. Source Changes:
  - a. Should material source(s) change, establish new asphalt concrete mix formula 5 days before new materials(s) is used.
  - b. Perform check tests of properties of plant-mix bituminous materials on first day of production and as requested by Engineer to confirm that properties are in compliance with design criteria.
  - c. Make adjustments in gradation or asphalt content as necessary to meet design criteria.
- B. Composition: Hot-plant mix of aggregate, mineral filler if required, and paving grade asphalt cement. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that resulting mixture meets grading requirements of mix formula.

# Part 3 Execution

## 3.1 Line And Grade

#### Asphalt Paving

A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.

## 3.2 Preparation

- A. Prepare subgrade as specified in Section 31 20 00 Earth Moving.
- B. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

# 3.3 Pavement Application

A. General: Place asphalt concrete mixture on approved, prepared base in conformance with this Section.

#### B. Pavement Mix:

- 1. Place asphalt concrete pavement mix in one single lift.
- 2. Compacted Lift Thickness:
  - a. Minimum: Twice maximum aggregate size, but in no case less than 1 inch.
  - b. Maximum: 2.5 inches.
- 3. Total Compacted Thickness: 2 inches.
- 4. Apply such that meet lines are straight and edges are vertical.
- 5. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
- 6. Joints:
  - a. Offset edge of each layer a minimum of 6 inches so joints are not directly over those in underlying layer.
  - b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
  - c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.

#### C. Compaction:

- 1. Uniformly compact to target density arrived at in compaction control strip.
- 2. Joint Compaction:
  - a. Place top or wearing layer as continuously as possible.
  - b. Cut back previously compacted mixture when Work is resumed to produce slightly beveled edge for full thickness of layer.
  - c. Cut away waste material and lay new mix against fresh cut.

#### D. Tolerances:

- General: Conduct measurements for conformity with crown and grade immediately after initial compression. Correct variations immediately by removal or addition of materials and by continuous rolling.
- 2. Completed Surface or Wearing Layer Smoothness:
  - a. Uniform texture, smooth, and uniform to crown and grade.
  - b. Maximum Deviation: 1/8 inch from lower edge of a 10-foot straightedge, measured continuously parallel and at right angle to centerline.
  - c. If surface of completed pavement deviates by more than twice specified tolerances, remove and replace wearing surface.
- 3. Transverse Slope Maximum Deviation: ¼ inch in 10 feet from rate of slope shown.
- 4. Finished Grade:
  - a. Perform field differential level survey on maximum 50-foot grid and along grade breaks.
  - b. Maximum Deviation: 0.02 foot from grade shown.

# 3.4 Pavement Overlay

### A. Preparation:

- 1. Remove fatty asphalt, grease drippings, dust, and other deleterious matter.
- 2. Surface Depressions: Fill with asphalt concrete mix, and thoroughly compact.
- 3. Damaged Areas: Remove broken or deteriorated asphalt concrete and patch as specified in Article Patching.

### B. Application:

- 1. Place and compact asphalt concrete as specified in Article "Pavement Application."
- 2. Place first layer to include widening of pavement and leveling of irregularities in surface of existing pavement.
- 3. When leveling irregular surfaces and raising low areas, the actual compacted thickness of any one lift shall not exceed 2 inches.
- 4. Actual compacted thickness of intermittent areas of 100 square yards or less may exceed 2 inches, but not 3 inches.
- 5. Final wearing layer shall be of uniform thickness, and meet grade and cross-section as shown.

# 3.5 Patching

#### A. Preparation:

1. Remove damaged, broken, or unsound asphalt concrete adjacent to patches. Trim to straight lines exposing smooth, sound, vertical edges.

### B. Application:

- 1. Patch Thickness: 2 inches or thickness of adjacent asphalt concrete, whichever is greater.
- 2. Place asphalt concrete mix across full width of patch in layers of equal thickness.

### Asphalt Paving

3. Spread and grade asphalt concrete with hand tools or mechanical spreader, depending on size of area to be patched.

## C. Compaction:

- 1. Roll patches with power rollers capable of providing compression of 200 to 300 pounds per linear inch. Use hand tampers where rolling is impractical.
- 2. Begin rolling top course at edges of patches, lapping adjacent asphalt surface at least ½ the roller width. Progress toward center of patch overlapping each preceding track by at least 1/2 width of roller.
- 3. Make sufficient passes over entire area to remove roller marks and to produce desired finished surface.

#### D. Tolerances:

- 1. Finished surface shall be flush with and match grade, slope, and crown of adjacent surface.
- 2. Tolerance: Surface smoothness shall not deviate more than ¼ inch when ten-foot long straightedge is laid across patched area between edges of new pavement and surface of old surfacing.

# 3.6 Testing

### A. Field Density Tests:

- 1. Measure with properly operating and calibrated nuclear density gauge in accordance with ASTM D2950.
- 2. Maximum Density: In accordance with ASTM D2041, using sample of mix taken prior to compaction from same location as density test sample.

#### B. Testing Frequency:

- 1. Quality Control Tests:
  - a. Asphalt Content, Aggregate Gradation: Once per every 500 tons of mix or once every 4 hours, whichever is greater.
  - b. Mix Design Properties, Measured Maximum (Rice's) Specific Gravity: Once every 1,000 tons or once every 8 hours, whichever is greater.
- 2. Density Tests: Once every 500 tons of mix or once every 4 hours, whichever is greater.

**END OF SECTION** 

# Part 1 General

# 1.1 Summary

#### A. Section Includes:

- 1. Work consists of furnishing and installing a Permeable Interlocking Concrete Pavement (PICP) System in accordance with these specifications and in general conformance with the lines, grades, design, and dimensions shown on the plans.
- 2. Installation work includes:
  - Verifying subgrade elevations and slope generally conform to the lines, grades, infiltration rate, density, and site conditions depicted in the construction documents;
  - b. Furnishing and installing geotextile and/or geomembrane liner (where required), horizontal drainage piping (where required), subbase course, base course, bedding course, edge restraint, concrete pavers and permeable joint material in general conformance to the lines and grades shown on the construction documents.

### 1.2 References

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM C33 Standard Specification for Concrete Aggregates
  - 2. ASTM C94 Standard Specification for Ready-Mixed Concrete
  - ASTM C131 Standard Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - 4. ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse-Grained Aggregates
  - 5. ASTM C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
  - 6. ASTM C936 Standard Specification for Solid Concrete Interlocking Paving Units
  - 7. ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete
  - 8. ASTM C1645 Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Interlocking Paving Units
  - 9. ASTM C1781 Standard Test Method for Surface Infiltration Rate of Permeable Unit Pavement Systems
  - 10. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
  - 11. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
  - 12. ASTM D3034 Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

### Permeable Interlocking Concrete Paving

- 13. ASTM D3350 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
- 14. ASTM D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
- 15. ASTM E2835 Standard Test Method for Measuring Deflections using a Portable Impulse Plate Load Test Device
- B. Interlocking Concrete Pavement Institute (ICPI)
  - 1. Permeable Interlocking Concrete Pavement manual (latest edition)
  - 2. Permeable Design Pro software for hydrologic and structural design
  - 3. Tech Specs and Technical Bulletins

## 1.3 Submittals

- A. Contractor shall submit to the owner for approval a minimum of four full-size samples of each concrete paver type/size/thickness/color/finish specified. The samples shall represent the range of shape, texture, and color permitted for the respective type. Color(s) will be selected by Architect/Engineer/Landscape Architect/Owner from Manufacturer's standard colors.
- B. Prior to delivery of the associated material to the site, the Contractor shall submit the following product-specific documentation for approval:
  - Aggregates
    - a. Sieve analysis per ASTM C136 for subbase, base, bedding and joint aggregate materials
    - b. Minimum 3 lb. sample of each material for independent testing.
  - 2. Concrete Pavers:
    - a. Test results from an independent testing laboratory for compliance to ASTM C936.
    - b. For machine installation projects, stitching details to be used during product placement.
    - c. Safety Data Sheets (SDS).
  - 3. Geosynthetics
    - a. One 18-inch x 18-inch panel of each type of geosynthetic (geotextile or geomembrane Liner) to be used for inspection and testing. The sample panels shall be uniformly rolled and shall be wrapped in plastic to protect the material from moisture and damage during shipment. Samples shall be externally tagged for easy identification. External identification shall include the name of the manufacturer; product type; product grade; lot number; and physical dimensions.
    - b. Current National Transportation Product Evaluation Program (NTPEP) evaluation report.
    - c. Safety Data Sheets (SDS).

# 1.4 Quality Assurance

- A. Contractor Qualifications:
  - Contractor shall submit a list of five (5) previously constructed projects of similar size and magnitude prior to the bid date to be qualified. Contact

- names, telephone numbers, and date of completion shall be listed for each project.
- 2. The Contractor's site foreman shall hold a PICP Specialist Designation from the Interlocking Concrete Pavement Institute (ICPI). The site foreman shall be onsite for the entire installation.
- 3. Contractor shall conform to all local, state/provincial licensing and bonding requirements.
- B. Mockups: Build mockups to verify selections made under submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Install a 10 ft x 10 ft paver area following the installation practices described in Article 3.2 to 3.4. This area shall be used to verify joint sizes; lines; laying pattern(s); stitching details (for mechanical installation); color(s); and, texture of the job.
  - 2. To provide a proper representation of color blend, blending during installation of sample mock-up will be pulled from a minimum of 3 cubes.
  - 3. This area shall be the standard from which the work will be judged.
  - Subject to approval by the Owner, the mock-up may be retained as part
    of the finished work. If mock-up is not retained, remove and dispose of
    mock-up at the completion of the project.

# 1.5 Delivery, Storage, And Handling

- A. Contractor shall coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
- B. Contractor shall check all materials upon delivery to assure that the proper materials have been received and are in good condition before signing off on the manufacturer's packing slip.
- C. Contractor shall protect all materials from damage or contamination due to job site conditions and in accordance with manufacturer's recommendations. Damaged or contaminated materials shall not be incorporated into the work.
- D. Concrete pavers shall be delivered to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by forklift or clamp lift. Unload and store concrete pavers at the job site in such a manner that no damage occurs to the product.
- E. Contractor shall handle and transport aggregates to avoid segregation, contamination, and degradation and keep different materials sufficiently separated as to prevent mixing. The material shall not be dumped or stored one material on top of another unless it is part of the installation process. Materials shall be covered to prevent removal by wind.
- F. Geosynthetics shall be delivered, stored and handled in accordance with ASTM D4873.

#### 1.6 Environmental Conditions

- A. Pavers shall not be installed during heavy rain, freezing conditions or snowfall.
- B. Pavers shall not be installed on frozen soil subgrade or aggregates.

### 1.7 Maintenance Materials

- A. Provide 50 square feet additional paver material for use by Owner for maintenance and repair.
- B. Store extra paver materials in Owner-designated location.

# Part 2 PRODUCTS

# 2.1 Permeable Interlocking Concrete Pavers

- A. Permeable Interlocking Concrete Pavers Basis-of-Design:
  - 1. Paver Name: Aqualine 3-piece system
    - a. Thickness: 3-1/8 inches (80 mm)
    - b. Color: Selected by Owner from samples submitted by contractor
    - c. Finish: Standard (Smooth)
    - d. Supplier:
      - Supplier: Local Belgard Supplier and Old Castle Company
    - e. Brent Davis, PLA, GSWCC Level II, Design Consultant Engineered Solutions Belgard
    - f. Substitutions: No substitutions permitted.
- B. Pavers shall meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units.
  - Measured length or width of test specimens shall not differ by more than +/- 0.063 in, while measured thickness shall not differ by more than +/-0.125 in.
  - 2. Average compressive strength of 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa) when tested in accordance with ASTM C140.
  - 3. Average absorption of 5% or less with no unit greater than 7% when tested in accordance with ASTM C140.
  - 4. Efflorescence shall not be a cause for rejection.
  - 5. Pigment in Concrete Pavers shall conform to ASTM C979.

# 2.2 Aggregate Materials

- A. General Requirements:
  - 1. Clean, non-plastic aggregate, free from deleterious or foreign matter, manufactured from crushed rock. Recycled aggregates shall not be used.
  - 2. Percent of angular and sub-angular particles greater than 90%. Rounded river gravel shall not be used.
  - 3. LA Abrasion of the aggregate used shall be less than 40 as per ASTM C131.

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- 4. All aggregates shall be washed and have less than 2% passing the No. 200 (0.075 mm) sieve.
- 5. All aggregate material gradations shall be tested in accordance with ASTM C136.
- B. Bedding Course/Joint Fill Material open-graded aggregate conforming to the following gradation:

Note: No. 89 or No. 9 stone may be used as joint fill material. If No. 8 stone material is not available locally, No. 89 can be used as a bedding course if choke criteria is met with underlying base aggregate.

ASTM C33 size No. 8

Sieve Size	Percent Passing
1/2 in. (12.5 mm)	100
3/8 in. (9.5 mm)	85 to 100
No. 4 (4.75 mm)	10 to 30
No. 8 (2.36 mm)	0 to 10
No. 16 (1.18 mm)	0 to 5
No. 200 (0.075 mm)	0 - 2

C. Base Course Material - open graded aggregate conforming to the following gradation:

ASTM C33 size No. 57

Sieve Size	Percent Passing
1-½ in. (37.5 mm)	100
1 in. (25 mm)	95 to 100
1/2 in. (12.5 mm)	25 to 60
3/8 in. (9.5 mm)	0 to 10
No. 4 (4.75 mm)	0 to 5
No. 200 (0.075 mm)	0 - 2

D. Subbase Course Material – open-graded aggregate conforming to the following gradation:

Note: ASTM No. 3 or No. 4 may be used as subbase material if No. 2 stone in unavailable locally.

ASTM C33 size No. 2

Sieve Size	Percent Passing
3 in. (75 mm)	100
2- ½ in. (63 mm)	90 to 100
2 in. (50 mm)	35 to 70
1-½ in. (37.5 mm)	0 to 15
¾ in. (19 mm)	0 to 5
No. 200 (0.075 mm)	0 - 2

# 2.3 Edge Restraints

A. Edge restraints shall be cast in place concrete curbs in general conformance with the specifications and dimensions in the construction documents

# 2.4 Pipe Underdrains

A. Where shown on the plans, pipe underdrains shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D3034 or corrugated HDPE pipe manufactured in accordance with ASTM D3350 and comply with the requirements of Section 33 46 14.19 - Pipe Underdrains.

# Part 3 Execution

# 3.1 Preparation

- A. Prior to commencement of any work, the Contractor shall conduct a preconstruction meeting with the Owner, Designer, and affected sub-trades. The pre-construction meeting should establish contractor responsibilities and at a minimum verify:
  - 1. The location of the mock-up, and whether it will be part of the final construction or need to be removed.
  - 2. The site layout is in general conformance to the construction documents. In particular, the location and elevation of discharge points (if any) of the pipe underdrains.
  - 3. The subgrade lines and elevations are in general conformance with the construction documents. The subgrade elevations shall be within +/- 0.1 ft of the specified grades.
  - 4. The minimum slope of subgrade shall be at least 0.5% or as specified in the design.
  - 5. Subgrade soil conditions and grades meet the requirements in the construction documents.
  - 6. The details of the site's erosion and sediment control plan.
- B. Proof-roll prepared subgrade according to requirements in Section 31 20 00 Earth Moving to identify soft pockets and areas of excess yielding. Proceed with subbase installation only after deficient subgrades have been corrected. Scarify subgrade surface following any stabilization efforts before installing subbase course.
- C. If compaction is required in the construction documents, Contractor shall verify compaction of the subgrade is in general conformance with the construction documents prior to placing subbase materials.
- D. Once the Contractor has confirmed the subgrade conditions are in general conformance with the requirements in the construction documents, the Contractor shall begin installing the subbase material. By initiating installation of the subbase material, the Contractor acknowledges acceptance of the subgrade.

## 3.2 Installation Of Subbase And Base Courses

- A. Keep the area where the pavement is to be constructed free from sediment during the entire job. Any materials contaminated with sediment shall be removed and replaced with clean material.
- B. Install membrane liner and any associated cushion geotextile in accordance with the manufacturer's recommendations. The membrane liner is applied to the bottom and sides of the excavation for non-infiltration purposes and must include a drainage pipe. Allow for enough membrane liner to exceed the final elevation of the surface. After completion of the surface, the excess liner should be cut flush with the finished grade. Membrane lines shall be welded together and boots installed around all protrusions.
- C. Install geotextiles as required in accordance with the specifications and drawings. The geotextile is applied to the bottom and sides of the excavation with overlapping joints a minimum of [12 inches] [24 inches]. Overlaps to be constructed to "shingle" moisture from upstream panel to downstream panel. Allow for enough geotextile to exceed the final elevation of the surface. After completion of the surface, the excess geotextile should be cut flush with the finished grade.
- D. Install the subbase course and base course at the thicknesses, compaction rates, surface tolerances, and elevations outlined below.
  - 1. Place and spread the first layer of subbase without displacing or damaging the geosynthetics (if used). To prevent damage, tracked vehicles shall not be allowed directly on the geotextiles or geomembranes during the initial spreading process of the subbase layer.
  - 2. The aggregate should be spread and compacted in uniform layers not exceeding 6-inch loose thickness. Compaction is performed using either a 10 T (10 ton) vibratory roller or a minimum 13,500 lb-f centrifugal force reversible vibratory plate compactor. For each lift, make at least two passes in the vibratory mode and at least two passes in the static mode and continue compaction until there is no visible movement in the materials.
  - 3. At the specified elevation(s), install the pipe underdrains in accordance with the manufacturer's recommendations. Ensure the pipes are sloped to provide proper drainage to the outlets. Pipes shall be surrounded by a minimum of 4 inches of base course material to prevent damage during compaction. Care must be taken not to damage pipe underdrains during subsequent aggregate installation.
  - 4. Final subbase surface tolerance shall be plus or minus 0.1 ft over a 10-foot straight edge laid in any direction.
  - 5. Final base surface tolerance shall be plus or minus 3/4 inch over a 10-foot straight edge laid in any direction.
  - 6. Provide proper compaction near curbs, grade beams, concrete collars around utility structures, lights standards, tree wells, building edges and other protrusions as applicable to the project.
- E. Before starting to place the bedding course, the base shall be inspected and approved by the Owner or the Designer.

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- F. Light Weight Deflectometer (LWD) for Compacted Base Aggregate Deflection Testing:
  - 1. After three preloading drops, the maximum average deflection from three additional drops shall be no greater than 0.5 mm.
  - 2. Conduct LWD tests on every (800 tons) of remaining area of compacted base aggregates.]
- G. LWD Test Report shall include the following:
  - 1. Project description.
  - Sketch of the test area and numbered test locations.
  - 3. Aggregate type and layer thicknesses.
  - 4. Aggregate characteristic properties: gradation, porosity, bulk density.
  - 5. Compaction equipment type and weight.
  - 6. Static and/or vibratory compaction.
  - 7. Number of passes of the compaction equipment.
  - 8. Average of three deflections for each location.

# 3.3 Installation Of Edge Restraints

A. All concrete edge restraints shall be constructed to dimensions and grades in general conformance with the construction documents and shall be supported on a compacted base not less than 6-inch thick and meet local requirements or the requirements of Section 32 16 13 Curbs and Gutters whichever are more restrictive. All concrete shall be in accordance with ASTM C94 requirements.

# 3.4 Installation Of Bedding Course, Pavers, And Joint Material

- A. Spread the bedding course evenly over the base course and screed to a nominal 2 in. thickness utilizing an approved mechanical spreader or by screed rails and boards. Do not use the bedding material to fill depressions in the base course surface. Surface tolerances shall be +/- 3/8 inch over a 10-foot straight edge.
- B. Ensure that concrete pavers are free of foreign material before installation. Concrete pavers shall be inspected for color distribution and all chipped, damaged, or discolored concrete pavers shall be replaced. Initiation of concrete paver placement shall be deemed to represent acceptance of the pavers.
- C. Lay the concrete pavers in the pattern(s) shown on the drawings. Maintain straight pattern lines. For mechanical installations, follow the stitching details as submitted and verified during the mock-up.
- D. Paving units shall be installed simultaneously from a minimum of 3 bundles for hand installations, and 6 bundles for mechanical installations to provide proper color blending.
- E. Joints between the individual concrete pavers shall be uniformly maintained and installed in accordance with the in-place dimensions

- F. Fill gaps at the edges of the paved area with cut pavers or edge units. Do not install cut pavers smaller than one-third of a whole paver along edges subject to vehicular traffic trim two pavers to fit.
- G. Cut pavers using a masonry saw or splitting device. Upon completion of cutting, the area must be swept clean of all debris.
- H. Using a low amplitude plate compactor capable of at least 5,000 lbs. (22 kN) compaction at a frequency of 75 Hz –100 Hz, compact and seat the concrete pavers into the bedding course.
- I. The pavers shall be compacted to achieve consolidation of the bedding course and brought to level and profile by not less than three passes. Initial compaction should proceed as closely as possible following the installation of the paving units and prior to the acceptance of any traffic.
- J. Any units that are structurally damaged during compaction shall be immediately removed and replaced.
- K. Apply the joint material to the surface and sweep into the joints and voids. Fill joints and voids then sweep off excess material before vibrating the material down into the joints using a plate compactor. This will typically require two to three passes with the plate compactor.
- L. Do not compact within 6 feet of unrestrained edges of the paving units.
- M. All work to within 6 feet (1 m) of the laying face must be left fully compacted at the end of each day.
- N. Sweep off excess aggregate when the job is complete.

### 3.5 As-Built Construction Tolerances

- A. Final inspection shall be conducted to verify conformance to the drawings after removal of excess aggregate. All pavements shall be finished to lines and levels to ensure positive drainage at all drainage outlets and channels.
- B. The final surface elevations shall not deviate more than +/- 3/8 inch under a 10 ft long straight edge.
- C. Lippage shall be no greater than 1/8-inch difference in height between adjacent pavers.
- D. Bond lines for the pavers shall be +/- 1/2-inch over a 50-foot string ling.
- E. Verify the in-situ surface infiltration rate of the permeable pavement is a minimum of 100 in/hour using ASTM C1781.

## 3.6 Maintenance And Protection

- A. At the completion of the work, the Contractor shall provide the Owner with the manufacturer's PICP System Operation and Maintenance Guidelines.
- B. Once the work is complete, the Owner shall be responsible for protecting the work from sediment deposition and damage due to subsequent construction activity on the site.
- C. The Contractor shall return to the site after 6 months from the completion of the work and conduct an inspection of the PICP System with the Owner, Designer, and Contractor in accordance with the PICP System Operation and Maintenance Guidelines.

**END OF SECTION** 

# Concrete Sidewalks and Curbs

# Part 1 - General

### 1.1 Work Included

- A. Concrete curbs.
- B. Concrete sidewalks.

# 1.2 Measurement For Payment

- A. Sidewalks: The quantities of sidewalks to be paid for will be the number of square yards of each depth of sidewalk constructed as indicated.
- B. Curbs: The quantities of curbs and gutters to be paid for will be the number of linear feet of each cross section constructed as indicated, measured along the face of the curb at the gutter line.

# 1.3 Basis For Payment

- A. Sidewalks: Payment of the quantities of sidewalks measured as specified will be at the contract unit price per square yard of the thickness specified.
- B. Curbs: Payment of the quantities of curbs and gutters measured as specified will be at the contract unit price per linear foot of each cross section.

### 1.4 References

- A. ASTM International (ASTM)
  - 1. ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
  - 2. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete
  - 3. ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete
  - 4. ASTM C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
  - ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
  - 6. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
  - 7. ASTM C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - 8. ASTM C920 Standard Specification for Elastomeric Joint Sealants
  - 9. ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

10. ASTM D5893 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

# 1.5 System Description

#### A. General Requirements

- Provide plant, equipment, machines, and tools used in the work subject to approval and maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified.
- 2. Use of the equipment shall be discontinued if it produces unsatisfactory results.
- 3. The Landscape Architect shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.
- B. Slip Form Equipment: Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

## 1.6 Submittals

- A. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:
- B. Submit manufacturer/supplier certifications for aggregate and cement. Provide the project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates, materials manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results.
- C. Submit mix design in accordance with ACI requirements. Provide for each mix design, the project name, city, general contractor, concrete strength, and it's intended use.
- D. Submit 2 copies of laboratory test reports with standard deviation analysis or trial batch data. All concrete materials shall be listed.

# 1.7 Environmental Requirements

### A. Placing During Cold Weather

- 1. Do not place concrete when the air temperature reaches 40 degrees F and is falling, or is already below that point.
- 2. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Make provisions to protect the concrete from freezing during the specified curing period.

- 3. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions.
- 4. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited.
- 5. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating shall be approved.
- 6. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer.
- 7. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

# B. Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F
except where an approved retarder is used. The mixing water and/or
aggregates shall be cooled, if necessary, to maintain a satisfactory placing
temperature. The placing temperature shall not exceed 95 degrees F at
any time.

# Part 2 Products

#### 2.1 CONCRETE

A. Provide concrete conforming to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 4000 psi at 28 days. Maximum size of aggregate shall be one inch. Submit copies of certified delivery tickets for all concrete used in the construction.

#### B. Air Content

1. Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

#### C. Slump

1. The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C143.

#### D. Reinforcement Steel

1. Reinforcement bars shall conform to ASTM A615. Wire mesh reinforcement shall conform to ASTM A1064.

# 2.2 Concrete Curing Materials

- A. Impervious Sheet Materials: Impervious sheet materials shall conform to ASTM C171, type optional, except that polyethylene film, if used, shall be white opaque.
- B. Burlap: Burlap shall conform to AASHTO M 182.

#### 2.3 Concrete Protection Materials

A. Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

# 2.4 Joint Filler Strips

- A. Contraction Joint Filler for Curb: Contraction joint filler for curb shall consist of hard-pressed fiberboard.
- B. Expansion Joint Filler, Pre-molded
  - Expansion joint filler, pre-molded, shall conform to ASTM D1751 or ASTM D1752,
     1/2 inch thick, unless otherwise indicated.

#### 2.5 Joint Sealants

A. Joint sealant, cold-applied shall conform to ASTM C920 or ASTM D5893.

### 2.6 Form Work

- A. Design and construct form work to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified.
- B. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete.
  - 1. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects.
    - a. Wood forms shall have a nominal length of 10 feet.
    - b. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness.

- 2. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points.
  - a. Ends of steel forms shall be interlocking and self-aligning.
  - b. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers.
  - c. Steel forms shall have a nominal length of 10 feet with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.
- C. Sidewalk Forms: Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.
- D. Curb Forms: Curb outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form.
  - Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used.
  - 2. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.
  - 3. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

## Part 3 Execution

# 3.1 Subgrade Preparation

- A. The subgrade shall be constructed to the specified grade and cross section prior to concrete placement.
- B. Subgrade shall be placed and compacted in conformance with Section 31 20 00 Earth Moving.
- C. Sidewalk Subgrade: The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.
- D. Curb Subgrade: The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.
- E. Maintenance of Subgrade: The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition

when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

# 3.2 Form Setting

- A. Set forms to the indicated alignment, grade and dimensions.
- B. Hold forms rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet.
  - 1. Corners, deep sections, and radius bends shall have additional stakes and braces, as required.
  - 2. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms.
- C. Forms shall be removed without injuring the concrete.
  - 1. Bars or heavy tools shall not be used against the concrete in removing the forms.
- D. Any concrete found defective after form removal shall be promptly and satisfactorily repaired.
- E. Forms shall be cleaned and coated with form oil each time before concrete is placed.
  - 1. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

#### F. Sidewalks

- 1. Set forms for sidewalks with the upper edge true to line and grade with an allowable tolerance of 1/4 inch in any 10 foot long section.
- 2. After forms are set, grade and alignment shall be checked with a 10 foot straightedge.
- Forms shall have a transverse slope as indicated with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

#### G. Curbs

- 1. The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed.
- 2. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing.

# 3.3 Sidewalk Concrete Placement And Finishing

#### A. Formed Sidewalks

- 1. Place concrete in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated.
- 2. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted.
- 3. The concrete shall be consolidated by tamping and spading or with an approved vibrator, and the surface shall be finished to grade with a strike off.

#### B. Concrete Finishing

- After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.
- 2. Edge and Joint Finishing:
  - a. Refer to the Drawings for concrete sidewalk finish details.
  - b. All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch.
  - c. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger.
  - d. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.
- C. Surface and Thickness Tolerances: Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

# 3.4 Curb Concrete Placement And Finishing

- A. Formed Curb: Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped curbs shall be finished with a standard curb "mule".
- B. Curb Finishing: Approved slipformed curb and gutter machines may be used in lieu of hand placement.

### C. Concrete Finishing

- 1. Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes.
- 2. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch.

- Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed.
- 5. Joint Finishing: Curb edges at formed joints shall be finished as indicated.
- D. Surface and Thickness Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

### 3.5 Sidewalk Joints

- A. Sidewalk joints shall be constructed to divide the surface into rectangular areas.
  - 1. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or as indicated on the Drawings, whichever is less, and shall be continuous across the slab.
  - 2. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width.
  - 3. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs.
  - 4. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated.
- B. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated and to match the adjacent paving.
  - 1. Expansion joints are required between sidewalks and curb/walls that abut the sidewalk longitudinally.
- C. Sidewalk Contraction Joints: The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved.
  - 1. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated.
  - 2. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

#### D. Sidewalk Expansion Joints

 Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D1752 or building paper.

- 2. Joint filler shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing.
- 3. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed.
- 4. At the end of the curing period, expansion joints shall be cleaned and filled with cold-applied joint sealant.
- 5. Joint sealant shall be gray or stone in color.
- 6. The joint opening shall be thoroughly cleaned before the sealing material is placed.
- 7. Sealing material shall not be spilled on exposed surfaces of the concrete.
- 8. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material.
- 9. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

#### E. Reinforcement Steel Placement

1. Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

### 3.6 Curb Joints

A. Curb joints shall be constructed at right angles to the line of curb.

#### B. Contraction Joints

- 1. Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length.
- Contraction joints (except for slip forming) shall be constructed by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.
- 3. When slip forming is used, the contraction joints shall be cut in the top portion of the gutter/curb hardened concrete in a continuous cut across the curb, using a power-driven saw. The depth of cut shall be at least one-fourth of the curb depth and 1/8 inch in width.

## C. Expansion Joints

 Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb. Expansion joints shall be provided in curb directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement.

#### Concrete Sidewalks and Curbs

- 2. Where curb do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not less than 10 feet nor greater than 40 feet.
- 3. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated.
- 4. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit.
- 5. Expansion joints and the top 1 inch depth of curb contraction-joints shall be sealed with joint sealant.
- 6. The joint opening shall be thoroughly cleaned before the sealing material is placed.
- 7. Sealing material shall not be spilled on exposed surfaces of the concrete.
- 8. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material.
- 9. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

# 3.7 Curing And Protection

### A. General Requirements

- 1. Protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation.
- 2. Protect unhardened concrete from rain and flowing water.
- 3. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins.
- 4. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

### B. Impervious Sheeting Method

- 1. The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material.
- 2. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used.
- 3. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets.
- 4. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing.
- 5. The curing medium shall remain on the concrete surface to be cured for not less than 72 hours.

## C. Membrane Curing Method

 A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed

- surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms.
- 2. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears.
- 3. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage rate of approximately 200 square feet/gallon for the total of both coats.
- 4. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat.
- 5. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes.
- 6. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above.
- 7. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed.
- 8. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints.
- 9. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period.
- 10. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time.
- 11. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

# 3.8 Backfilling

A. After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

#### 3.9 Protection

A. Completed concrete shall be protected from damage until accepted.

B. Repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

## 3.10 Field Quality Control

A. Submit copies of all test reports within 24 hours of completion of the test.

### B. General Requirements

- 1. Perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing.
- 2. Based upon the results of these inspections and tests, take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

#### C. Concrete Testing

- Strength Testing: Provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C172. Cylinders for acceptance shall be molded in conformance with ASTM C31 by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.
- 2. Air Content: Determine air content in accordance with ASTM C173 or ASTM C231. ASTM C231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Owner's inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.
- 3. Slump Test: Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

- 4. Thickness Evaluation: The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.
- 5. Surface Evaluation: The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

#### 3.11 Surface Deficiencies And Corrections

- A. Thickness Deficiency: When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.
- B. High Areas: In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. Areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.
- C. Appearance: Exposed surfaces of the finished work will be inspected by the Owner and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

**END OF SECTION** 

# **PVC Coated Chain Link Fencing**

### Part 1 - General

- 1.1 Submit complete specifications and shop drawings for the A/E's approval.
- 1.2 Furnish and install materials as noted on contract documents.
- 1.3 Fencing and all accessories shall be provided by a single distributor.
- 1.4 Refer to other Sections for work related to that specified under this heading.
- 1.5 Height of all chain link fences shall be as indicated on the drawings.
- 1.6 Fencing shall be provided for each area as specified under section Fencing Schedule.
- 1.7 Contractor is to supply and install PVC coated fencing fabric, Posts, Rails, etc. Class 2B Thermally Fused per ASTM F668 Class 2b.
- 1.8 SHOP DRAWINGS: Submit layout of fences and gates, with dimensions, details, and finishes of components, accessories, and post foundations.
- 1.9 SAMPLES: Submit Color selection for PVC finishes and fabric to A/E.
- 1.10 Submittals to be per Document 01 33 00 Submittals Procedures requirements.

## Part 2 - Products

- 2.1 Products from qualified manufacturers having a minimum of five years' experience manufacturing thermally fused chain link fencing.
- 2.2 POSTS, RAILS, AND BRACES
  - A. All structural and roll formed shapes shall conform to the provisions of ASTM A123 for galvanized coating.
  - B. All tubular members shall comply with SS40 for weight and coating or be high strength triple coated steel in accordance with ASTM A569.
    - 1. End, Corner, and Pull Post: For fence up to and including 12' 0" in height, 3" diameter SS-40. For 24'-0" in height fencing, 6-5/8" diameter SS049 tubular posts. A minimum of 15 micrograms of zinc chromate per square inch, and a minimum of 10 mils of lifecoat fuse bonded polyester powder exterior coating, on pipe size normally not available with class 2B thermally fused.
    - 2. Line Posts General (10' 0" Maximum Spacing):
      - a. Fabric Up To 6'-0" in Height: Manufacturers standard type SS40 tubular steel posts 2" nominal diameter.
      - b. Fabric 8'-0" in Height and Over: Manufacturer's standard type 2 ½"

SS40 tubular steel posts.

c. 24' height fencing - Type 5540 4" diameter.

#### Gate Posts:

- a. Gate Leaves Up To and including 6'-0" Wide: 3½" diameter SS-40.
- b. Gate Leaves Over 13'-0" and Up To and Including 18'-0" Wide: 6-5/8" outside diameter, Schedule 40 pipe or higher strength steel pipe.

### 4. Top Rail and Bottom Rail:

- a. The top rail shall be a type SS20 tubular steel as specified in the Fencing Schedule.
- b. Furnish in the manufacturer's standard lengths of approximately 21'-0", with each piece having swedged ends approximately 6" long for each joint. Provide means for attaching top rails securely to each gate, corner, pull, and end posts. The top rail shall form a continuous brace from end to end to each run of fence.
- c. Tension Wire: 7 gauge galvanized or aluminum coated coil spring wire
- 5. Post Bracing Assembly: To match top rail. Brace rail assembly shall be complete with a 3/8" diameter rod and adjustable take-up. Provide brace rails for fencing over 6' in height.
- 6. PVC Coated Finish: In accordance with ASTM F1043, apply supplemental color coating of 10 to 15 mils of thermally fused PVC in black color to match fabric.

### 2.3 Chain Link Fabric General

- A. The fabric shall consist of one piece fabric widths for fences up to 12'-0". The fabric shall be 2" mesh, 6 or 9 gauge, or as specified on drawings, with heights as indicated on the drawings. All fabric shall be PVC coated thermally fused to zinc-coated or zinc -5% aluminum-misch metal alloy coated steel core wire: ASTM F668 Class 2b, 7 mil thickness thermally fused. Core wire tensile strength 75,000 PSI. Refer to drawing.
- B. Selvage Edges: Fence fabric shall be knuckled at both selvages for all fence heights.

#### 2.4 Accessories

- A. All accessories, except tie wires, shall be galvanized to comply with ASTM A153. Finish matching framing and fabric.
- B. Post Tops: pressed steel or malleable iron (designed as a weather tight closure cap for tubular posts). Where top rail is used, provide tops to permit the passage of the top rail.
- C. Stretcher Bars (for tubular end, corner, pull, or gate posts only): one piece lengths equal to the full height of the fabric, with a minimum cross section of 3/16" by 3/4". Provide one stretcher bar for each gate and end post and two for each corner and pull post.

- D. Stretcher Bar Bands: heavy pressed steel spaced not over 15" on center to secure stretcher bars to tubular end, corner pull, and gate post.
- E. Wire Ties: For tying fabric to line posts, use 9 gauge aluminum wire ties for tubular posts, spaced 14" on center. For tying fabric to rails and braces, use 9 gauge aluminum wire ties spaced 24" on center. For tying fabric to tension wire, use 11 gauge hog rings spaced 24" on center.
- F. Nuts and bolts are galvanized but not vinyl coated. Paint with PVC touch up paint to match color coat.

### 2.5 Gates

- A. Ballfield Gates Gates shall be pre-fabricated units to match the ballfield fencing posts in finish.
- B. Site Gates Fabricate gate perimeter frames of 1.90" outside diameter tubular members galvanized in accordance with ASTM A120. Provide additional horizontal and vertical members to ensure proper gate operation and to allow for attachment of fabric, hardware, and accessories. Allow for concrete curb at dugout and infield gates. Frame to be painted with minimum of three (3) coats of PVC paint of color to match fabric.
- C. Assemble gate frames by welding or fittings and rivets for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges, and tie at top and bottom edges. Attach stretcher bars to gate frame at not more than 15" on center. Attach hardware with rivets or by other means that will provide security against removal or breakage.
- D. Provide diagonal cross bracing that consists of 3/8" diameter adjustable length truss rods on gates where necessary to provide frame rigidity without sag or twist.
- E. Gate Hardware: Provide the following hardware and accessories, with a heavy galvanized finish, for each gate:
  - 1. Hinges: pressed steel or malleable iron to suit gate size, nonlift-off type, offset to permit 180 degrees gate opening. Provide one pair of hinges for each leaf.
  - 2. Latch: forked type or plunger bar type to permit operation from either side of the gate. Provide padlock eye as an integral part of the latch.
  - 3. Keeper: Provide a keeper for all vehicle gates that automatically engages the gate leaf and holds it in the open position until manually released.
  - 4. Double Gates: Provide gate stops for all double gates consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Provide locking device and padlock eyes as an integral part of the latch, with one padlock for locking both gate leaves.
- F. Gate hardware to be galvanized but not vinyl coated. Paint with with minimum of two (2) costs of PVC touch up paint to color coat.

# 2.6 Fencing Schedule

A. Line Fencing: Line fences shall be at the heights as shown on the drawings with top

and center rails. Stretch from outside wire.

- 1. Line Posts: Type SS20 2" nominal diameter
- 2. Terminal Posts: Type SS40 2½" nominal diameter
- 3. Fabric: The fabric shall consist of one piece fabric width composed of 2" mesh of either 6 or 9 gauge wire. Refer to the Drawings.
- 4. Bottom Bracing: Bottom Rail as specified.

### Part 3 - Execution

- 3.1 The packing for all products shall be Level C.
- 3.2 Set all posts in a 3,500 PSI concrete footing.
  - A. Trowel smooth the top of each footing at a 20 degrees angle from the post to the surrounding ground so as to shed water away from the post. The post shall extend to the full depth of the footing. Fencing 8' high and below shall have a footing (4) times the width of the post (min) in diameter and 3' deep. Fencing above 8' shall have a footing (4) times the width of the post (min) in diameter and 4' deep (min).
- 3.3 Install All Fencing To The Limits Shown On The Drawings.
  - A. Install end or corner posts at any break in the alignment greater than 20 degrees. Install intermediate posts between end or corner posts, spaced equally at a maximum of 10 feet center to center. Install end, corner, or gate posts on both sides of a gate. Only one end or corner post shall be installed at the junction of different heights of fence and shall be consistent with the largest post required at the junction.
  - B. Install gates to allow a clear and level swing in either direction to their maximum limit. Set all posts with a vertical tolerance of less than 1" in 10' as measured with a plumb bob.
- 3.4 All Corner, Terminal, And Gate Posts For Fence 6' And Higher Shall Have A Mid-Rail And 3/8 Round Adjustable Truss Rod To The Next Post.
- 3.5 All Gates Shall Have A Full Wraparound Hinge System With A Positive Latch With Provision For A Padlock. Gates 5' And Under Shall Have A Self-Closing Mechanism.
- 3.6 All Fences Shall Have A Bottom Rail Attached To The Fabric And Posts.

**END OF SECTION** 

### Part 1 General

## 1.1 Summary

A. This Section includes piping, valves, sprinklers, controls and wiring for automatic control irrigation systems.

### 1.2 Definitions

- A. Lateral Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.
- C. Mainline Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- D. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. FRP: Fiberglass-reinforced plastic.
  - 3. PA: Polyamide (nylon) plastic.
  - 4. PE: Polyethylene plastic.
  - 5. PP: Polypropylene plastic.
  - 6. PTFE: Polytetrafluoroethylene plastic.
  - 7. PVC: Polyvinyl chloride plastic.
  - 8. TFE: Tetrafluoroethylene plastic.
  - 9. HDPE High Density Polyethylene plastic.

## 1.3 Performance Requirements

- A. Head to head coverage irrigation system for lawns and exterior plants as shown or indicated on associated plans.
- B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain a minimum of head to head coverage of turf and planting areas unless otherwise indicated.
- C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:
  - 1. Irrigation Main Piping: 200 psi.
  - 2. Lateral Piping: 200 psi.

### 1.4 Submittals

- A. Product Data: Include pressure ratings, rated capacities, and settings of selected models for the following:
  - 1. Electrical Control Valves.
  - Quick Coupler Valves.
  - 3. Isolation Valves.
  - Valve boxes.
  - 5. Sprinklers.
  - 6. Controllers and associated communication equipment.
  - 7. Control cables. Include splice kits.
  - 8. Decoders.
  - 9. Grounding equipment.
  - 10. PVC fittings.
  - 11. PVC Primer and Cement.
  - 12. Mainline, Lateral and Sleeve piping.
  - 13. Mainline, Lateral pipe fittings
  - 14. Sensors
- B. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals including data for the following:
  - 1. Automatic-control valves.
  - 2. Isolation valves.
  - 3. Sprinklers.
  - 4. Control systems.

## 1.5 Quality Assurance

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

# 1.6 Delivery, Storage, And Handling

- A. Deliver piping 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.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 Project Conditions

- A. Interruption of Irrigation System Operation for Existing Sports Fields: Do not interrupt irrigation system operation to the existing sports fields occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service, if needed, to maintain the fields, according to requirements indicated:
  - 1. Notify Owner's Representative no fewer than two (5) days in advance of proposed interruption of water supply to sports fields.
  - 2. Do not proceed with interruption of irrigation system operation without Owner's Representative written permission.
- B. Removal of Hardscape: Do not remove hardscape surface unless permitted under the following conditions:
  - 1. Coordinate with Owner's Representative no fewer than two (2) days in advance of proposed hardscape removal.
  - 2. Hardscape removal must not interrupt normal traffic flow on hardscape area.
  - 3. Area of removal must be useable prior to close of work day and completely repaired within 2 days of removal.

### 1.8 Coordination

A. A. Coordinate installation of irrigation system with Owner's Representative and/or all other trades on site to insure irrigation system or other work on site will not be damaged. Should contractor fail to coordinate and damages occur it will be the contractor's responsibility to repair damages at his own costs.

### 1.9 Extra Materials

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Rotary Sprinkler Units: Equal to two (2) percent of amount installed for each type and size indicated, but no fewer than 10 units.
  - 2. Spray Sprinkler Units: Equal to two (2) percent of amount installed for each type and size indicated, but no fewer than 10 units.
  - 3. Electric Control Valve Units: Equal to five (5) percent of amount installed for each type indicated, but no fewer than ten (5) units of each size and type.
  - 4. Isolation Valves: Equal to five (5) percent of amount installed for each type indicated, but no fewer than two (2) units of each type.

### 1.10 Product Substitution

A. All products other than those shown on the plans and in the specifications must be pre-approved for use prior to bid date. Product substitution request must be made 14 days prior to bid date. Requested product substitution will be analyzed based on

how well the product meets the plans and specifications intent. If product is approved information to that effect will be included in Addendum form no later than 7 days prior to bid date.

### Part 2 Products

#### 2.1 Manufacturers

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide and warrantee products by one of the manufacturers specified.
  - System components shown in the Irrigation Schedule within the Irrigation Plans
    are the basis for design, other manufacturers equal products will be considered
    for pre-approval prior to the Request for Information (RFI) in the bid process.
    Products submitted for approval after the RFI cut off date will not be accepted

## 2.2 Pipes, Tubes, And Fittings

- A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, Type S or E, Grade A or B, galvanized with threaded ends.
  - 1. Steel Pipe Nipples: ASTM A 733 made of ASTMA 53A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe with threaded ends.
  - Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
  - 3. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
  - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
  - 5. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.
  - B. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
    - Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
    - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
    - Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
  - C. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
    - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

- 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
- 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
- D. PVC Pipe: ASTM D 1785, PVC 1120 compound, Class 200.
  - 1. PVC Socket Fittings, Schedule 40: ASTM D 2466, 3" and smaller for lateral pipe
  - 2. Ductile Iron Gasket Joint Fittings ASTM A536 for pipe sizes 3" and larger for mainline pipe, all ductile iron fittings to have joint restraints as per manufacturer's recommendations.
- E. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedule 80.
  - 1. PVC Socket Fittings, Schedule 80: ASTM D 2467.
  - 2. PVC Threaded Fittings: ASTM D 2464.

## 2.3 General-Duty Valves

- A. AWWA, Cast-Iron Gate Valves: AWWA C509, resilient-wedge nonrising-stem, grayor ductile-iron body and bonnet gate valve, epoxy coated; with steel stem and 2" operating nut.
  - 1. Minimum: Working Pressure: 200 psig.
  - 2. End Connections: Mechanical join flanged or ring-tite.
  - 3. Interior Coating: Complying with AWWA C550.
  - 4. Manufacturers:
    - a. Matco
    - b. Leemco
    - c. Pre-approved Equal
- B. Isolation Valve Boxes: Ten inch circular valve box with 6" SDR 21 PVC pipe riser from top of valve to center line of valve box. Pipe to be centered on operating nut to allow easy access.
  - 1. Operating Wrenches: Furnish total of two (2) steel, tee-handle operating wrenches with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Bronze Gate Valves: MSS SP-80, Class 125, Type 1, nonrising-stem, bronze body with solid wedge, threaded ends, and malleable-iron hand wheel.
  - 1. Manufacturers:
    - a. NIBCO INC.
    - b. Pre-approved Equal.

## 2.4 Specialty Valves

#### **Irrigation Systems**

- A. Quick-Couplers: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.
  - 1. Locking-Top Option: Vandal-resistant, locking feature. Include four matching keys with hose swivel for each key.
  - 2. Manufacturers:
    - a. Toro.
    - b. Pre-approved Equal.

### 2.5 Control-Valve Boxes

- A. Plastic Control-Valve Boxes: Box and cover, with open bottom and openings for piping; designed for installing flush with grade. Size for all valves to be standard 12" rectangular.
  - 1. Shape: Rectangular.
  - 2. Sidewall Material: ABS.
  - 3. Cover Material: ABS.
    - a. Lettering: IRRIGATION.
    - b. Green in Color.
    - c. Lockable with hex key mechanism or similar.
  - 4. Manufacturers:
    - d. Rain Bird.
    - e. Pre-approved Equal.

# 2.6 Sprinklers

- A. Description: Plastic housing and corrosion-resistant interior parts designed for uniform coverage over entire spray area indicated, at available water pressure.
  - 1. Manufacturers:
    - a. Toro.
    - b. Pre-approved Equal
  - 2. Pop-up, Rotary Sprinklers: Gear drive, full-circle and adjustable part-circle types with screw-type flow adjustment, stainless-steel retraction spring, stainless steel riser, drain check valve, flow stop valve, minimum of 8 nozzles available, integral rubber cover, adjustable from the top of the sprinkler and pop-up heights of 5".

### 2.7 Electric Control Valves

- A. Description: Electrically controlled hydraulically actuated control valves.
  - 1. Manufacturers:

- a. Toro.
- b. Pre-approved Equal.

#### B. Features:

- 1. 24vac solenoid with .41A inrush current and .28A holding current.
- 2. Pressure rating of 220 psi.
- 3. Fabric reinforced diaphragm.
- 4. Internal and external bleed.
- 5. Flow control handle.
- 6. Contamination Resistant.

## 2.8 Automatic-Control System

- A. Manufacturers:
  - 1. Toro
  - 2. Pre-approved Equal.
- B. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding as per manufacturer requirements.
  - 1. Material: Enameled-steel, sheet metal or plastic pedestal.
  - 2. Mounting: Surface type for wall mounting, concrete mounting base for pedestal.
- C. Control Transformer/Decoder Output: 24VAC 4A secondary, with overload protection and or primary fuse.
  - 1. Decoder Line Output: 38 V peak to peak.
  - 2. Decoder Power Draw: 40mA per active output.
  - 3. Solenoid Capacity: 2 standard 24VAC solenoids per output, maximum output of 20 simultaneously.
  - D. Controller Stations for Automatic Control Valves: Each station is variable from approximately 1 minute to 12 hours. Include switch for manual or automatic operation of each station.
  - E. Timing Device: Adjustable, 24-hour, 365 day clock, with automatic operations to skip operation any day in timer period, to operate every other day, odd-even days, interval days, to operate up to 32 times daily.
    - 1. Manual or Semi-automatic Operation: Allows this mode without disturbing preset automatic operation.
    - 2. Minimum 30 day internal power storage: Automatically powers timing device during power outages.
    - 3. Six (6) start times.
    - 4. Simultaneous program operation.

#### **Irrigation Systems**

- 5. Test program.
- 6. One button manual start.
- 7. Seasonal adjust 0% to 255%.
- 8. Internal self diagnostics circuit breaker.
- 9. Ten (10) independent programs.
- 10. Surge Protection: Metal-oxide-varistor type on each station and primary power.
- 11. Rain Sensor compatible with over-ride capabilities.
- 12. Remote control capabilities.

#### F. Wiring:

- 1. Manufacturers:
  - a. Paige
  - b. Pre-approved Equal.
- 2. Feeder-Circuit Cables: No. 14 AWG minimum, between building and controllers.
- 3. Decoder Output Cable: No. 14 Paige #P7072D "Maxi Cable".
- 4. Splicing Materials: 3M DBRY-6 as required by manufacturer.

### Part 3 Execution

#### 3.1 Earthwork

- A. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.
- B. Install piping and wiring in sleeves under sidewalks, roadways, parking lots, and railroads.
  - 1. Install piping sleeves prior to hardscape sub-base being installed if possible.
  - 2. Sleeving installed in open trench to be completely backfilled crushed limestone, approved by owners representative and compacted to insure no future settling.
  - 3. Pipe sleeves are to be a minimum of two times the diameter of the pipe in the sleeve.
- C. Provide minimum cover over top of underground piping according to the following:
  - Irrigation Main Piping: Minimum depth of 24 inches from top of pipe to finished grade.
  - Circuit Piping: 18" to the top of the pipe in the sports fields, 12' within general landscape areas, piping to be a minimum of 3 inches laterally\vertically from mainline at all times.
  - 3. Drain Piping: 12 inches.

4. Sleeves: 22 inches from top of pipe for mainlines and 12 inches from top of pipe for laterals.

## 3.2 Excavation Preparation

- A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's Representative's approval before excavation.
- B. Excavate area for pipe installation 4" wider than diameter of pipe.
  - 1. Level trench base to insure consistent contact of pipe to trench bottom.
  - 2. Remove all rocks and other sharp objects.
  - 3. Place pipe in trench snaking from side to side if possible.
  - 4. Backfill to the top of pipe compacting the sides.
  - 5. Backfill in 8" lifts compacting to 90% between lifts until complete.
  - 6. All trenches greater than 4" in width to be restored to grade, +- 1/4", with sod as approved by owners representative.
  - 7. All trenches 4" or small in width to be restored to grade, +-  $\frac{1}{4}$ " with a minimum of 3" of topsoil as approved by owners representative.
  - 8. Whenever possible trenching should be outside of a tree dripline. If trenching is done within the dripline it should be at least 10' from existing tree, if 10' is not possible the trenching must be done by hand and all tree roots greater than 1" to be left in place. All tree roots 1" or less may be removed by saw cutting root on either side of the excavation and root removal.

## 3.3 Piping Applications

- A. Install components having pressure rating as shown on the plan.
- B. Piping in above ground may be joined with flanges instead of joints indicated.
- C. Aboveground Irrigation Main Piping: Use the following piping materials for each size range:
  - 1. NPS 4 and Larger: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.
  - 2. NPS 3 and Smaller: hard copper tube, wrought- or cast-copper fittings, and soldered joints.
- D. Underground Irrigation Main Piping: Use the following piping materials for each size range:
  - 1. NPS 25 and Smaller: Class 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
  - 2. NPS 3 and larger: Class 200 PVC, pressure rated pipe with gasket joint ends, Ductile Iron gasket joint fittings with manufacturer's recommended joint restraint.

#### **Irrigation Systems**

- E. Circuit Piping: Use the following piping materials for each size range:
  - 1. NPS 4 and Smaller: Class 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.
- F. Underground Branches and Offsets at Sprinklers and Devices ¾" and greater: Schedule 80, PVC pipe; acme threaded o-ring sealed PVC fittings.
- G. Risers to Aboveground Sprinklers and Specialties: Type L hard copper tube, wrought-copper fittings, and soldered joints.
- H. Sleeves: SCH 40 PVC pipe and socket fittings; and solvent-cemented joints.
- I. Transition Fittings: Use transition fittings for plastic-to-metal pipe connections according to the following:
  - 1. Couplings:
    - Underground Piping NPS 2-1/2 and Smaller: Manufactured fitting or coupling.
    - b. Underground Piping NPS 3 and Larger: PVC Flange with stainless steel bolts and rubber gasket.
  - 2. Fittings:
    - a. Aboveground Piping: Plastic-to-metal transition fittings.
    - Underground Piping: Union with plastic end of same material as plastic piping.
- J. Dielectric Fittings: Use dielectric fittings for dissimilar-metal pipe connections according to the following:
  - 1. Underground Piping:
    - a. se
    - b. NPS 2-1/2 and Larger: Prohibited except in valve box.
  - 2. Aboveground Piping:
    - a. NPS 2 and Smaller: Dielectric unions.
    - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
  - 3. Piping in Valve Boxes or Vaults:
    - a. NPS 2 and Smaller: Dielectric unions.
    - b. NPS 2-1/2 to NPS 4: Dielectric flanges.
    - c. 3.5 VALVE APPLICATIONS
- K. Aboveground, Shutoff-Duty Valves:
  - 1. NPS 2 and Smaller: Bronze gate valve.
  - 2. NPS 25 and Larger: Cast-iron, nonrising-stem gate valve.
- L. Isolation Valves:

- 1. NPS 2 and Smaller: Bronze nonrising-stem gate valve.
- 2. NPS 25 and Larger: Cast\ductile-iron, nonrising-stem gate valve with 2" operating nut.

## 3.4 Piping Installation

- A. Location and Arrangement: Drawings indicate suggested location and arrangement of piping systems. Install piping as indicated unless deviations are approved by Owner's Representative.
- B. Install piping free of sags and bends.
- C. Install groups of pipes parallel to each other with a space between minimum of 4", spaced to permit single valve removal and or servicing.
- D. Install fittings for changes in direction and branch connections.
- E. Install dielectric fittings to connect piping of dissimilar metals.
- F. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.
- G. Lay piping on solid sub base, uniformly sloped without humps or depressions.
- H. Install PVC piping in dry weather when temperature is above 32 deg F 5 deg C. Allow joints to cure at least 24 hours at temperatures above 32 deg F 5 deg C before testing unless otherwise recommended by manufacturer.
- I. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Flush the line prior to installation to remove debris. Install the valve so that the flow arrow marked on the valve body tag corresponds to the flow through the line. Install shutoff valve on outlet.

### 3.5 Valve Installation

- A. Electrical Control Valves: Install in valve box with top flush with and perpendicular to grade.
  - 1. All electrical control valve boxes to be 14" rectangular valve box.
  - 2. From bottom of valve to a depth of 6" install washed stone or gravel sized between 3/4" and 1" in diameter to create sump and stabilize valve box.
  - 3. Install valve box extensions as necessary to bring lid level with finished landscape grade.
  - 4. Control Valves to be installed with center line of valve 12" below finished grade.
- B. Underground, Manual Control Valves: Install with 6" SDR 21 PVC riser from top of pipe to center line of valve box finishing with 10" round valve box level with finished landscape grade.

#### **Irrigation Systems**

1. Install valves and PVC pipe with restrained, gasketed joints as necessary at the same depth as the mainline pipe.

## 3.6 Sprinkler Installation

- A. Flush circuit piping with full head of water prior to installing sprinklers.
- B. Install sprinklers at manufacturer's recommended heights perpendicular to grade.
- C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries, unless otherwise indicated on the plans.
- D. Adjust all sprinklers to irrigated plant material indicated for the station.

### 3.7 Automatic-Control System Installation

- A. Obtain approval of controller location from owner's representative prior to installation. Install wall mount controllers level 40"-60" above FFE. Securely fasten controller to wall with metallic fasteners appropriate for wall type or install pedestal controller on concrete pad with all necessary conduit installed through the pad to accommodate all wire to controller. All irrigation control wire between controller and finished grade to be in PVC electrical conduit.
- B. All 2 wire control wire not in a pipe trench to be installed in 1-1/4" electrical conduit.

### 3.8 Connections

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Ground equipment according to ASIC Grounding Guidelines www.aisc.org. Resistance readings to ground to be as recommended by the manufacturer. If there are no manufactures requirements then the controller should have a resistance of 10 ohms or less.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

## 3.9 Field Quality Control

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 4. Remove and replace units and retest and re-inspect as specified above.

### 3.10 Startup Service

- A. Engage a factory-authorized service representative to perform startup service of control system.
- B. Verify that controllers are installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- D. Complete startup checks according to manufacturer's written instructions.

### 3.11 Adjusting

- A. Program controller(s) to insure adequate moisture is available for the root zone of the plant. Insure there is no run-off, over watering or deep percolation. Insure controller operates within irrigation window as defined by Owner's Representative or local governing authorities. See additional controller programming notes on plans provided.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit. Use pressure regulation for each control valve if pressure is higher than recommended for the sprinklers in the circuit.
- C. Adjust sprinklers so they will be 1/8 inch above finish grade in sodded lawns and 1/2 inch above grade in seeded lawns. In shrub beds adjust sprinklers to insure top of sprinkler is at finished mulch levels.
- D. Adjust sprinklers arc and radius to insure no water is sprayed outside of the irrigated area

### 3.12 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

### 3.13 DEMONSTRATION

- A. It is contractors' responsibility to train Owner's maintenance personnel to adjust, operate, and maintain sprinklers, isolation valves, controllers and automatic control valves.
- B. Periodic site visits will be made by the Landscape Architect\Irrigation Consultant to review the quality and progress of the work. Work found to be unacceptable must be corrected within five (5) calendar days. Remove rejected materials promptly from the project.
- C. Upon completion of the Work, the Contractor shall notify the Landscape Architect and Owner at least ten (10) days prior to requested date of the site visit for Substantial Completion of all portions of the Work. Landscape Architect\Irrigation

#### **Irrigation Systems**

Consultant will issue a punch list for all work to be corrected. All work on the punch list must be complete within five (5) working days from the date of the site visit. Where Irrigation Work does not comply with the requirements, replace rejected Work. If such replacements are not completed within the time specified, the Irrigation Contractor may be considered to be in default of the Contract, and the Owner may use the

- D. Contract Retainage to hire other Contractors to finish the work.
- E. It will be the responsibility of the Irrigation Contractor to provide reliable communication system (remote control or two way radios) for Substantial Completion and all periodic site visits.
- F. If a site visit to verify Substantial Completion has been scheduled and the Landscape
- G. Architect\Irrigation Consultant arrives at the site and determines that the irrigation system is not substantially complete (all system components in place, operational and checked) the Contractor will be responsible for all expenses included but are not limited to the following: mileage, airfare, consultant's time, parking fees, meals, car rental, etc. All incurred expenses will be deducted from the final contract amount.

**END OF SECTION** 

### Part 1 - General

## 1.1 Summary Of Work:

- A. Extent of Landscape Work is indicated on Drawings and in schedules.
- B. Provide and furnish all labor, materials and equipment required or inferred from Drawings and Specifications to complete the Work of this Section.

### 1.2 Quality Assurance:

- A. Industry Reference Standards: Refer to Division 1 References Section.
  - National List of Scientific Plant Names, 1982.
  - American National Standards Institute, Inc. (ANSI):
     ANSI Z60.1 96 American Standard for Nursery stock by the American
     Association of Nurseryman.
  - American Wood Preservers Association (AWPA):
     C2-98 Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment.
  - 4. American Society for Testing and Materials (ASTM):

D 1140-97	Lest Method for Amount of Material in Soils Finer Than the
	No. 200 Sieve.

D 1248-00 Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

D 2434-68 (94) Test Method for Permeability of Granular Soils (Constant Head).

D 2487-00 Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

D 2940-98 Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.

D 2974-87(95) Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.

D 4491-99a Test Methods for Water Permeability of Geotextiles by Permitivity.

D 4549-98 Specification for Polystyrene Molding and Extrusion Materials (PS).

D 4632-91(97) Test Method for Grab Breaking Load and Elongation of Geotextiles.

D 4751-99a Test Method for Determining Apparent Opening Size of a Geotextile.

D 4759-88 (96) Practice for Determining the Specification Conformance of Geosynthetics.

D 4972-95a Test Method for pH of Soils.

D 5268-92(96) Specification for Topsoil Used for Landscaping Purposes. Specifications for Corrugated Polyethylene (RE) Piping and Fittings.

#### B. Qualifications:

- Installer Qualifications: Engage a firm specializing in landscape installation. Submit written documentation of successful completion of ten (10) projects of similar size, scope and complexity to work specified for this Project.
  - a. Firm Experience Period: Seven (7) years of experience.
  - b. Field Foreman Experience: Five (5) years of experience with installing firm.
- C. Soil-Testing Laboratory Qualifications: Engage a reputable independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct testing and analysis of existing surface soils representative of planting areas and lawn areas on site, new topsoil to be used in soil mixes and soil mixes with reference to specified plant materials. Soil report to include analysis of a minimum of three (3) soil samples from different locations for existing on site surface soils.

### 1.3 Submittals

- A. Section Cross Reference: Refer to Division 1 Submittals Section for general requirements.
- B. Topsoil Location and Sample: Furnish Landscape Architect with written statement stating location of property from which additional topsoil is to be obtained, depth to be stripped, and crops grown during past two (2) years. Submit one (1) cubic foot of topsoil proposed for use.
- C. Topsoil Test Report: Submit results of soil analysis by a qualified soil-testing laboratory, for information only, of stockpiled and additional topsoil proposed for use in planting soil mixes. Report shall include percentages of deleterious materials; organic matter; gradation of sand, silt, and clay content, as determined by test methods included in Part 2 Products; cation exchange capacity; pH level; mineral, major nutrient and micro nutrient content of top soil.
- Planting Soil Mix Sample: Submit one cubic foot of each proposed planting soil mix.
- E. Planting Soil Mix Test Report: Submit results of soil analysis by a qualified soil-testing laboratory, for information only, of each planting soil mix as specified. Report shall include percentages of organic matter; pH level; mineral; major nutrient and micro nutrient content of each mix.
  - 1. State recommended quantities of nitrogen, phosphorus, potash and other nutrients and soil amendments to be added for suitable plant growth.
- F. On Site Soil Report: Submit results of soil analysis by a qualified soil-testing laboratory, for information only, of on-site soil. Report shall include pH level, mineral; major nutrient and micro nutrient content of on-site soil.
  - 1. State recommended quantities of nitrogen, phosphorus, potash and other nutrients and lime to be added for suitable plant growth.

- G. Product Data: Submit, for information only, product data for proprietary materials and items, including soil amendments, soil conditioner, and other packaged products.
- H. Soil Permeability Test Report: Submit laboratory test results of planting soil mix to be used in all structured planters. Planting soil mix shall be tested in accordance with ASTM D 2434.
- I. Tree Pit Drainage Certification: Submit written documentation certifying that results of drainage test on tree pits and planting beds comply with requirements contained here in.
- J. Fertilizer Analysis: Submit, for information only, label or technical data for fertilizer bearing the trade name, manufacturer's name, weight and analysis for fertilizers used in planting soil mixes and on sodded lawn areas.
- K. Planting Schedule: Submit planting schedule showing scheduled dates for each type of planting in each area of site. The Owner may require special schedule requirements for specific areas of the project, prior to beginning the Work.
- L. Certification: Prior to acceptance of plant material submit certificates of inspection as required by governmental authorities, and manufacturer's or vendors certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements. Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.
- M. Maintenance Instructions: Upon completion of the installation, submit typewritten recommendations for maintenance of any portion of the landscape which, in the opinion of the Contractor, requires special attention.
- N. Installer Certification: Submit written documentation certifying that Installer complies with requirements of "Installer Qualifications" above.

### 1.4 Material Quantities

A. It is the Contractor's responsibility to total and confirm all material quantities. Items quantified by an area (i.e., square feet - sf., square yard - sq. yd.) or volume (cubic feet - cu. ft., cubic yard - cu. yd.) shall be calculated and confirmed by the Contractor. The quantities listed on the plant list are estimated. In the event of a discrepancy between the totals listed on the plant list and the numerical callouts on the Drawings, the Drawings shall govern. The actual total quantities shall be determined by the Contractor.

## 1.5 Delivery, Storage And Handling

#### Exterior Landscape

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored on site.
- B. Sod: Time delivery so that sod will be placed within twenty-four (24) hours after stripping. Protect sod against drying and breaking of rolled strips.
- C. Trees, Shrubs and Ground Cover: Provide freshly dug trees and shrubs. Do not prune prior to delivery. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during shipment.
  - 1. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.
- D. Deliver trees, shrubs and ground cover after preparations for planting have been completed and plant immediately. If planting is delayed more than six (6) hours after delivery, set trees, shrubs and ground cover in shade, protect from current and forecasted weather and mechanical damage, and keep roots moist.
  - 1. Set balled stock on ground or in partially excavated hole and cover rootb-ball with soil, peat moss, sawdust or other acceptable material.
  - 2. Do not remove container-grown stock from containers until planting time.
  - 3. Heal-in bare-root stock. Soak roots in water. Do not let roots dry out.
  - 4. Water root systems of plant material stored on-site. Water as often as necessary to maintain root systems in a moist condition.
- E. Label at least one (1) tree and one (1) shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.
- F. Do not remove labels attached to plant material by the Landscape Architect until directed to do so.

# 1.6 Project Conditions

- A. Insurance on plant material and other materials stored or installed is the responsibility of the Contractor. Such insurance shall cover fire, theft, vandalism and other unusual phenomenon. Should the Contractor elect not to provide such insurance, he will in no way hold the Owner responsible for any losses incurred by the aforementioned acts. The Contractor is responsible for all costs incurred in replacing damaged or stolen materials prior to Date of Substantial Completion of the Work.
- B. Proceed with and complete landscape work as rapidly as portions of Site become available, working within seasonal limitations for each kind of landscape work required.
- C. Existing Grades: Existing grades will be within 0.05 feet of grades shown on the Civil Engineering Drawings when landscape work is to begin. Determine condition

of existing grades prior to beginning the Work. When irregular or incomplete grading conditions are encountered, notify the Owner in writing before beginning the Work. Determine location of existing drainage patterns and maintain patterns in completed Work. Perform Work in a manner which will avoid damage to finished grading and drainage patterns. All damage to finished grading and drainage resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.

- D. Existing Utilities: Determine location of underground utilities. Perform Work in a manner which will avoid possible damage. Excavate as required. Maintain grade stakes set by others unless removal is mutually agreed upon by parties concerned. All damage to utilities resulting from Work covered in these Contract Documents shall be repaired at the Contractor's expense.
- E. Existing Conditions: Perform landscape Work in the Tree Protection Zones and in existing or previously completed landscape areas to avoid damage and disturbance to these areas. Limit work in these areas to only that necessary to perform work specified herein and shown on the Drawings. Return and repair any areas damaged or disturbed while performing the Work to the existing conditions encountered prior to the Work.
- F. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect in writing before planting.
- G. Weather Limitations: Proceed with planting when existing and forecasted weather conditions are suitable.
- H. Planting Schedule: Prepare a proposed planting schedule. Schedule dates for each type of landscape work during contract period. Coordinate schedule with General Contractor and Irrigation Contractor.
- I. Coordination With Lawns: Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to Landscape Architect. If planting of trees and shrubs occurs after lawn Work, protect lawn areas and promptly repair damage to lawns resulting from plant operations.

## 1.7 Warranty

A. Warranty for a period of one (1) year, following the Date of Substantial Completion, all trees, shrubs, groundcovers, plants and grass against any defects including death and unsatisfactory growth, as determined by the Landscape Architect. Warranty shall include the complete cost to supply and install all replacement plant materials according to the requirements herein. Defects resulting from lack of adequate maintenance, neglect or abuse by the Owner, abuse or damage by others, or unusual phenomenon or incidents beyond the Contractor's control are excepted. Should questions arise concerning the responsibility of replacement, the Landscape Architect will be available for arbitration provided the Owner and Contractor mutually desire.

- B. Remove and replace all trees, shrubs, groundcovers and lawn, or other plants found to be more than 25 percent dead or in unhealthy condition during warranty period as determined by Landscape Architect or Owner. Make replacements immediately unless required to plant in the succeeding planting season.
- C. Replacements: Match adjacent specimens of same species. Replacements are subject to all requirements stated in the Contract Documents and are subject to observation by the Landscape Architect prior to digging.
- D. Repair grades, lawn areas, paving and any other damage resulting from replacement planting operations, at no additional cost to the Owner.
- E. Inspect Project site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner.
- F. Replacements made during the Warranty Period or following the site visit for Final Acceptance will carry an additional one (1) year warranty beginning at the time of replacement.

### Part 2 - Products

## 2.1 Source Quality Control

- A. General: Only plant material grown in a recognized nursery in accordance with good horticultural practice will be accepted. Provide healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions or disfigurement.
- B. Observation of Plant Material Prior to Digging:
  - 1. Contractor must locate all plant material to be supplied for the Project and inform the Landscape Architect in writing of location within thirty (30) days of the date of the Contract or notice to proceed, whichever is first.
  - 2. In the event plant material is found to be unacceptable, the Contractor will pursue other sources until acceptable plant material is found, at no additional cost to the Owner. If, due to unacceptable plant material at the Contractor's source, additional tagging trips are required by the Landscape Architect, the Contractor will reimburse the Landscape Architect for his time and travel expenses.
  - Approval at the plant source does not impair the right of the Landscape Architect to observe and reject material at the time of shipping or during progress of the Work.

#### C. Shipping:

 Ship landscape materials with certificates of inspection required by governing authorities. Inspection by Federal and/or State Governments at Grower does not preclude rejection of plants at the site by the Landscape Architects.

- Comply with regulations applicable to landscape materials. Prepare plants for shipment to prevent damage to the plants.
- 2. From March 15th to September 15th, ship plant material to be transported over one hundred (100) miles at night only. Make arrangements to have plant material watered during shipment as necessary to avoid excessive stress. Plant material may be rejected if not properly shipped.
- 3. Do not ship plant material in temperatures below 20 degrees Fahrenheit.
- D. Do Not Make Substitutions: If specified landscape material is not obtainable, submit to Landscape Architect proof of non-availability and for use of equivalent material. For proof of non-availability submit a written statement from a minimum of twelve (12) reliable nursery sources (American Nurserymen's Association Members) that the plant in question is not obtainable in the Eastern United States.
- E. Analysis and Standards: Package standard products with manufacturer's certified analysis. Including but not limited to:
  - 1. Soil Amendments
  - 2. Grass Materials
  - 3. Mulch
- F. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under the Drawings and Specifications is subject to the approval of the Landscape Architect. The Landscape Architect has the right to reject any and all materials and any and all Work which, in his opinion, does not meet the requirements of the Contract Documents at any stage of the operations. The Contractor shall remove rejected work and/or materials from Project site and replace promptly.

## 2.2 Topsoil

- A. Topsoil has been stockpiled for re-use in planting soil and other Landscape Work.
- B. Provide new topsoil, when necessary, which is fertile, friable, pervious, sandy loam, surface soil; free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than one and one-half (1½) inches in any dimension, and other extraneous or toxic matter harmful to plant growth.
- C. Obtain topsoil, when necessary, from local sources or from areas having similar soil characteristics to that found at Project Site. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than four (4) inches; do not obtain from bogs or marshes, unless specified.
- D. Topsoil: ASTM D 5268 complying with the following composition as determined by the indicated test methods:
  - 1. Deleterious Materials: 2 percent max. by mass; ASTM D 2487. (Rock, gravel, slag, cinder, stone).
  - 2. Organic Material: 5-10 percent min. by mass; ASTM D 2974.
  - 3. Sand Content: 20 to 40 percent by mass; ASTM D 1140.

- 4. Silt and Clay Content: 40 to 50 percent by mass; ASTM D 1140.
- 5. pH Range: 5 to 7; ASTM D 4972.

### 2.3 Inorganic Soil Amendments

- A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 sieve and a minimum 75 percent passing a No. 60 sieve.
- B. Aggregate Soil Conditioner: Rotary kiln expanded slate specially graded for use as a horticultural soil conditioner with the following composition as determined by the indicated test methods:
  - 1. Dry Loose Unit Weight: 48-55 lbs/cu.ft.; ASTM C 29.
  - 2. Specific Gravity: To meet 1.45 to 1.60 dry bulk; ASTM C 127.
  - 3. Gradation: 3/8-inch to No. 8; ASTM C 330 with 100 percent passing the 3/4-inch sieve.
  - 4. Absorption: Five percent or more; ASTM C 127.
  - 5. LA Abrasion: Weight loss between 20 percent and 30 percent; AASHTO T 96.
  - 6. Chemical Characteristic:
    - a. pH: 6.5 to 10 range.
    - b. Soluble salts: To meet horticultural rural range of 0.75 to 3.5 mmhos/cm.
    - 7. Process the slate using only non-hazardous fuels such as coal or natural gas.
    - 8. The expanded slate shall be free of clay lumps and organic impurities.
    - 9. Obtain aggregate soil conditioner from a single supplier.
    - 10. Available Products: Subject to compliance with the requirements, aggregate soil conditioners that may be incorporated in the Work includes, but is not limited to the following:
      - a. Acceptable Supplier and Products:
        - 1) Supplier: Caroline Stalite Company
          - a) Product: 5/16-inch Perma Till
- C. Coarse Sand: Clean, washed, natural or manufactured sand, free of extraneous or toxic matter with the following grain size distribution or coarser; ASTM C136.

Sieve Size	% Passing
.5 in.	100.0
.375 in.	98.0
#4	98.0
#10	93.0
#20	21.0
#60	1.0
#140	0.5
#200	0.5

# 2.4 Organic Soil Amendments

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 4 to 6 decisiemens/m; not

exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

- 1. Organic Matter Content: 50 percent minimum of dry weight.
- 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste that meet all State Environmental Protection Agency requirements.
- 3. Available Products: Subject to compliance with the requirements, compost products that may be incorporated in the Work includes, but is not limited to the following:
  - a. Acceptable Supplier and Products:
    - 1) Supplier: ERTH Products, LLC
      - a) Product: ERTH Food
    - 2) Supplier: It Saul Natural, LLC
      - a) Product: Hen Manure Compost
- B. Humus: Air dried, finely shredded, and pH range suitable for intended horticultural use. Humus shall be completely decomposed forest type including composted leaves, bark and organic wastes.
- C. Peat: Air dried, finely shredded or granular texture, completely decomposed and free of fibers with pH range suitable for intended horticultural use. Peat shall be a naturally occurring, highly organic and derived primarily from plant materials.
- D. Organic Pre-Mixed Soil Amendment: Composted and screened 100 percent organic manufactured soil amendment.
  - 1. Acceptable Supplier and Products:
    - a. Supplier: It Saul Natural, Inc.
      - 1) Product: Mr. Natural CLM
      - 2) Product: Mr. Natural WSM
- E. Shredded Pine Bark: Shredded bark pieces between one-half (1/2) inch and two (2) inches in length with partially decomposed bark matter.

#### 2.5 Fertilizer

- A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.
- B. Superphosphate: Commercial phosphate mixture, soluble, minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-released nitrogen, 50 percent derived from natural organic sources, phosphorous, and potassium in the following composition:
  - 1. General: For trees, shrubs and groundcover, provide a homogeneous fertilizer complete with micro nutrients having an analysis of 12-4-8 (12 pounds of

- nitrogen, 4 pounds of available phosphoric acid, and 8 pounds of water soluble potash respectively for each 100 pounds of mixture).
- 2. For trees, shrubs, and ground cover provide fertilizer with adjusted analysis in accordance with results and recommendations of planting soil mix test reports.
- 3. For lawns, provide fertilizer in accordance with results and recommendations of existing on site surface soil report relative to lawn installation. Provide nitrogen in a form that will be available to lawn during initial period of growth.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in existing on site surface soil reports from a qualified soiltesting laboratory.

## 2.6 Planting Soil

- A. Planting Soil Mix For On-Grade Plantings: Provide soil mix amended as per laboratory recommendations. Basic planting soil mix consists of:
  - 1. 60 percent topsoil (as specified)
  - 2. 40 percent prepared additives (by volume as follows)
    - a. 2 parts humus, peat, and/or compost
    - b. 1 part shredded pine bark (bark pieces between 1/2 inch and 2 inches in length)
    - c. 1 part sterilized composted cow manure
  - 3. Commercial fertilizer as recommended in soil report
  - 4. Lime as recommended in soil report
- B. Humus shall be omitted from planting soil mixes if topsoil used has an organic content of 40 percent or greater as determined by the topsoil test report.
- C. Planting Soil Mix For Planters: Provide type of soil mix as indicated above for specific type of planting/plant materials to fill the top ten (10) inches of all above grade planters. Remaining depth of planter to be filled with specified topsoil. Contractor to have planting soil mix tested by an independent laboratory for compatibility with soil separator and drainage medium.

### 2.7 Plant Materials

#### A. General:

- Provide plants true to species and variety, complying with recommendations of ANSI Z60.1 "American Standard for Nursery Stock". Nomenclature to comply with "National List of Scientific Plant Names."
- 2. Specific requirements concerning plant material and the manner in which it is to be supplied are shown on the Drawings and plant list.
- Plant material indicated as pre-tagged and pre-purchased on the Drawings has been selected and purchased for the Project by the Owner at the nursery indicated. Contractor shall be responsible for the total installation of the

- material including freight, labor, profit, complete warranty and replacement, and all items specified herein and as indicated on the Drawings.
- 4. Acclimatization: Plants must have grown under climatic conditions similar to those of the locality of the project site for a minimum of two (2) years immediately prior to being planted on the Project.

#### B. Quality and Size:

- Furnish nursery grown plants, freshly dug, normally shaped and well branched, fully foliaged when in leaf and with healthy well developed root systems. Plants to be free of disease, insect infestations or their eggs and larvae, and defects such as knots, sun scald, injuries, abrasions and disfigurement.
- 2. Furnish plants to match as closely as possible whenever symmetry is called for
- Provide trees and shrubs of sizes shown or specified. Trees and shrubs of larger size may be used if acceptable to the Landscape Architect, and if sizes of roots or rootballs are increased proportionately. The increased size will not result in additional cost to the Owner.
- 4. Stock Specified in a Size Range: Within each size range not less than 50 percent the plants must be of the maximum size specified.
- 5. Balled and Burlapped Plants: Plants designated "B&B" are to have firm, natural balls of soil corresponding to sizes specified in ANSI Z60.1 "American Standard for Nursery Stock". Balls to be firmly wrapped in biodegradable burlap and securely tied with biodegradable heavy twine, rope and/or wire baskets. Plants with loose, broken or manufactured rootballs will be rejected. Rootballs shall be lifted from the bottom only, not by stems or trunks.
- Container grown plants in cans, plastic containers or timber boxes will be acceptable in lieu of balled and burlapped plants provided that they are of specified quality. The container must be removed prior to planting, with care being exercised as to not injure the plant.

#### C. Trees:

- Provide trees of height and caliper listed or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are specified in the Contract Documents.
- 2. Provide self supporting trees with straight trunks and leaders intact. Where required in the Contract Documents, provide trees with character as described.
- 3. Determining dimensions for trees are caliper, height and spread. Caliper shall be measured six (6) inches above ground for trees up to and including four (4) inch caliper. Trees over four (4) inch caliper shall be measured twelve (12) inches above ground. Specified height and spread dimensions refer to the main body of the plant and not branch tip to tip. Take measurements with branches in natural position.
- D. Tree Forms: Do not limb up tree forms more than two (2) feet before planting. Prune to desired shape as directed by Landscape Architect.

- E. Shrubs: Provide established and well-rooted plants, in removable containers, with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
- F. Ground Cover: Provide established and well-rooted plants, in removable containers or integral peat pots, having not less than minimum number and length of runners by ANSI Z60.1 for the pot size specified.

#### G. Grass Materials:

- Grass Seed: Provide fresh, clean, new crop-seed complying with tolerance for purity and germination established by Association of Official Seed Analysts. Provide seed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified on Drawings.
- 2. Sod: Provide viable sod of uniform density, color, and texture, strongly rooted, not less than two (2) years old and free of weeds and undesirable native grasses. Only provide sod capable of growth and development when planted (viable, not dormant). Provide machine cut sod of a uniform minimum soil thickness of five-eights (5/8) inch, plus thickness of top growth and thatch. Sod pieces to be consistent in size and shape. All sod must be a true certified turf grass.

### 2.8 Miscellaneous Landscape Materials

- A. Burlap for wrapping earthball shall be biodegradable jute mesh not less than 7.2 oz. per square yard. Wrapping materials made from man made fibers are unacceptable.
- B. Guy Stakes, Upright Stakes, and Deadmen: Grade No. 2 or better, uniform grade pressure preservative treated pine AWPA C-2, or sound new hardwood or redwood free of knots, holes and other defects, two (2) by two (2) inches by thirty (30) inches long, pointed at one end.
- C. Guy Anchors: Buried anchors only. Anchors are to be buried a minimum of 1'-6" with a quantity of three (3) per tree to be placed.
  - Manufacturer: Duckbill
     Manufacturer: Better Bilt
     Manufacturer: Arborbrace
  - 4. Guys Ties: Woven synthetic strap manufactured specifically for this purpose.
    - a. Manufacturer: Arbor-Tie
- E. Hose: One half (1/2) inch diameter black reinforced rubber or plastic garden hose. Cut to required lengths to protect tree trunks from damage by wires. Used hose is acceptable.
- F. Water and water transportation is the sole responsibility of the Contractor.
- G. Mulch:

- 1. Shredded Hardwood Bark Mulch: Premium grade shredded and ground, one (1) inch maximum particle size in any dimension.
  - a. Submit sample for approval.
- H. Lawn Anti-Erosion Mulch: Clean, threshed straw of wheat, rye, oats or barley.
- I. Anti-Desiccant: Water-insoluble emulsion type, film-forming agent designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully labeled containers and mix in accordance with manufacturer's instructions.

### Part 3 Execution

## 3.1 Preparation

#### A. General:

- 1. Contractor shall examine conditions under which planting is to be installed, review applicable architectural and engineering Drawings, and be familiar with alignment of underground utilities before digging.
- 2. Planting Time: Planting operations are to be performed at such times of the year as the job may require, with the stipulation that the Contractor guarantees the plant material as specified. Plant only during periods when weather conditions are suitable.
- 3. Verify layout information shown on the Drawings, in relation to property survey and existing bench marks before proceeding to layout the work. Locate and protect existing benchmarks and control points. Preserve reference points (coordinates) shown on the Drawings during construction.
- 4. Work from lines established by the property survey, established bench marks and markers to set coordinate points for the tree locations on the Project. Calculate and measure required dimensions. Do not scale Drawings to determine dimensions.
- 5. Tree Locations: Locate and layout tree (coordinate) locations by instrumentation and similar appropriate means.
- 6. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Landscape Architect's acceptance before start of excavation for planting work. Make adjustments as requested.
- 7. Notify Landscape Architect of adverse sub-surface drainage or soil conditions. State conditions and submit a recommendation for correction including costs. Obtain approval for method of correction prior to continuing Work in the affected area. In the event that alternate locations are selected, the Contractor shall prepare such areas at no additional expense to the Owner.

### B. Excavation for Trees and Specimen Shrubs:

1. Excavate pits, beds and trenches with vertical sides, as specified and as shown on the Drawings.

- 2. Loosen hardpan and moisture barrier until hardpan has been broken and moisture is allowed to drain freely.
- 3. For balled and burlapped (B&B trees and shrubs), make excavations at least four (4) feet wider than the ball diameter for the top twelve (12) inches of the pit. For the remaining depth of the pit, excavate at least two (2) feet wider than the full diameter and equal to the ball depth, plus an allowance for setting of ball on a layer of compacted backfill. Allow for six (6) inch minimum setting layer of excavated soil.
- 4. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

### C. Test Drainage:

1. Tree and Specimen Shrub Pits: Fill each pit with water. If percolation is less than 100 percent within a period of twelve (12) hours, drill a ten (10) inch diameter auger hole to a depth up to five (5) feet below the bottom of the pit. Fill auger hole with drainage gravel and cover with filter fabric. Retest pit. In case drainage is still unsatisfactory, notify Landscape Architect, in writing, of the condition before planting trees in the questionable areas. Contractor is fully responsible for warranty of the plant material.

#### D. Subsoil Removal:

1. Dispose of subsoil removed from landscape excavations at an off-site location. Do not mix with planting soil. Do not use as backfill.

## 3.2 Field Quality Control

A. Testing: Contractor shall employ testing agency to perform soil permeability test in accordance with ASTM 2434 on planting soil mix to be used in structured planters prior to procuring and installing drainage matting. Test results shall be used to determine weight of integral non-woven filter fabric.

# 3.3 Preparation Of Planting Soil

- A. Before mixing, clean topsoil, or existing surface soil if using a soil conditioner, of roots, plants, clods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
- B. Mix specified soil amendments and fertilizers with topsoil, or soil conditioner with existing surface soil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.
- C. For pit and trench type backfill, mix planting soil prior to backfilling and keep covered until used.
- D. For planting soil prepared with a manufactured soil conditioner, mix planting soil in large batches before backfilling, stock pile for use at site and keep covered until used. Do not mix soil conditioner at individual planting sites.

- E. For groundcover and shrub beds, mix planting soil either prior to planting or apply on a surface layer over prepared bed area and mix both thoroughly in the bed before planting.
  - 1. Mix lime, if required, with dry soil prior to mixing of fertilizer.
  - 2. Prevent lime from contacting roots of acid-loving plants.
  - 3. Apply phosphoric acid fertilizer (in addition to that constituting a portion of complete fertilizers) directly to subgrade before applying planting soil and tilling.

## 3.4 Preparation Of Shrub And Groundcover Planting Beds

- A. Layout planting beds on the ground to the lines shown on the Drawings. Have layout approved by Landscape Architect prior to constructing the bed.
- B. Outline bed with a trench edge as shown on the Drawings. Place soil for trench edge within bed area.
- C. Loosen existing soil to a minimum depth of twelve (12) inches using a roto tiller or similar equipment. Remove all sticks, stones, rubbish and other material detrimental to plant growth.
- D. Spread four (4) inch minimum layer of planting soil mix over entire bed area. (Additional soil mix may be necessary to build up shrub beds to grade as shown on the Drawings.) Work planting soil mix into top of loosened soil with roto tiller.
- E. Smooth planting areas to conform to specified grades after settlement has occurred. Slope surface of shrub beds to drain toward the trench edge.
- F. Mass preparation of beds is not applicable for areas exceeding 4:1 slope.

## 3.5 Preparation For Planting Lawns

- A. Loosen the grade of lawn areas to a minimum depth of six (6) inches. Remove stones over one and one-half (1½) inches in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
- B. Place approximately one-half (1/2) of total amount of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of topsoil mixture to minimum depth required to meet lines, grades and elevations shown, after light rolling and natural settlement.
- C. Allow for sod thickness in areas to be sodded.
- D. Grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.

- E. Fertilize and lime prior to start of grassing operation. Apply ground limestone at the rate recommended by soil test analysis and work into top six (6) inches of soil. Apply fertilizer at the recommended rate; work into top two (2) inches of soil. The fertilizer application shall not precede the placement of sod by more than three (3) days.
- F. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
- G. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.
- H. Preparation of Unchanged Grades: Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: Till to a depth of not less than six (6) inches; apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogenous mixture of fine texture, free of lumps, clots, stones, roots and other extraneous matter. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of Owner's property; do not turn over into soil being prepared for lawns.

## 3.6 Planting Trees And Specimen Shrubs

- A. Set balled and burlapped (B&B) stock on layer of compacted excavated existing soil, plumb and in center of pit or trench with top of ball two to three (2-3) inches above the finish grade and also two to three (2-3) inches above the grade they bore to natural grade before transplanting. Remove all straps and ropes made of man-made fibers completely from rootball. Loosen and remove burlap and biodegradable ropes from top half of rootball. Cut and remove the top half of all wire baskets before backfilling. Use planting soil mixture to backfill plant pits. When plants are set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately two thirds (2/3) full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.
- B. Remove all man made or impervious materials from the rootball and trunk before final installation of trees and specimen shrubs.
- C. Set container grown stock as specified for balled and burlapped stock, except remove containers, without damaging rootballs, prior to backfilling.
- D. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again after planting as per manufacturer's recommendations.

- E. Mulching: Immediately after planting work has been completed, mulch pits, trenches and planting beds. Provide a minimum depth of two (2) inches of bark. Finish edges according to the Drawings.
- F. Water: Soak all plants immediately after planting, continue watering thereafter as necessary until Date of Substantial Completion.
- G. Smooth planting areas to conform to specified grades after full settlement has occurred and mulch has been applied.

# 3.7 Staking, Guying And Pruning

- A. Stake and guy trees immediately after planting. Plants shall be plumb after staking or guying. Maintain stakes, wires and guys until Final Acceptance of the Work.
- B. Staking trees of one (1) inch caliper and under or four (4) feet <a href="height: Use single stake with rubber hose and wire loop around trunk">height: Use single stake with rubber hose and wire loop around trunk</a>. Use only wooden stakes as specified.
- C. Staking trees of one (1) to two and three quarters (2-3/4) inch caliper: Drive stakes securely into ground and fasten to tree with wire and tie. Use hose around wire so wire is not in contact with plant, or use Cinch-tie of appropriate size. Adhere to staking details unless alternate detail has been approved by Landscape Architect prior to beginning of planting operation.
- D. Guying trees of three (3) inch caliper and larger: Guy trees according to detail. Position guys around trunk at approximately two-fifths (2/5) the height of the tree. Anchor guys in ground either to notched stakes or steel rods driven securely into ground with top end three (3) inches below finish grade.
- E. Pruning: Unless otherwise directed by the Landscape Architect do not cut tree leaders. Remove only injured or dead branches from trees, if any. Prune shrubs at the direction of the Landscape Architect.
- F. Remove and replace promptly any plants pruned or mis-formed resulting from improper pruning.
- G. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures.

# 3.8 Planting Shrub And Groundcover Beds

- A. Excavate large enough area in loosened soil to install specified container grown plants.
- B. Remove containers without damaging the rootball and set in excavated hole.
- C. Place container grown plant in excavated hole with top of rootball even with final shrub bed elevation.

- D. Backfill rootball with soil from the bed and lightly compact soil around plant to eliminate voids and air pockets.
- E. Mulching: Immediately after planting mulch planting beds with a minimum depth of two (2) inches of bark. Finish edges according to the Drawings. Remove all mulch from foliage of plants.
- F. Watering: Soak entire area immediately after planting. Continue watering thereafter as necessary until Date of Substantial Completion.

# 3.9 Installing Lawns

#### A. Seeding New Lawns:

- 1. The grass seed shall be applied at the rate specified in the Seed Schedule and at the planting dates indicated.
- 2. Sow seed using a spreader or hydro-seeding machine.
- 3. Do not seed when wind velocities affect even distribution. Do not sow when seed bed is crusty or frozen. Sow in equal quantities in two (2) directions at right angles to each other.

### **GRASS SEEDING SCHEDULE**

<u>Seed Type</u> 1.Hybrid Bermuda	Seeding Rate Lbs/1000 sf 2 - 3	<u>Planting Dates</u> May 1 – Aug. 15	Visible Seedling Stand Under Ideal Conditions 12 days*	Ultimate Mowing <u>Height</u> 1-1/4 – 1"
2. Annual Ryegrass	4 – 6	Oct 1 – Mar 1	6 days*	2 – 2-1/2"

- \*Planting dates for type 1-3 are the general project area only. These dates differ for other areas where seasonal variations require modification. According to the Plant Hardiness Zone Map published by the United States Department of Agriculture, 1990, these dates refer to Zones 7a and 7b.
- 4. If seed bed is left slightly rough or furrowed, no "planting" of the seed is necessary. If seed bed is smooth and very dry, the seed should be lightly raked into the top quarter (1/4) inch of seed bed.
- 5. Protect seeded areas with slopes not exceeding 1:5 by spreading wheat straw or hay mulch. The quantity of mulch to be applied shall be that to uniformly form a continuous blanket at least three-quarters (3/4) of an inch and not more than one and one-half (1½) inches in loose depth over the seeded area. Spread by hand, blower, or other suitable equipment.
- a. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

- 6. Protect seeded areas with slopes exceeding 1:5 with erosion-control fiber mesh and 1:3 with erosion-control blankets installed and stapled according to manufacturer's written instructions.
- 7. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
  - a. Mix slurry with non-asphaltic tackifier.
  - b. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.
- 8. Thoroughly moisten seeded area immediately after seeding. If rainfall is insufficient lightly water planting area until grass is established.
- 9. Protect seeded areas from traffic and disturbance.
- 10. Scarify, re-seed and re-fertilize seeded areas that do no show satisfactory growth within fifteen (15) days after sowing, until a satisfactory stand is established. Seeded areas are considered established when a dense grass stand has developed of a uniform green color, reasonably free from weeds, the specified grass is vigorous and growing well, and no bare spots larger than one (1) square foot area is apparent. Full coverage is required in thirty (30) days. Irregularities resulting from diseases and insect infestation are unacceptable. Mow grass at height specified in seeding schedule.
- 11. After two (2) or three (3) mowings the new lawn shall be fertilized with ammonium nitrate at the rate of 50 lbs/acre. Nitrogen shall be applied with mechanical hand spreader capable of producing uniform coverage. One (1) application is mandatory. Nitrogen shall not be applied between October 15 and March 15, unless noted otherwise.

#### B. Sodding New Lawns:

- 1. Water soil prior to receiving sod. At the time of sod placement soil must be moist but not saturated.
- 2. Lay sod within twenty-four (24) hours from time of stripping. If not possible, sod may be stored on site up to thirty-six (36) hours after stripping provided sod is properly protected: unstack, unroll and place in shade and keep moist until installation.
- 3. Do not plant dormant sod.
- 4. Do not plant sod on frozen ground.
- 5. Lay sod to form a solid mass with tightly fitted joints. Snugly fit ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
- 6. Anchor sod with wood pegs to prevent slippage on slopes equal to or greater than 3:1 and wherever erosion can be anticipated. Lay sod perpendicular to slope direction, with staggered joints.
- 7. Water sod thoroughly with a fine spray immediately after planting until soil is damp to a depth of four (4) inches. If rainfall is insufficient, keep sodded area moist until grass has securely rooted into the planting area.

#### C. Reconditioning Existing Lawns:

- 1. Recondition existing lawn areas damaged by Contractor's operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.
- Provide fertilizer, seed or sod and soil amendments as specified for new lawns and as required to provide a satisfactorily reconditioned lawn. Provide new topsoil as required to fill low spots and meet new finish grades.
- 3. Cultivate bare and compacted areas thoroughly to provide a satisfactory planting bed.
- 4. Remove diseased and unsatisfactory lawn areas; do not bury under soil. Remove topsoil containing foreign materials resulting from Contractor's operations including oil drippings, stone, gravel and other loose building materials.
- 5. Where substantial lawn remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.
- 6. Thoroughly water newly planted areas immediately after planting. If rainfall is insufficient, lightly water planting area until new grass is established.

# 3.10 Maintenance

- A. Begin maintenance immediately after planting.
- B. Maintain trees, shrubs lawns, and other plants until Date of Substantial Completion of the Work.
- C. Maintain trees, shrubs, lawns and other plants by watering, pruning, cultivating, weeding, and re-mulching as required for healthy growth. Restore trench edges around mulch rings and along bed limes. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease.
- D. Maintain lawns by watering, weeding, mowing, repair of eroded areas and re-seeding or re-sodding as necessary to establish a uniform stand of the specified grasses.
- E. Remove all trees, shrubs, ground covers, lawn or other plants which die, turn brown and/or defoliate prior to Date of Substantial Completion from the site. Replace immediately with plant material of the same species, quantity, size and meeting all requirements.

# 3.11 Clean Up And Protection

- A. During Landscape Work, keep pavements clean and work area in an orderly condition.
- B. Upon completion of Work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect and Owner.

- C. Protect landscape Work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape Work as directed, at no additional cost to the Owner.
- D. Theft: Contractor is responsible for theft of plant material at the Project site before, during and after planting, until the Date of Substantial Completion of the Work.

## 3.12 Observation And Acceptance

- A. Periodic site visits will be made by the Landscape Architect to review the quality and progress of the Work. Work found to be unacceptable must be corrected within five (5) calendar days. Remove rejected plants and materials promptly from the Project.
- B. Upon completion of Work, the Contractor shall notify the Landscape Architect and the Owner at least ten (10) days prior to requested date of site visit for Substantial Completion of all or portions of the Work. Landscape Architect will issue a punch list for work to be corrected. All work on the punch list must be completed within five (5) working days from date of site visit. Where Work does not comply with requirements, replace rejected Work and continue specified maintenance until by Landscape Architect finds work to be acceptable.
- C. If a site visit to verify Substantial Completion has been scheduled and the Landscape Architect arrives at the site and determines that the Landscape Development is not substantially complete, the Contractor shall be responsible for all costs incurred by the Landscape Architect to re-visit the site. Reimbursable expenses include but are not limited to the following: mileage, airfare, consultant's time, parking fee, meals, rental car, etc. All incurred expenses will be deducted from the final contract amount.
- D. Certificate of Substantial Completion will be issued for acceptable Work. If punch list items are issued with the Certificate, they must be corrected within five (5) working days.
- E. One (1) Year Warranty commences on the date of issuance of the Certificate of Substantial Completion. Refer to Section 02900, 1.08 Warranty.
- F. Final Acceptance: One (1) year after Date of Substantial Completion of the Work in total the Landscape Architect and/or the Owner will visit the site to determine Final Acceptance. Upon satisfactory completion of repairs and/or replacements the Landscape Architect and/or the Owner will certify, in writing, the Final Acceptance of the Work. The Final Acceptance letter will serve as evidence that the Contractor's one (1) year warranty obligations have been met.

#### **END OF SECTION**

# Natural Turf Sports Field Construction and Laser Grading

## Part 1 - General

- 1.1 The work called for by this section shall include, but not necessarily be limited to preparation of subgrade, finish grading and the spreading and shaping of topsoil to the finished contour elevations indicated by the drawings for the natural turf sports fields. This work shall be done by a pre-qualified Sports Field Contractor.
- 1.2 Refer to other sections for work related to that specified under this heading. Coordinate this work with that specified by other sections for timely execution.

#### Part 2 - Products

- 2.1 TOPSOIL: Use imported topsoil as specified elsewhere. Topsoil furnished shall be natural, fertile, containing sufficient organic material and other elements as required to promote healthy plant growth, and be friable soil possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well drained areas. It shall be a sandy loam soil. It shall not be excessively acid or alkaline nor contain toxic substances that may be harmful to plant growth. Topsoil shall be without admixture of subsoil and shall be cleaned and reasonably free from clay lumps, stones, stumps, roots, or similar substances 1/2 inches or more in diameter (screen topsoil if necessary to meet this requirement), debris, or other objects that are a hindrance to planting operations and/or presents a safety or playability issue with the fields. Samples of topsoil shall be submitted to A/E for approval. Topsoil is to be tested to indicate pH value, fertilization requirements along with relevant micronutrient information for the specified turf grass.
- 2.2 SUB-SURFACE SOIL: The soil directly below the topsoil shall be either existing compacted soil or imported material or both. It shall be properly compacted to provide a uniform base for the topsoil and of sufficient character as to provide an adequate root zone medium.
- 2.3 SAND: United States Golf Association (USGA) greens sand or approved equal.
- 2.4 BLEACHERS: As noted on plans.
- 2.5 INFIELD MATERIAL: Turface Diamond Mix
- 2.6 INFIELD CONDITIONER: Turface MVP

### Part 3 Execution

3.1 Do not begin work until the earth is dry enough to be tillable. Install fields a minimum of thirty (30) days prior to sprigging and/or sodding to allow settling and germination of any weed seeds.

- 3.2 Inspect subgrades to see that they generally conform to the standards called for elsewhere in these specifications, particularly with regard to the approximate depths required for the work. After work is completed, inspect it to ensure that all finish grading complies with design requirements. Do not over compact sub-surface soil. This soil shall be evenly compacted.
- 3.3 Place finished grade stakes wherever necessary to bring the work accurately to the elevations required by the drawings.
- 3.4 Remove lip around infields and correct transition.
- 3.5 Till the field(s) with a disc harrow 6" 8" into the subsurface a minimum of 3 times.
- 3.6 Remove small loose rocks, stones, and debris, using a RockHound or equivalent as required, thereby causing the subsurface soil to be reasonably free of such miscellaneous matter.
- 3.7 Laser grade the subsurface to within +/- one-half inch (1/2") of the designated slopes and elevations. Automatic laser-controlled systems and equipment shall be used for laser grading.
- 3.8 Adjust locations of irrigation heads along infield transition as needed and cap existing irrigation that is to be abandoned. For sports fields where underground drainage is to be installed, repair irrigation main and lateral lines. Re-compact trenches and other excavations to prevent future settling. The depth and height of installation is subject to the final grade.
- 3.9 Spread minimum of 4 inches (4") of topsoil or as noted in drawings and grade based on designated thickness and locations (initial placement/spreading of the topsoil can be by the grading contractor).
- 3.10 Add sand, as a leveling course, as needed to aid in the laser grading of the fields.
- 3.11 Add, subject to soil conditions and soil test (testing to be provided by the Sports Field Contractor), a minimum of one ton (1T) of 5-10-15 fertilizer and two tons (2T) of lime per acre and evenly distribute.
- 3.12 Lightly blend the topsoil, sand, lime and fertilizer into the previous tiled and laser graded subsurface, thereby creating the root zone with a loose consistency. Laser grade to within +/- one-fourth inch (1/4") of designated slopes and elevations. For the baseball/softball fields, lightly scarify/groove the infield subgrade surface to help bond the subgrade to the infield material. Install a total of four inches (4") of infield material onto the subgrade in two, two inch (2") lifts. Compact the first 2" lift to 90-95% Standard Proctor; add additional material as necessary to achieve a 2" depth and re-compact as necessary. Lightly scarify/groove the surface to help bond the infield material lifts add an additional lift of two inches (2") of infield material and compact to 90-95%, adding material as needed to achieve a full 4" compacted depth. Laser grade the surface within +/- one-fourth inch (1/4") of the designated slopes and elevations. The Owner has contracted with a testing provider for compaction testing, coordinate testing to validate the specified compaction of the infield material prior to installation of the Turface MVP conditioner. Install one ton of

- Turface MVP conditioner to a uniform depth across the infield material and laser grade to one fourth inch (1/4") of the designated slopes. Install home plate, pitcher's rubber, bases and foul poles as required per specifications.
- 3.13 Install the sprinkler heads even with the surface and carefully re-compact around the heads to prevent future settling. Provide a 2' square sod strip around each sprinkler head; recess sod so as not to create a mound. The irrigation system shall be tested and its proper operation thoroughly confirmed and demonstrated prior to installing the sprigs and/or sod.
- 3.14 Prior to the installation of sprigs or sod, treat all emerged weeds with Roundup Pro @ 3 qts/acre or approved equal.
- 3.15 Coordinate sprigging or sodding with installation of lighting, other structures such as dugouts, bullpens and batting cages as required and all per the designated specifications in the appropriate sequence, fencing typically being last.
- 3.16 Dispose of excess excavated materials and debris away from the site.

**END OF SECTION** 

# Sanitary Sewer Utility Piping

#### PART 1 GENERAL

#### 1.1 WORK INCLUDED

- A. Construction of gravity sanitary utility piping, including piping, manholes, and appurtenances
- B. Testing and inspection

#### 1.2 SYSTEM DESCRIPTION

A. Pipe material for sewer lines 18 inches and smaller shall be PVC unless otherwise shown on the Drawings. Ductile iron pipe shall be used only when so indicated on the Drawings.

#### 1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 Submittal Procedures
- B. Shop Drawings
  - 1. Detailed pipe drawings showing pipe details, special fittings and bends, dimensions, coatings, and other pertinent information
  - 2. Detailed manhole drawings showing details, connections, dimensions, castings, anti-flotation provisions and other pertinent information

#### C. Product Data

- 1. Pipe data, including pressure class, wall thickness, reinforcing, and strength calculations.
- 2. Manufacturer's data for couplings, saddles, gaskets and other pipe accessories.
- 3. Manhole data, including wall thickness, reinforcing, and strength calculations.
- D. Certification for Fiberglass Reinforced Polyester (FRP) Manholes: As a basis of acceptance, the FRP manhole manufacturer shall provide an independent certification which consists of a copy of the manufacturer's test report accompanied by a copy of the test results that the manhole has been sampled, tested, and inspected in accordance with the provisions of the specification of ASTM D 3753 and meets all requirements.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Installing Contractor's License shall be current and be state certified or state registered.
- B. For PVC and ductile iron pipe, furnish a certificate from the pipe manufacturer indicating that the pipe meets all applicable requirements of these specifications.
  - The minimum pipe stiffness for PVC pipe at 5 percent deflection shall be 46 psi for all sizes when tested in accordance with ASTM D2412; external loading properties of plastic pipe shall be by parallel plate loading.
  - A specimen of PVC pipe 6 inches long shall be flattened between parallel plates in a suitable press until the distance between the plates is 40 percent of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is complete in 2 to 5 minutes.
  - After being immersed for 2 hours in a sealed container of anhydrous acetone (99.5 percent pure), a sample ring of PVC pipe shall show no visible spalling or cracking when tested in accordance with ASTM D2152 (swelling or softening is not considered a failure).

### C. Drawings

- 1. Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.
- 2. Submit As-Built Drawings for the complete sanitary sewer system showing complete detail with all dimensions, both above and below grade, including invert elevation.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

#### A. Delivery and Storage

- Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping, jointing materials, and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
- 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy

accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

B. Handling: Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

#### PART 2 PRODUCTS

#### 2.1 PIPE

## A. Polyvinyl Chloride (PVC)

- 1. To meet and/or exceed the requirements of ASTM D3034, SDR 26; suitable for use as a gravity sewer conduit with provisions for contraction and expansion at each joint; with a rubber ring and standard lengths of 20 feet and 12.5 feet plus or minus 1 inch; designed to pass all tests at 73 degrees F (plus or minus 3 degrees F); 6 inch long sections of pipe to be subjected to impact from a free falling type (20 pounds, Type A) in accordance with ASTM D2444 with no evident splitting or shattering (denting not considered a failure); and with a minimum envelope of 4 inches of granular material around the pipe, but with all other bedding and backfilling requirements remaining the same as for other pipe material.
- 2. PVC Plastic Gravity Joints and Jointing Material: Joints shall conform to ASTM D3212. Gaskets shall conform to ASTM F477.

#### 2.2 CONCRETE MATERIALS

- A. Cement Mortar: Cement mortar shall conform to ASTM C270, Type M with Type II cement.
- B. Portland Cement: Submit certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes. Portland cement shall conform to ASTM C150/C150M, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C33/C33M, a cement containing less than 0.60 percent alkalies shall be used.
- C. Portland Cement Concrete: Portland cement concrete shall conform to ASTM C94/C94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500

#### Sanitary Sewer Utility Piping

psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

#### 2.3 MANHOLES

A. Gaskets and Connectors: Gaskets for joints between manhole sections shall conform to ASTM C443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923, and shall be Pelleborg Kor-N-Seal I with Korband Expander, or approved equal.

#### PART 3 EXECUTION

#### 3.1 PROTECTION

- A. Carefully protect from damage all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electrical lines, and other utilities or structure in the vicinity of the work at all times. If it is necessary to repair, remove, and/or replace any such utility or structure in order to complete the work properly, do so in compliance with the provisions set forth in other sections of these specifications. Any such work shall be considered incidental to the construction of pipe sewers, and no additional payment will be allowed therefore.
- B. Water service connections that are damaged shall be repaired or replaced by the Contractor, in accordance with the Owner's Specifications.
- C. Service or house connections to existing sewers that are damaged or removed shall be repaired or replaced by the Contractor, in accordance with the Owner's Specifications.

### 3.2 PIPE SEPARATION

- A. Lay sewers at least 10 feet horizontally from any existing or proposed water main. If this is not practical, the sewer may be laid closer than 10 feet to a water main provided it is laid in a separate trench and the elevation of the top of the sewer is at least 18 inches below the bottom of the water main.
- B. Where a sewer crosses under water mains, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the sewer cannot be varied to meet the above requirements, relocate the water main to provide this separation, or else reconstruct it with mechanical joint ductile iron pipe for a distance of 10 feet on each side of the sewer with a full joint of the water main centered over the sewer.
- C. If it is impossible to obtain proper horizontal and vertical separation as stipulated above, construct both the water main and the sewer of mechanical joint ductile iron pipe, and pressure test each.

#### 3.3 PIPE LAYING

- A. Lay no pipe except in the presence of Engineer or project representative representing the Owner.
- B. Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting or trench boxes as provided in Section 31 20 00 Earth Moving.
- C. Wherever necessary to provide satisfactory bearing surface, place concrete cradles as shown on the Drawings. Cradles shall be of concrete and conform to the dimensions shown on the Drawings. Concrete placed outside the dimensions shown shall be at the Contractor's expense.
- D. Lasers shall be used to set line and grade, after the type and procedures are approved by the Engineer. Set reference points for both line and grade at each manhole. Where grades are 0.6 percent or less, check the elevation of the beam each 100 feet with an offset point or engineer's level.
- E. Do not allow water to run or stand in the trench while pipe laying is in progress or before the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to dewater.
- F. Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have started, bringing them to exact line and grade with compacted earth or stone as necessary.

### G. Special Requirements:

- Installation of PVC Plastic Piping: Install pipe and fittings in accordance with this section and with the requirements of ASTM D2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
- H. Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench. Pipe-laying shall proceed upgrade, staring at the lower end of the grade and with the bells upgrade. When pipe-laying is not in progress, keep the ends of the pipe tightly closed with an approved temporary plug.
- I. Bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Cut out the bell holes no more than 2 joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel rests on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.

- J. Install tee branches in sewer lines to serve properly each lot facing or abutting on the street or alley in which sewer is being laid. If tee branches are not to be used immediately, close them with approved stopper that are held in place to prevent infiltration and withstand all test requirements.
- K. For all tees that are plugged and laid in rock, blast a minimum of 6 LF of ditch line in the direction and to the approximate grade of the future lateral, but do not excavate the material. This shall be done at no extra cost to the Owner. Furnish the Owner with a record of the exact location of each tee installed.
- L. If the work consists of constructing a new sewer to replace an existing one, connect only existing active service lines to the new line, unless directed otherwise by the Owner.
- M. New service laterals shall conform to the standard drawings.
- N. As the work progresses, thoroughly clean the interior of the pipe in place. After each line of pipe has been laid, carefully inspect it, and remove all earth, trash, rags, and other foreign matter from its interior.
- O. After the joints have been completed, they shall be inspected, tested, and accepted by the Owner's Representative before being covered. The pipe shall meet the test requirements for watertightness; immediately repair any leak or defect discovered at any time after completion of the work. Any pipe that has been disturbed after joints were formed shall be taken up, the joints cleaned and remade, and the pipe relaid at the Contractor' expense. Carefully protect all pipe in place from damage until backfilling operations are completed.
- P. Do not begin the backfilling of trenches until the pipe in place has been reviewed and approved by the Owner's Representative.
- Q. Make connections to all existing active sewer lines as shown on the Drawings. Make connections either by removing a section of the sewer from the existing line and inserting a wye or tee branch of the proper size or by constructing a manhole, junction box, regulator chamber, or other structure as shown on the Drawings.
- R. Make connections to existing manholes or inlets by cutting a hole in the wall of the existing structure, inserting a length of sewer pipe into the hole, filling around the pipe with concrete or mortar, and troweling the inside and outside surfaces of the joint to a neat finish. Shape or reshape the bottom of the manholes as necessary to fit the invert of the sewer pipe.
- S. Joint dissimilar pipe by using suitable compression couplings. If compression couplings are not available, make jointing with a special fabricated coupling approved by the Owner.
- T. Provide concrete protection or concrete cap as shown on the Drawings for pipe sewers that, when completed, have less than 2.5 feet of covering in

nontraffic areas and 4 feet of cover in traffic areas. If such protection is not shown on the Drawings, place it in accordance with the typical section shown.

- U. Existing water service connections which are damaged by the Contractor will be repaired or replaced at his expense as an incidental part of the work.
- V. Existing service or house connections to existing sewers that are damaged or removed shall be repaired or replaced by the Contractor at his own expense as an incidental part of the work.

#### 3.4 CONCRETE WORK

A. Cast-in-place concrete is included in Section 03 30 00 – Cast In Place Concrete. The pipe shall be supported on a concrete cradle, or encased in concrete where indicated on the drawings or directed by the Engineer.

#### 3.5 FIELD QUALITY CONTROL – SEWER LINES

- A. Before constructing or placing any joints, demonstrate to the Owner's Representative, by completing at least 1 sample joint, that the methods to be used conform to the specifications and will provide a watertight joint and further that the workmen to be involved in this phase of work are thoroughly familiar with experienced with the type of joint proposed.
- B. No other type of joint may be used unless authorized in writing by the Owner.
- C. Testing Of Gravity Sewers

#### 1. Visual Tests

- a. Upon completion of the construction or earlier if the Owner's Representative deems advisable, the Owner's Representative will make a visual inspection of the sewer and construction site. Immediately repair all leaks and defects found by such inspection.
- b. In addition to general cleanup and leakage, the following standard shall be used to determine failure or defects of this project. Sewers shall be built so as to remain true to line and grade. The inclining grade of the bottom of the sewer after completion shall be such that no remaining puddle of water is deeper than 1/2 inch on pipe 36 inches internal diameter or smaller and 3/4 inch on pipe larger than 36 inches internal diameter. Any section of pipe that does not comply with the specifications at any time previous to final acceptance of the work shall be replaced or relaid at the Contractor's expense.

- c. The Contractor will be held strictly responsible that all parts of the work bear the load of the backfill. If defects develop in the pipe within 1 year from the date of final acceptance of the work, the Contractor will be required to replace, at his expense, all such cracked pipe. To this end, the Contractor is advised to purchase pipe under a guarantee from the manufacturer, guaranteeing proper service of sewer pipe under conditions established by the Drawings, specifications, and local conditioning at the site of the work.
- 2. Leakage Tests: Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.
  - a. Infiltration tests and exfiltration tests: Perform these tests for sewer lines made of the specified materials, not only concrete, in accordance with ASTM C969. Make calculations in accordance with the Appendix to ASTM C969.
  - b. Low pressure air tests: Perform low pressure air testing as follows:
    - 1) Furnish all equipment, facilities, and personnel necessary to conduct the test. The test shall be observed by a representative of the Owner.
    - 2) Perform the first series of air tests after 2,000 LF but before 4,000 LF of sewer has been laid. The purpose of this first series of tests is to assure both the Contractor and the Owner that the materials and method of installation meet the intent of these specifications. Conduct the remainder of the tests after approximately each 10,000 LF has been laid.
    - 3) Plug all tees and ends of sewer services with flexible joint plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.
    - 4) Prior to testing, check the pipe to see that it is clean. If not, clean it by passing a full-gauge squeegee through the pipe. It shall be the Contractor's responsibility to have the pipe cleaned.

- 5) Clay pipelines: Test in accordance with ASTM C828. Allowable pressure drop shall be as given in ASTM C828. Make calculations in accordance with the Appendix to ASTM C828.
- 6) Concrete pipelines: Test in accordance with ASTM C924. Allowable pressure drop shall be as given in ASTM C924. Make calculations in accordance with the Appendix to ASTM C924.
- 7) Ductile Iron pipelines: Test in accordance with ASTM C924. Allowable pressure drop shall be as given in ASTM C924. Make calculations in accordance with the Appendix to ASTM C924.
- 8) PVC plastic pipelines. Test in accordance with UBPPA Uni-B-6. Allowable pressure drop shall be as given in UBPPA Uni-B-6. Make calculations in accordance with the Appendix to UBPPA Uni-B-6.
- 3. Deflection Testing: Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of the pipe. Determine whether the allowable deflection has been exceeded by the use of a pull-through device or a deflection measuring device.
  - a. Pull-through device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:
    - A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
    - 2) Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 40 degrees F, and shall have a surface Brinell hardness of not less than 150.

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- 3) Center bored and through-bolted with a 1/4 inch minimum diameter steel shaft having a yield strength of not less than 70,000 psi, with eyes or loops at each end for attaching pulling cables.
- 4) Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
- b. Deflection measuring device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.
- c. Pull-through device procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.
- d. Deflection measuring device procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.
- D. Visual Inspection of Miscellaneous Materials: All material used on this project are subject to visual inspection by the Owner's Representative at the site for conformance to the required specifications. When reasonable doubt exists that said material meets the specifications, the Owner's Representative may require certified mill tests, samples, and/or tests by an independent laboratory or other suitable form of verification that the material meets the required specifications.
- E. Field Tests for Concrete: Field testing requirements are covered in Section 03 30 00 Cast-In-Place Concrete.

#### 3.6 CLEANUP

A. After completing each section of the sewer line, remove all debris, construction materials, and equipment from the site work, grade and smooth over the surface on both sides of the line, and leave the entire right-of-way in a clean, neat, and serviceable condition.

#### **END OF SECTION**

## PART 1 – GENERAL

## 1.1 WORK INCLUDED

- A. The Contractor shall furnish and install a factory assembled submersible grinder pumping station consisting of two submersible grinder pumps, controls, fast-out assemblies, guide rails, liquid level controls, control panel, junction box and electrical connections, meters, meter base, FRP wet well with hatch cover, valve box with hatch cover, and all necessary appurtenances, as shown on the drawings and specified herein, complete and ready for operation.
- B. The sewer lift station, as specified herein, shall be provided by a single pump supplier.

## 1.2 REFERENCE STANDARD

A. Products and Execution listed in this Section shall comply with Alabama Department of Transportation Standard Specifications for Highway Construction 2018 Edition (ALDOT, 2018) at minimum. If a discrepancy exists between these specifications and ALDOT, 2018, then the Engineer shall be notified and the more stringent requirement will apply.

### 1.3 SUBMITTALS

- A. Submittal shall be provided in accordance with Section 01 33 00 Submittal Procedures.
- B. The shop drawings shall include outline dimensions and external connection diagrams. A list of components; certified typical curves showing complete pump performance from shutoff to at least 15 percent below rated head conditions, brake horsepower and NPSH required; control panel one-line wiring diagram and specifications; and a copy of the manufacturer's warranty. Shop drawings shall be submitted for wet well, access covers, pumps, valves, and control panel.
- C. Submit Operations and Maintenance Data including, but not limited to, the following:
  - 1. Submit manufacturer's complete parts list showing all parts, spare parts, and bulletins for pump. Clearly show all details, parts, and adequately describe parts or have proper identification marks. The parts lists shall be printed on good quality 8-1/2 by 11 inch paper, bound separately of the Operation and Maintenance manual with a flexible, durable cover. Drawings incorporated in the parts lists may be reduced to page size provided they are clear and legible, or they may be folded into the bound lists to page size. Photographs or catalog cuts of components may be included for identification.
  - 2. Pump Field Test Reports

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- 3. Installation and Start-Up Engineer's Report
- 4. Operating and Maintenance Instructions
- D. Submit Warranty.

### 1.4 SYSTEM DESCRIPTION

- A. General Project Requirements: Pumps shall be as specified by the Drawings or an approved equal. The Drawings list a product by name to establish a standard of quality, system operating characteristics, and dimensional constraints. Pumps by other manufacturers may be submitted to the Engineer for approval provided they are of the same or better standard of quality, produce the same system operation characteristics, and do not significantly alter the dimensional constraints.
- B. Provide station with two pumps with controls capable of operating the pumps either simultaneously or individually, depending on the flow.
  - 1. Furnish and install each lift station as a complete unit with necessary appurtenances.
  - 2. The pumps shall be easily removable from the lift station for inspection or service without the need for removal of nuts, bolts, or other fasteners and without the need for personnel to enter the wet well. Each pump shall be fitted with a stainless steel chain of adequate strength and length to permit raising the pump for inspection and removal. Manufacturer shall provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

### 1.5 QUALITY ASSURANCE

- A. The pump supplier shall provide a performance affidavit, signed by an officer of the company supplying the pumps and witnessed by a notary public, including the following:
  - 1. Verify conformance of materials and equipment for package lift station to the referenced publications or as specified,
  - 2. Verify that the manufacturer is regularly engaged in the manufacture of such products and systems, and
  - 3. Certify that the Contract Documents have been examined and that the equipment will meet in every way the performance requirements set forth in the Contract Documents for the application specified.
- B. Pump Supplier Qualifications: The pump manufacturer shall have overall responsibility to supply the pumping units (submersible pump/motor, discharge elbow, cables, instrumentation and accessories) that meet the requirements of this

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specification. Thus, during start-up, installation, and performance evaluation, the pump manufacturer is the sole responsible party. The pump manufacturer shall supply a list of installations at which pumps of his manufacture, and ones similar to those specified, have been operating for at least 2 years.

### C. Warranty

- 1. Provide a manufacturers' warranty for pumps. Create a list or reference all specific operation and maintenance procedures that are required to keep the warranty valid.
- 2. The manufacturer of the pump station shall guarantee for a period of one year from substantial completion that the entire station and all equipment therein shall be free from defects in design, materials, and workmanship. Normal use items, such as grease, light bulbs, and mechanical seals, are excluded.

#### 1.6 EXTRA MATERIALS

A. Spare parts for routine maintenance and repair for a period of one year as recommended by the equipment manufacturer shall be provided by the Contractor.

# 1.7 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall inspect materials delivered to site for damage or other distress. Unload and store with minimum handling. Store materials onsite, in enclosures, or under protective covering, as recommended by the manufacturer. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and wet well free of dirt and debris. The manufacturer's instructions shall be followed for extended storage. Proper equipment for handling the pumps shall be supplied and shall be considered as special tools if not completely standard. Follow the manufacturer's recommendations for handling of the pump.

# PART 2 PRODUCTS

### 2.1 PUMP DESIGN

A. Pump shall be centrifugal type with volute case and semi-open impeller with pump-out vanes on the back shroud. Grinder impeller shall discharge directly into inlet of centrifugal impeller leaving no exposed shaft to cause packing of ground solids. The grinder unit shall consist of a primary grinder ring and impeller to macerate the solids for pumping by the centrifugal impeller. This arrangement shall be capable of handling large quantities of solids with a minimum of water. All parts of the grinder unit shall be hardened stainless steel. Complete grinder assembly shall be removed from pump without disturbing pumps, seals, or motor.

## 2.2 SUBMERSIBLE GRINDER PUMP

#### A. Pump Construction

- 1. All major parts, such as the pump casing, seal housing, motor housing, motor and cap, sliding bracket, and impeller, shall be of gray iron and shall be painted with a red primer and finished with an epoxy acrylic paint. All nuts, bolts, and miscellaneous hardware in contact with pumped material and inside wet well shall be stainless steel (Type 316), unless otherwise indicated on plans.
- 2. Each pump shall be provided with a mechanical rotating shaft seal in an oil reservoir. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The pump impeller and grinder unit shall be mounted on the common stainless steel extended motor shaft. The impeller shall be statically and dynamically balanced, and shall be non-overloading for operation at any capacity within its range.
- 3. The electric motor shall be NEMA Design B with Class F insulation, and designed for continuous duty. Motor winding, rotor and bearings shall be completely sealed in oil. Oil shall lubricate bearings and transmit heat from winding to outer shell. Motor shaft shall be stainless steel. No lubrication of motor or seals shall be required. The shaft shall be sealed with two mechanical face type seals with an oil chamber between the seals to lubricate running faces.
- 4. The cable entry seal design shall be such to ensure a watertight and submersible installation. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be sized to allow motor voltage conversion without replacing the cable.
- 5. Each motor shall incorporate an ambient temperature compensated overheated sensing device and a moisture sensing device wired in series. The protective devices shall be wired into the pump controls in such a way that if either device operates, the pump will shut down.

#### B. Mounting

1. The manufacturer shall provide cast iron fast-out fixtures to allow the pump to be installed or removed without requiring personnel to enter the wet well. The fixtures shall consist of a discharge elbow permanently mounted to the floor of the wet well, a sliding guide bracket which shall be an integral part of the pump unit, two stainless steel slide rails which will guide the pump into position, and stainless steel lifting cable, as shown on the plans.

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#### 2.3 WET WELL

A. Basin shall be molded of fiberglass reinforced polyester resin of the lay-up and spray technique to assure that the interior surface is smooth and resin rich. 25% glass fibers shall be used and resin shall be POLYCOR 939-X-100 as manufactured by Cook Paint & Varnish Co. or equal. The basin shall have a minimum wall thickness of 1/4". A heavy rib shall extend vertically around the basin for strength and shall have holes through the rib for anchoring in concrete to prevent flotation.

### 2.4 ACCESS COVERS

- A. Wet Well: The Contractor shall furnish and install one single leaf aluminum access door within alum basin cover. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 300 pounds per square foot. Access covers shall be hinged and hasp-equipped, including stainless steel guide rail bracket and holders for lifting chain and motor cable. Access cover shall be provided with stainless steel hardware.
- B. Valve Box: The Contractor shall furnish and install one double leaf aluminum access door. Door leaf shall be 1/4-inch aluminum diamond pattern plate to withstand a live load of 300 pounds per square foot. Access covers shall be hinged and haspequipped with stainless steel hardware.

## 2.5 CONTROLS

#### A. General:

- 1. All electrical equipment and materials supplied by the Contractor shall be coordinated to function according to the design indicated on the Drawings. All materials and equipment shall be new and a standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer. Equipment or materials found to be defective or damaged shall be replaced or repaired by the Contractor at no additional cost to the Owner.
- 2. Electrical work shall be in accordance with the latest edition of the National Electric Code and with all applicable local codes, regulations, and ordinances in effect at the place of the work.

#### B. Scope and Panel Operation

- 1. The control logic shall operate two electrical submersible grinder pumps at the power characteristics as specified.
- 2. The control logic shall provide for the operation of the pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump will automatically start to handle the increased flow. As the

liquid level decreases, the pumps will shut off at the elevations shown on the plans. In the event of a malfunction or a flow that exceeds the capacity of the pumps, a high level audible and light alarm will be excited to indicate alarm conditions. A silencer shall lock out the audible alarm; however, the alarm light shall release only with the correction of the high level condition.

C. Construction and Materials: The control panel shall be NEMA 3R of fiberglass, Type 304 stainless steel or aluminum construction, with dead front aluminum inner door, and mounted on a concrete post and of adequate size to install all electrical components necessary. The junction box shall be heavy duty plastic (English Electric type APO weather tight or approved equal).

#### D. Panel Exterior:

- 1. Panel to have heavy duty key locking door handle. Mounted on the exterior enclosure shall be an alarm light, a high water level audible alarm with silencer button, and a standby generator receptacle.
- 2. All exterior mounted accessories shall be constructed of corrosion proof materials such as stainless steel or aluminum.
- 3. Control wiring from the wet well shall enter the panel in a manner to prevent the possible entry of gases from the wet well, in accordance with NEC Article 501 for Class 1, Division I locations.

#### E. Panel Inner Door

- The inner aluminum door mounted on a continuous hinge shall be furnished for protection against exposed wiring and shall have cutouts for access to the circuit breakers and pump resets. Mounted on the inner door will be pump run lights, level indication lights, seal failure/over temp lights, hands-off automatic switches, elapsed time meters, main circuit breaker, a fifteen (15) ampere ground fault duplex receptacle, motor resets, emergency circuit breaker with transfer interlock, control circuit breaker, duplex receptacle breaker, motor circuit breakers, lightning arrestor, and surge arrestor.
- 2. A permanently affixed 11" x 17" (minimum), laminated panel wiring schematic and pump data sheet shall be installed on the interior of the enclosure door.

#### F. Control Circuits

- In order to ensure maximum personnel safety, all wet well (level sensor) circuits shall be run at 24 volts AC. The control circuit breakers shall be run at 115 volts.
- G. Panel Components: The following power, control and alarm components shall be provided:
  - 1. Circuit Breakers: All circuit breakers shall be heavy duty ER molded case breakers as manufactured by Square D or equal. The main circuit breaker shall

- be mounted on the exterior panel side and be provided with provisions for locking in an "on" or "off" position.
- 2. Auxiliary Power Connection: A receptacle for the connection of a standby generator and a manual transfer switch to select either main or standby power shall be provided. Plugs and receptacles shall be as approved by the Engineer.
- 3. Duplex Service Receptacle: A duplex service receptacle supplying 30 amps at 115 volts shall be provided on the panel door. The duplex receptacle shall be provided with ground fault protection.
- 4. Lightning Arrestor and Surge Capacitor: A lightning arrestor and surge capacitor shall be installed and wired to protect motors and control equipment from lightning induced line surges and transient voltage surges.
- 5. Elapsed Time Meters: Elapsed time meters shall be 115 volt non-reset types and shall indicate pump running time in hours and tenths of hours to 99999.9 hours.
- Motor Starters: The panel shall contain two NEMA FVNR starters. The motor starters shall be across the line magnetic starters with individual overload protection on each power leg with motor resets installed through the dead front door. Acceptable manufacturers are Allen Bradley, Square D, and Cutler Hammer or equal.
- 7. Phase Monitor (for 3-phase pump motors only): A 3-phase shall be installed and wired to disconnect control power from the motor starters in the event of loss of power, phase reversal, loss of any phase or phase balance, or low voltage. The phase monitor shall automatically reset upon removal of any and all of the preceding conditions.
- 8. Pump Run Lights: A 115 volt pump run lights shall be connected in parallel with each motor starter and indicate when a particular pump is running.
- 9. Control System: The control system shall consist of: 24 volt transformer; plug-in relays; plug-in solid state automatic alternator with test switch; plug-in three phase monitor (as required); and terminal strip for the installation of four level regulators. All control wiring shall be color coded (minimum of 18 colors) size 18, rated for 300 volts, 80 C stranded tinned copper, PVC insulated, and shall be installed in wiring duct with cover.
- 10. Audible Alarm: The audible alarm shall consist of a weatherproof high intensity electronic horn mounted on the side of the enclosure.
- 11. The audible alarm shall be equipped with a control panel mounted push-button silencer. The alarm circuit will automatically reset when the high liquid level condition is corrected.
- 12. Liquid Level Indication Lights: A 115 volt level indication light shall be connected in parallel with each liquid level control sensor and indicate when a

- particular liquid level sensor is activated.
- 13. Red Alarm Light with Flasher: The alarm light shall consist of a weatherproof light with lexan globe. The alarm circuit will automatically reset when the high liquid level condition is corrected.
- 14. Moisture and Temperature Sensors: One moisture and temperature sensing relay with associated red indicator light for each pump shall be mounted in the dead front panel. These sensors shall detect moisture in the casing of the submersible pump and excessive heat within the pump motor. If either condition is noted, then the indication light shall light, the pump disconnects and the alarm sound.
- 15. Terminal Strip: Terminal strip for pumps shall be of the lug type, rated for 600 volts. Amperage rating shall match the largest pump in the station and will accommodate the control circuit amperage.

### H. Liquid Level Controls

- Liquid level sensors with electrical cables (of the proper lengths) shall be provided to control the pumps based upon the control level elevations as shown on the drawings.
- 2. The liquid level sensors shall be hollow and hermetically sealed, rigidly molded in abrasion and corrosion resistant polypropylene which contains a hermetically sealed SPDT mercury switch, cushioned and mounted along the main axis at about a 65° inclination. A three conductor oval cable, heavily sheathed in PVC for resistance to immersion, corrosion and abrasion, to convey electrical signals and to provide support for the unit, shall be assembled into the small end of the sensor.
- 3. The liquid level sensors shall contain an eccentric metal weight. When not immersed in liquid, the weight shall cause the sensor body to hang straight down from the cable, providing one stable position for both body and circuit. As liquid immerses the body, the free end shall rise as the weighted end holds the cable taut, retaining a vertical position. This ensures the proper switch position for repeatable circuit closure at the given inclination.

# PART 3 EXECUTION

### 3.1 INSTALLATION

A. Install lift station as indicated, in accordance with drawings and the manufacturer's instructions. Dampen and isolate equipment vibration.

### 3.2 FIELD QUALITY CONTROL

#### A. Field Test

1. When the pumping facility is complete and ready for operation, then the station shall be inspected and tested for compliance to the contract documents. Test of the equipment shall be made in the presence of the Engineer, the Contractor, the Electrical Subcontractor (if used), the equipment manufacturer's representative, and the Owner's representative. The equipment tests shall include, but not be limited to, the following:

#### B. Pumps and Motors

- 1. Pump shall be run and a determination made of the pumping capacity. Performance of the pump shall meet the specified criteria when field tested.
- Contractor shall have suitable pressure gauges installed on each pump discharge for use during testing. Once satisfactory performance of pumps has been demonstrated, Contractor shall remove pressure gauges and install removable plugs.

#### C. Electrical

1. Recorded readings shall be made of voltage and amperage on all electrical components at start and operating conditions. Such readings shall be recorded on a form provided by the manufacturer and the results shall meet the manufacturer's prescribed limits. If a tested item fails to meet its requirements, then it shall be replaced. Results of the tests shall be given to the Engineer with the serial number of the accessory tested.

#### D. Controls

1. Controls shall be tested to determine satisfactory performance for starting and stopping at the proper liquid levels, pump sequence and alarm actuation.

### E. Equipment

 Equipment shall be operated to determine if the alignment is visually correct, that there is no overload or overheating or objectionable vibration and that all the operating features are in working order. Submersible pumps shall be raised completely and reset to assure proper seating and operation.

## F. Inspection

 A thorough inspection of all mechanical and electrical equipment and controls, piping, valves, fittings, brackets, mountings, seals, conduit, painting, sleeves, components, and features shall be made while the station is being tested to determine performance and compliance with design requirements and specifications.

#### G. Structure

1. The station shall be inspected for performance, structural soundness, and water tightness.

### H. Repairs, Adjustments and Replacements

 The Contractor shall make any and all necessary repairs, adjustments, and replacements until performance has been demonstrated to the satisfaction of the Engineer. The Contractor shall bear the cost of any repair, adjustment, and replacement.

## I. Manufacturer's Representative

1. The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble free operation and instruct the operating personnel in the proper care and operation of the equipment.

**END OF SECTION** 

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## Part 1 - General

### 1.1 Section Includes

- A. Pipe and fittings for underground force mains.
- B. Valves and appurtenances

### 1.2 Reference Standard

A. Products and Execution listed in this Section shall comply with Alabama Department of Transportation Standard Specifications for Highway Construction 2018 Edition (ALDOT, 2018) at minimum. If a discrepancy exists between these specifications and ALDOT, 2018 then the Engineer shall be notified and the more stringent requirement will apply.

## 1.3 Submittals

- A. Submit in accordance with Section 01 33 00 Submittal Procedures.
- B. Product Data: Submit manufacturer's standard drawings or catalog cuts. Include information concerning gaskets with submittals for joints and couplings. Provide data on:
  - 1. Pipe materials
  - 2. Pipe fittings, joints, valves, couplings and accessories.
  - Valve boxes.
- C. Manufacturer's Certificates:
  - 1. Certify that pipe, fittings, and valves meet or exceed specified requirements.
- D. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. For all valves and fittings, provide either GPS coordinates (to centimeter accuracy) or provide field ties to two permanent above-ground locations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

# 1.4 Quality Assurance

A. Perform Work in accordance with Owner's requirements and applicable regulations of the State of Alabama.

# 1.5 Delivery, Storage, and Handling

- A. Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Do not store materials directly on the ground. Store PVC pipe away from heat or direct sunlight.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Keep the interiors of all piping, fittings and other accessories free from dirt and foreign matter at all times.
- D. Handle pipe, fittings, valves and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Owner. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight. Under no circumstances shall pipe be dropped or dumped from delivery trucks to the ground or into the trench.

## Part 2 - Products

## 2.1 General

- A. All materials of the same type shall be the product of the same manufacturer.
- B. All fittings and valves shall be manufactured in the United States.
- C. Unless otherwise shown on drawings, piping for force mains less than 4 inches in diameter shall be polyethylene (PE) plastic.

# 2.2 Polyethylene (PE) Plastic Piping

- A. Pipe, tubing, and heat-fusion fittings shall conform to AWWA C906. High Density Polyethylene Pipe (HDPE) and fittings shall be made of high density extra high molecular weight (EHMW) polyethylene with a standard thermoplastic material designation code of PE3408 and having a cell classification of 345464E per ASTM D3350. The molecular weight category shall be extra high (250,000 to 1,500,000) as per the Gel Permeation Chromatography determination procedure with a typical value of 300,000 to 330,000.
- B. All HDPE piping must have identifiable green striping (dual) every 120°. The pipe will be color grey or black and shall meet the Utility Location and Coordination Council, "Uniform Color Code," for sewer lines per APWA/ULCC Standards Committee.

- C. The pipe and fittings shall have product traceability. The manufacturer shall include a print line on the pipe. This shall notate the manufacturer's name, date of manufacture, the lot and supplier of raw material, plant location, and production shift. The ASTM standard shall also appear as ASTM F714 with the material designation as PE3408.
- D. The polyethylene pipe manufacturer shall provide certification that the stress regression testing has been performed on the specific product. The said certification shall include a stress life curve per ASTM D2837. The stress regression testing shall have been performed in accordance with ASTM D2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined by ASTM D2837.
- E. The material shall be listed by the Plastics Pipe Institute (PPI), a division of The Society of the Plastics Industry in PPI TR-4. The pipe material shall have a Hydrostatic Design Basis of 1600 psi at 73°F and 800 psi at 140°F. The PPI listing shall be in the name of the pipe manufacturer and testing and validation of samples of the pipe manufacturer's production pipe shall be based upon ASTM D2837 and PPI TR-3.
- F. The manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these specifications and that the pipe complies with AWWA Standards and NSF Standard 61. The certificate shall state the specific resin used and its source.
- G. HDPE pipe manufactured from materials meeting the specifications of this section shall have an Environmental Stress Crack Resistance of no failures in 10,000 hours (ESCR: FO>10,000) when tested in accordance with ASTM F1248.
- H. Pipe and fittings shall be manufactured from material meeting the requirements of this section. Pipe supplied under this specification shall have a nominal DIP (Ductile Iron Pipe) outside diameter unless otherwise specified. The Dimension Ratio (DR) and pressure rating of the pipe at 73°F shall be selected for 150 psi pressure rating.
- I. Connections of HDPE pipe to other piping materials shall be made with weld-on transition fittings.

# 2.3 Trace Tape or Wire

- A. Magnetic detectable conductor, in accordance with Section 31 20 00 Earth Moving.
- B. Tracer wire shall be a #12 AWG (minimum) copper conductor, insulated with a minimum 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet APWA color code standard for buried utilities.

### 2.4 Accessories

A. Concrete for Thrust Restraints: Use concrete, ASTM C94/C94M, having a minimum compressive strength of 3,000 psi at 28 days.

#### B. Air Release Valves

Air release valves shall be designed to permit release of air from an empty pipe during filling and shall be capable of discharging accumulated air in the line while the line is in operation and under pressure. Valves shall be attached by means of threaded pipe connections. Valves shall be vented to the atmosphere.

- 1. Manual Air Release Valves: Manual air release valves shall consist of a 3 inch gate valve and 3 inch ductile iron pipe and fittings. The valve shall be installed with its line of flow in the horizontal position.
- 2. Automatic Air Release Valve: Automatic air release valves shall be of the compound lever type capable of withstanding operating pressures of 150 psi. The valves shall have a 1/2 inch outlet. The body and cover of the valve shall be of iron with a stainless steel float. All internal parts shall be stainless steel or bronze. The valve shall be specifically adapted for use with sewage. Each valve shall be complete with hose and blow-off valves to permit backflushing without dismantling the valve.
- 3. Manufacturer/Product: Apco, VentoMat, or Valmatic

## Part 3 - Execution

## 3.1 Examination

- A. Verify that municipal utility force main size, location, and invert are as indicated on the drawings. Report any discrepancies to the Engineer before proceeding with the work.
- B. Examine all pipe, fittings, valves, and other appurtenances carefully for damage and other defects immediately before installation. Mark defective materials and hold for final disposition.

# 3.2 Preparation

- A. Cut pipe ends square and beveled, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges, unions or threaded.

# 3.3 Trenching

- A. Hand trim excavation for accurate placement of pipe to elevations indicated. Bell holes shall be big enough so that there is ample room for pipe joints to be properly made. Between bell holes, carefully grade the bottom of the trench so that each pipe barrel will rest on a solid foundation for its entire length.
- B. Form and place concrete for pipe thrust restraints at each change of pipe direction.

- Place concrete to permit full access to pipe and pipe accessories. Install thrust restraints in the sizes indicated on the Drawings.
- C. Restrained Joints. Restrained Joints shall be installed as shown on the plans or as directed by the Engineer. Installation shall conform to the manufacturer's recommendation.
- D. The standard laying conditions shall be completed in accordance with ANSI/AWWA C150/A21.50 and as required by the specifications.

## 3.4 Installation - Pipe

- A. Separation of Water Mains from Sanitary Sewer Mains
  - 1. Parallel Installation
    - a. Normal conditions Water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole, whenever possible; the distance shall be measured edge-to-edge.
    - b. Unusual conditions When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that:
      - 1) The bottom of the water main is at least 18 inches above the top of the sewer;
      - Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

### 2. Crossings

- a. Normal conditions Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.
- b. Unusual conditions when local conditions prevent a vertical separation as described in 2.a. above, the following construction shall be used:
  - Sewers passing over or under water mains should be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.
  - 2) Water mains passing under sewers shall, in addition, be protected by providing:
  - 3) Provide a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main;

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- 4) Provide adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;
- 5) The length of water pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.
- 6) Both the sewer and the water main shall be constructed of water pipe materials and tested in accordance with this specification.
- B. Lay force main lines to and maintain at the lines and grades required by the drawings. All fittings and valves shall be at the required locations, the spigots centered in the bells, and all valve stems plumb. Establish elevations of buried piping to ensure not less than 36 inches of cover unless otherwise indicated on the drawings.
- C. Route pipe as shown on the Drawings. Wherever pipe must be deflected from a straight line (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall not exceed 75% of the maximum deflection allowed by the pipe manufacturer, and shall be approved by the Engineer.
- D. Lay pipe with the bell ends facing in the direction of laying unless otherwise directed by the Engineer.
- E. Close the open ends of pipes with a watertight plug whenever pipe laying is not in progress. No debris, tools, clothing or other material shall be placed in the pipe at any time. If the joints of any pipe in the trench cannot be completed until a later time, caulk them with packing in order to make them as watertight as possible; this shall be done not only at the end of each working day but also before work is stopped for lunch periods, bad weather, or any other reason. If there is water in a trench, leave this seal in place until the trench has been pumped completely dry.
- F. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations. Loop wire up in all valve boxes to provide a minimum 24" loop.
- G. Lay no pipe in water or when it is the Engineer's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the project, and no separate payment will be made for its use.
- H. When crossing water courses which are greater than 15 feet in width:
  - 1. The pipe shall be of special construction, having flexible, watertight joints.
  - 2. Valves shall be provided at both ends of water crossing and the valves shall be easily accessible and not subject to flooding.
  - 3. Two 3/4-inch taps should be made for sampling and testing.

I. For installations requiring other forms of corrosion protection, see AWWA Manual M27.

## 3.5 Field Quality Control

- A. Perform field inspection and testing in accordance with Section 01 40 29 Testing Laboratory Services.
- B. Hydrostatic Testing
  - 1. Pressure test
    - a. Test restrictions. Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section.
    - b. Test pressure shall not exceed pipe or thrust-restraint design pressures.
    - c. The hydrostatic test shall be of at least 1-hour duration.
    - d. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. For tests at these pressures, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or the valve can be fully opened if desired.
    - e. The test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed valves.
  - 2. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing. Each valved section of pipe shall be slowly filled with water, and the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied using a pump connected to the pipe. The system should be allowed to stabilize at the test pressure before conducting the hydrostatic test.
  - 3. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at these points to expel the air as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and the pipe plugged or left in place as required by Engineer.
  - 4. Any exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves or joints that are discovered following the pressure test shall be repaired or replaced with reliable material, and the test shall be repeated until satisfactory results are obtained.

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#### C. Leakage Test

- Leakage shall be defined as the quantity of makeup water that must be supplied into the newly laid pipe or any valved section thereof to maintain the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall be measured by a drop in pressure in a test section over a period of time.
- 2. The leakage test shall be of at least a two hour duration. Contractor to furnish the pump, pipe, connections, measuring devices, and all other necessary apparatus as well as all necessary assistance to conduct the test. The leakage test shall be conducted in the presence of the Owner's representative.
- 3. No pipe installation will be accepted if the amount by Table 3 of makeup water is greater than that listed.
- 4. Should any test of laid pipe disclose leakage greater than that specified, the Contractor shall, at his own expense, locate and repair or replace the defective joints until leakage is within the specified allowance.
- 5. All visible leaks are to be repaired regardless of the allowance used for testing.

Table 3 Leakage testing allowance per 1,000 ft of pipeline\*-gpht

Avg. Test										
Pressure psi		Pipe Size (inches)								
	4	6	8	10	12					
250	0.43	0.64	0.85	1.07	1.28					
225	0.41	0.61	0.81	1.01	1.22					
200	0.38	0.57	0.76	0.96	1.15					
150	0.33	0.50	0.66	0.83	0.99					

<sup>\*</sup>If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.

<sup>t</sup>Calculated by the following formula:

$$L = \frac{SD\sqrt{P}}{148.000}$$

Where L is allowable leakage in gallons/hour, S is the length of pipe tested in feet, D is pipe diameter in inches and P is test pressure in psi.

D. If tests indicate that the Work does not meet specified requirements, repair the Work until it meets the requirements or remove the Work, replace and retest at no cost to the Owner.

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E. After each section of pipe is successfully tested, remove all debris and construction materials from the work site. Grade all areas to the elevations required by the drawings, or to the pre-construction elevations if no grade changes are required by the drawings. Seed and sod all areas disturbed by the construction.

**END OF SECTION** 

#### Part 1 General

- 1.1 The work covered by this section shall consist of excavating and backfilling the trench and of furnishing, laying, and jointing vitrified clay, precast concrete, and corrugated metal culvert pipe and fittings. It shall not include the construction of manholes, inlets, outlets, and ther structures incidental to the construction of storm sewers or drains, all of which are covered elsewhere in these specifications. Excavation for storm sewers or drains shall comply with all applicable provisions of Section 31 20 00, Earth Moving
- 1.2 Submit product data on all products specified in this section, per Section 01 30 00 requirements.

#### Part 2 Products

#### 2.1 General

A. The diameter of pipe culverts and storm drains shown on the project drawings and bid schedule are based on Manning's formula for pipe flowing full, using n = 0.013 and the slopes shown on the drawings and profiles. If alternative materials and types of pipe culverts and storm drains are used, alter the diameter of the pipe shown to accommodate the required flow.

### 2.2 HDPE And Concrete Culvert Pipe

- A. All high density polyethylene (HDPE) pipe and fittings shall conform to ASTM D3350 or ASTM D1248.
- B. All concrete sewer pipe with an internal diameter of 15 inches or less shall be extra strength sewer pipe conforming to ASTM C14. All concrete pipe with an internal diameter of 18 inches or more shall be reinforced concrete pipe conforming to ASTM C76, Table III, IV, or V, as specified on the drawings. Horizontal elliptical shall conform to C-507 Class HE-II, HE-III, or HE-IV as specified on the drawings.
- C. Circular concrete pipe with elliptical reinforcement is not included in these specifications and will not be accepted.
- D. All concrete pipe shall be a minimum of 3 feet long for pipe with an internal diameter of 6 inches or less and a minimum of 4 feet long for pipe with an internal diameter of 8 inches or more, unless otherwise indicated on the drawings. All concrete pipe with an internal diameter of 12 inches or less shall have bell and spigot joints. All concrete pipe larger than 15 inches in internal diameter shall have tongue and groove joints.
- E. All pipe and specials shall be inspected and accepted by an approved commercial testing laboratory prior to delivery to the work site. Each joint and each special shall be stenciled or otherwise marked with the laboratory's mark of acceptance. Furnish the A/E with 2 certified copies of the laboratory's report of inspection, test, and acceptance on all pipe and specials prior to its incorporation in the work.

#### Storm Sewers

- F. The Contractor shall require that his supplier furnish a certification that all materials furnished meet the above standards and specifications.
- G. Furnish pipe in the sizes shown on the drawings. Install wyes for future service connections where called for, and close with clay or concrete stoppers placed with the approved joints. All pipe and specials shall be of new materials not previously used.
- H. When rubber gasket joints are used, the pipe shall be manufactured in strict accordance with the recommendations and requirements of the manufacturer of the particular rubber gasket selected.

# 2.3 Joint Reinforcement - Concrete Pipe

- A. In all machine made concrete pipe with an internal diameter of 18 inches or more, the tongue shall be reinforced with circumferential reinforcement equal in area to that of a single line within the barrel of the pipe. At the groove end, the top strand of the circumferential reinforcement shall not be below the shoulder of the groove.
- B. In all cast concrete pipe with an internal diameter of 18 inches or more, both the tongue and groove ends of the pipe shall be reinforced with circumferential reinforcement equal in area to that of a single line within the barrel of the pipe.

#### 2.4 Joint Materials

- A. Joints shall meet ASTM M294 with integral bell and spigot. Joints shall have a gasket and be silt tight.
- B. Joint material for each sewer pipe larger than 15 inches in internal diameter and each tongue and groove pipe shall have a rubber gasket. The gasket material for caulking joints shall be twisted jute or oakum that is free from oil, tar, or grease.
- C. Rubber or neoprene joints shall be Tylox Type CR, Type C, O-ring, or equal; the bell and spigot and the tongue and groove of the pipe shall be specially manufactured and prepared for the use of the type of joint selected. The rubber gaskets shall meet the requirements of ASTM C443. Submit the shape and design to the A/E for his approval.

#### Part 3 Execution

# 3.1 Pipeline Construction

- A. Lay no pipe except in the presence of an inspector representing the A/E.
- B. Before constructing or placing joints, demonstrate to the A/E, by completing at least one sample joint, that the methods employed conform to the specifications and will provide a watertight joint, and further that the workmen intended for use on this phase of the work are thoroughly familiar and experienced with the type of joint proposed.
- C. Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as provided in Section 31 23 17, Unclassified Excavation for Utilities.

- D. Wherever necessary to provide a satisfactory bearing surface, place concrete cradles as shown on the drawings or as directed by the A/E. Cradles shall be of concrete with f' = 3,000 psi, as defined by ACI standards, and shall conform to the dimensions shown on the detailed drawings.
- E. Tightly stretch a mason's line or wire above the ground level, parallel to and directly above the axis of the pipe to be installed; this line is to be supported at intervals of no more than 50 feet on sewers being laid on a grade of 2% or more and not exceeding 25 feet for grades of less than 2%. Determine the exact line and grade for each section of pipe by measuring down from this line to the invert of the pipe in place. Accurately place each pipe to the exact line and grade called for on the drawings. Furnish all labor and materials necessary for erecting batterboards. The use of laser beams will be allowed in accordance with manufacturers recommendations.
- F. Do not allow water to run or stand in the trench while pipe laying is in progress, before the joint has completely set, or before the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to dewater.
- G. Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have been started, and bring them to exact line and grade with compacted earth as necessary.
- H. Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the bells upgrade.
- I. Bell holes shall be large enough to allow ample room for the pipe joints to be properly made. Cut bell holes out not more than 10 joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel will rest on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.
- J. Jointing operations shall follow pipe laying very closely; failure to comply with this provision will result in the A/E's stopping all pipe laying operations until jointing operations catch up.
- K. HDPE pipe shall be installed in accordance with ASTM D2321.

#### 3.2 Joint Construction

#### A. Rubber Joints

1. Rubber gaskets and the method of joint construction shall be in strict accordance with the manufacturer's directions and requirements. Adequately lubricate the gaskets with special cement provided for this purpose, and pipe joints shall be shall be adequately and thoroughly driven home or seated.

# 3.3 Wyes And Tees

- A. Install wyes and tee branches in the sewer line as shown on the drawings and/or at such other locations as may be designated by the A/E. If such branches are not to be used immediately, close them with precast clay or concrete stoppers held in place with jointing compound.
- B. As the work progresses, thoroughly clean the interior of all pipe in place. On small pipe, keep a swab or drag in the pipe line, and pull forward past each joint immediately after it has been made. After laying each line of pipe, carefully inspect it, and remove all earth, trash, rags, and other foreign matter from its interior.
- C. After the joints have been completed, they shall be inspected, tested, and accepted by the A/E before they can be covered. The pipe shall meet test requirements for watertightness; immediately repair any leaks or defects discovered at any time after completion of the work. Take up any pipe that has been disturbed after joints were formed; clean and remake the joints; and relay the pipe at the Contractor's expense. Carefully protect all pipe in place from damage until backfill operations are completed.
- D. Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the A/E. Backfilling shall be performed in the manner provided in Section 31 23 17, Unclassified Excavation for Utilities.

#### 3.4 Connections

- A. Make connections to all existing sewer lines as shown on the drawings or as directed by the A/E. Make connections either by removing a section of the sewer from the existing line and inserting in the space a wye branch of the proper size or by constructing a manhole, junction box, regulator chamber, or other structure as shown on the drawings.
- B. Make connections to existing manholes or inlets by cutting a hole in the wall of the existing structure, inserting a length of pipe into the hole, filling around the pipe with concrete or mortar, and troweling the inside and outside surfaces of the joint to a neat finish. Shape or reshape the bottoms of manholes as necessary to fit the invert of the sewer pipe.

# 3.5 Pipe Protection

A. If pipe sewer has less than 1-1/2 feet of cover when completed, provide concrete protection as shown on the drawings or required by the A/E. Place the protection in accordance with the standard drawings.

# 3.6 Existing Utilities

A. Carefully protect all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work from damage at all times. Wherever it is necessary for the proper accomplishment of the work to repair, remove, and/or replace any utility or structure, do so in accordance with

the provisions set forth in the General and Supplementary Conditions and in Division 1, General Requirements.

# 3.7 Clean-Up

A. After completing each section of sewer line, remove all debris and construction materials and equipment from the site of the work, grade and smooth over the surface on both sides of the line, and leave the entire right-of-way in a clean, neat, and serviceable condition.

**END OF SECTION** 

### Part 1 General

# 1.1 Scope of Work

- A. This item shall consist of catch basins, inlets, inspection holes and miscellaneous drainage structures constructed of such materials and in accordance with these Specifications at the locations and in conformity with the lines, grades and dimensions shown on the Plans or required by the Engineer. These structures shall include the furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown the Plans or required by Engineer. The structures shall provide for the collection of surface water with the exception of manholes and inspection holes with closed covers which will be designated on the Plans or required by the Engineer.
- B. Submit product data on precast structures and appurtenances per Section 013300 requirements.

#### 1.2 Brick

A. Brick shall be medium hard or better grade MA Brick, conforming to the requirements of the latest ASTM "Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)," Serial Designation C 32.

#### 1.3 Mortar

A. The mortar for brick masonry and similar work shall be composed of one part of Portland Cement and three parts mortar sand by volume. The Portland Cement shall conform to the requirements of ASTM "Standard Specification for Portland Cement," Serial Designation C 150, Type 1. The sand shall conform to the requirements of AASHTO, "Standard Specification for Aggregate for Masonry Mortar," Serial Designation M 45. The water shall be clean and free from injurious amounts of sewage, oil, acid, strong alkalis or vegetable matter.

#### 1.4 Concrete

- A. Plain and reinforced concrete used in structures, connection of pipes with structures, support of structures or frames, shall be Class A.
- B. Precast concrete catch basins, Inlets and miscellaneous drainage structures may be precast. These precast structures shall meet the requirements set forth in ASTM 478 and ASTM C913.

# 1.5 Frames, Covers And Gratings

A. The castings shall conform to the following requirements:

- 1. All castings shall be true to form and dimensions, and shall be free from inclusions of foreign material, casting faults, injurious blow holes, cracks, sponginess, and other defects rendering them unsuitable.
- 2. The finished frame and cover or grate shall have the bearing surfaces machined or ground so that there will be no variation that will permit rocking or rattling, and the diameter of the cover or grate shall be such as to fit the frame without wedging.
- 3. All grate castings shall be designed for supporting a uniform load of one hundred (100) pounds per square inch. The open areas of the gratings shall be as designated on Plans, and the design loading shall be as specified.

### 1.6 Steps

A. The steps or ladder bars shall be gray or malleable cast iron, galvanized wrought iron, or galvanized steel. The bars shall be smoothly rolled and free from slivers, depressions or seams. The steps shall be the size, length, and shape as shown on the Plans. The steps which are not galvanized shall be given a coat of bituminous paint when directed.

#### 1.7 Unclassified Excavation

- A. The Contractor shall do all excavation for structures and structure footings to the lines and grades or elevations, shown on the Plans, or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the Plans, shall be considered as approximate only, and the Engineer may order, in writing, such changes in dimensions or elevations of footings as may be deemed necessary to secure a satisfactory foundation.
- B. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.
- C. The Contractor shall do all bracing, sheathing, or shoring necessary to perform and protect the excavation and the structure; also, as required for safety or to conform to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.
- D. Unless otherwise provided, bracing, sheathing or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in such a manner as not to disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

E. After each excavation is completed, the Contractor shall notify the Engineer to that effect, and concrete and reinforcing steel shall be placed after the Engineer has approved the depth of the excavation and the character of the foundation material.

#### 1.8 Brick Structures

#### A. Foundations

 A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of Class A concrete mix. The foundation shall be built to the correct elevation, and shall be finished to insure the least possible resistance of flow.

#### B. Laying Brick

- 1. All bricks shall be thoroughly clean. The bed which is to receive the brick shall be thoroughly cleaned and wetted with water before placing mortar thereon. All brick shall be laid in freshly made mortar composed of one part by volume of Portland Cement and three parts by volume of sand, with the possible addition of hydrated lime in an amount not to exceed fifteen percent (15%) by volume of the cement used. The brick shall be laid in courses using the shoved joint method to thoroughly bond them into the mortar and always with the joints completely filled with mortar. The brick shall be laid in a work person-like manner and true to the lines and grades indicated on the Plans. The arrangement of headers and stretchers shall be such as will thoroughly bond the masonry, and unless otherwise indicated, brick masonry shall be of alternate headers and stretchers with consecutive courses breaking joints. The courses shall be laid continuously with joints broken or alternating evenly with the joints in the proceeding courses. The joints shall not be less than one-fourth inch (1/4") more than one-half inch (1/2") in thickness. Face joints shall be neatly struck, using the weather joint. All joints shall be finished properly as the laying of brick progresses.
- 2. No spalls or batts shall be used except in shaping around irregular openings or connections or when unavoidable to finish out a course, in which case, a full brick shall be used at the corner and the bat in the interior of the course.
- 3. In case any brick is removed, or a joint broken during the laying, the brick shall be taken up, the mortar thoroughly cleaned from the brick, bed, joints, and the brick re-laid in fresh mortar. In hot and dry weather or when directed, the brick masonry shall be protected and kept moist for a period of at least forty-eight (48) hours after laying of the brick.
- 4. Brick masonry shall not be constructed in freezing weather or when bricks contain frost, except by written permission of the Engineer and subject to such conditions for protection against freezing.

#### 1.9 Concrete Structures

A. The structures shall be constructed of concrete, built on prepared foundations, conforming to the dimensions and form indicated on the Plans. Any reinforcement required shall be of the kind, type and size, and shall be furnished, located, spaced,

- bent and fastened as indicated on the Plans. It shall be approved by the Engineer before the concrete is poured.
- B. All invert channels shall be constructed and shaped accurately so as to be smooth, uniform, and cause minimum resistance to flow. The interior bottom shall be sloped downward toward the outlet.
- C. Precast Concrete structures may be used in lieu of any poured in place concrete structure.

### 1.10 Inlet and Outlet Pipes

A. Inlet and outlet pipes shall extend toward the walls of the structures for a sufficient distance beyond the outside surface for connections, but shall be cut off flush with the wall on the inside surface unless otherwise directed. Concrete or brick and mortar shall be constructed around the pipes so as to prevent leakage and form a neat connection.

### 1.11 Placement and Treatment of Castings, Frames and Fittings

- A. All castings, frames and fittings shall be placed in the positions indicated on the Plans or as directed by the Engineer and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in-place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.
- B. When frames or fittings are to be placed upon previously constructed masonry, the bearing surface or masonry shall be brought true to line and grade and present an even bearing surface in order that the entire face or back of the unit will come in contact with the masonry, as indicated on the Plans or as directed and approved by the Engineer. All units shall set firm and secure.
- C. After the frames or fittings have been set in final position and the concrete or mortar has been allowed to harden for seven (7) days, the grates or covers shall be placed and fastened down.

# 1.12 Installation of Steps

A. The steps shall be installed as indicated on the Plans, or as directed by the Engineer. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is poured. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until seven (7) days have elapsed. After this period has expired, the steps shall be cleaned and painted, unless they have been galvanized.

# 1.13 Backfilling

A. After a structure has been completed, the area around it shall be filled with approved material, in horizontal layers not to exceed three inches (3") in loose depth, and

- compacted to the density specified. The fill shall be made to the elevation shown on the Plans, or as directed by the Engineer.
- B. No backfilling shall be placed against any structure until permission is given by the Engineer. In the case of concrete, such permission will not be granted until the concrete has been in place for fourteen (14) days, or until the tests made by the laboratory under the supervision of the Engineer establish that the concrete has attained sufficient strength to withstand any pressure created by the methods used and materials placed without damage or strain beyond a safe factor. Adequate provisions shall be made for thorough drainage.
- C. Fill shall be deposited all around a structure to approximately the same elevation at the same time. Special care shall be taken to prevent any wedging action against the structure, and all slopes bounding or within the area to be backfilled will be stepped or serrated to prevent wedge action.
- D. All backfill shall be compacted to the density required by Division 31.
- E. Backfill shall not be measured for direct payment. Performance of this work is not payable directly, but shall be considered as subsidiary obligation of the Contractor, covered under the contract unit price for the structure involved.

### 1.14 Cleaning and Restoration of Site

- A. After the backfilling is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulder or as ordered by the Engineer.
- B. After all work is completed, the Contractor shall remove all of his/her tools from the construction site, leaving the entire site free, clear and in good condition.
- C. Performance of the work described in this section is not payable directly, but shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for the structure.
- Part 2 Products (Not Used)
- Part 3 Execution (Not Used)

**END OF SECTION** 

SUBSURFACE EXPLORATION AND
GEOTECHNICAL ENGINEERING STUDY
Proposed
Guntersville Park Improvements
Sunset Drive
Guntersville, Alabama

OMI Job No. 8883

January 17, 2020

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January 17, 2020

Barge Design Solutions 200 Clinton Avenue, Suite 800 Huntsville, Alabama 35801

ATTN:

Mr. Garett Younanian, P. E.

SUBJECT:

Report of Geotechnical Engineering Study

Proposed Guntersville Park Improvements

Guntersville, Alabama OMI Job No. 8883

#### Ladies & Gentlemen:

OMI, Inc., has completed a subsurface exploration and geotechnical engineering study for the referenced project. Enclosed is the report of the findings as well as recommendations for foundation design and construction, site preparation, and other geotechnically related site activities. This work was authorized on September 18, 2019, by Mr. Garett Younanian, P. E. of Barge Design Solutions.

OMI, Inc., appreciates the opportunity to be of service to Barge Design Solutions and looks forward to continued involvement with the construction monitoring phase of this project. Please direct any questions concerning this report to the undersigned.

Respectfully submitted,

OMI, Inc.

Tyler A. White, E. I.

Staff Engineer

Distribution via email to: Garett. Younanian@bargedesign.com

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### 1.0 EXECUTIVE SUMMARY

The subject site is suitable for the support of the proposed structures. Soft to firm soils were encountered in proposed building and pavement areas and will require undercutting. OMI estimates that up to 4-ft of undercutting will be required to remove the poor soils in the building areas and up to 3-ft of undercutting will be required in proposed pavement areas. OMI recommends a contingency of 750 cubic yards of soil be included in the contract to be paid to the contractor on an in-place volume as required and recommended by OMI. Undercut quantities may be significantly reduced if earthwork activities proceed during the drier summer months. OMI has prepared passive pressure diagrams based on unconfined compressive strength tests performed on select split spoon samples. The passive pressure diagrams are included in the appendix of this report. OMI understands these diagrams will be used by others to design the foundations for the light poles. Auger refusal was encountered in 25 of the 31 light pole borings. Five of the light pole borings were terminated at 15-ft deep. The depth to auger refusal, where encountered, ranged from 7.5 to 13.5-ft deep. Specific recommendations for foundation design and site earthwork are given in the body of this report.

#### 2.0 INTRODUCTION

OMI, Inc., has completed a design geotechnical engineering study for the proposed Guntersville Park Improvements. This report outlines the scope of services provided and presents comments and recommendations based on professional opinions formed during the course of this study. This work was authorized on September 18, 2019, by Mr. Garett Younanian, P. E. of Barge Design Solutions. The work was performed in general accordance with OMI Proposal No. P-5664A. Foundation recommendations for the pedestrian culvert beneath Highway 69 are addressed in a separate report.

Assessment of the environmental aspects of this site, including previous land use or the determination of the presence of any chemical, industrial, or hazardous waste is beyond the scope of this study. However, OMI can provide these services if desired.

#### 3.0 EXPLORATION METHODS

The procedures used by OMI for field and laboratory testing are in general accordance with ASTM procedures and established engineering practice. Brief descriptions of the procedures used in this exploration are contained in the Appendix of this report.

Forty-two soil test borings were performed during this study. Boring locations are shown on the appended Boring Location Plan. Drilling and standard penetration testing was performed using track-mounted and truck-mounted drill rigs, each equipped with automatic hammers. A member of the OMI professional staff directed the drilling and logged the soils in the field. Subsequently, each sample was sealed and transported to the office. Selected samples were tested to determine the natural moisture content and Atterberg limits of the soil. These tests assist in confirming the visual classifications as well as provide an index of certain engineering properties. Unconfined compressive strength tests were also performed on select split spoon samples to assist in understanding the in-place soil strength properties. Particle size distribution tests were performed to assist with soil classifications. The soil classifications, field testing data, and the results of the laboratory tests are provided on the Soil Boring Records and in the Appendix of this report.

#### 4.0 SITE CONDITIONS

Guntersville Park is bordered to the east and west by Sunset Drive and Guntersville Lake, respectively. Guntersville Park borders Ogletree Park to the north. The southern end of Guntersville Park tapers to a point as Sunset Drive approaches the bank of Guntersville Lake. Highway 69 traverses the northern half of the subject property in an east to west alignment. Guntersville Park covers an area of about 47 acres with a maximum length and width of about 3,300-ft and 1,000-ft, respectively. Guntersville Park is currently occupied by several buildings including a senior center, gym, clubhouse with two swimming pools, tennis courts, seven athletic fields with associated field houses, dugouts, and restrooms, five parking lots, a boat dock, and a boat ramp just north of Highway 69.

The following topographic information is based on the Marshall County Interactive Maps website. Topographically, the site is relatively flat with an average ground surface slope of about one percent. Ground surface elevations range from about 607-ft MSL near the intersection of Highway 69 and Sunset Drive to 595-ft MSL along the bank of Guntersville Lake. The site is poorly drained. Standing water was observed in several areas of the site during this study. Surface drainage across the site generally flows to various grass lined swales or discharges as sheet flow to Guntersville Lake.

#### 5.0 SUBSURFACE CONDITIONS

Borings encountered topsoil, asphalt pavement, fill soil, alluvial soil, and residual soil deposits. The thickness of the topsoil layer, where encountered, was found to range from about 4 to 12-in with an average of about 7-in. Generally, the topsoil was underlain by fill soil and/or alluvial soil. Residual soil was encountered in each boring beneath the topsoil, fill, or alluvium. The residual soil extended to boring termination or auger refusal in each boring. Auger refusal was encountered in 31 of the 42 borings. Auger refusal was encountered as shallow as 7-ft below the ground surface.

Fill soil or possible fill soil was encountered in 23 of the 42 boring and extended to a maximum depth of about 5-ft below the ground surface. On average, the fill extended to about 2-ft below the surface. The fill soils' plasticity, consistency, color, and constituents varied widely across the site. Generally, the fill soil consisted of a low to high plasticity tan or brown sandy silty clay with trace organics. Standard penetration test (SPT) values in the fill soil ranged from 2 to 12 blows per foot (bpf) with an average of 5 bpf. Pocket Penetrometer values ranged from 1.25 to 4.5 tons per square foot (tsf) with an average of 3.0 tsf. Moisture contents ranged from 13 to 24 percent with an average of 20 percent.

Alluvial soil or possible alluvial soil was encountered in 5 of the 42 borings and extended to depths ranging from 2 to 7-ft below the ground surface with an average depth of about 4-ft. The alluvium was overlain by topsoil or fill and was underlain by residual soil. Generally, the alluvial soil consisted of a low plastic to non-plastic tannish gray sandy silty clay or clayey gravel with up to 40

percent gravel and up to 40 percent coarse to fine sand. SPT values in the alluvium ranged from 2 to 11 bpf with an average of 4 bpf. Pocket Penetrometer values ranged from 0.5 to 4.25 tsf with an average of 1.75 tsf. Moisture contents ranged from 19 to 47 percent with an average of 33 percent.

Residuals soil was encountered beneath the topsoil, pavement, alluvium, and/or fill in each boring. Residual soil extended to boring termination or auger refusal at each boring location. Generally, the residual soil consisted of a low to high plasticity tan or tannish-orange sandy silty clay with trace oxides and up to 10 percent gravel size chert. Thin bedded residual limestone fragments were noted in several borings at depths near auger refusal. Generally, strength values in the residual soil increased with increasing depth. SPT values in the residual soil ranged from 3 to over 30 bpf with an average of 12 bpf. Pocket penetrometer values ranged from 1.25 to 4.5 tsf with an average of 3.75 tsf. Moisture contents ranged from 12 to 36 percent with an average of 22 percent.

Atterberg limits tests were performed on 10 samples collected from the residual, alluvial, and fill soil deposits. Wash 200 sieve tests were also performed to assist with soil classification. Atterberg limits test results are tabulated below along with their respective boring number, depth of sample interval, depositional method, percentage by weight finer than a #200 sieve, and USCS soil classification.

Boring No.	Sample Interval Depth (ft)	Plastic Limit (percent)	Liquid Limit (percent)	Plasticity Index (percent)	Deposition Method	Percent Passing No. 200	USCS Classification
B-1	3.5 - 5.0	21	68	47	Residuum	-	СН
B-3	3.5 - 5.0	15	52	37	Residuum	-	СН
B-4	1.5 - 3.0	16	39	23	Alluvium	75.7	CL
B-4	6.0 - 7.5	15	49	34	Residuum	86.0	CL
B-5	1.5 - 3.0	14	51	37	Residuum	91.3	СН
B-6	1.5 - 3.0	19	41	22	Fill	58.3	CL
B-6	6.0 - 7.5	23	76	53	Residuum	86.2	СН
B-7	1.5 – 3.0	22	53	31	Residuum	-	СН
AP-4	1.5 – 3.0	18	50	32	Residuum	-	СН
LP-25	1.5 – 3.0	20	55	35	Residuum	-	СН

The results tabulated above indicates that the majority of the residual soil is high plastic while the fill soil and residual soil samples indicated a low plasticity. Atterberg limits test results for residual soil samples indicate an increasing plasticity with increasing depth.

Unconfined compressive strength tests were performed on select split spoon samples collected from the fill, alluvial, and residual soil deposits. The unconfined compression test results are provided in the appendix of this report. Test results indicate an undrained shear strength of alluvial and fill soils of 240 psf and 660 psf, respectively. Undrained shear strength values for the residual soils ranged from 580 to 4090 psf with an average of 1920 psf.

Groundwater was observed between 0.5-ft below the ground surface in boring B-4 and 9-ft in boring LP-22 during drilling. Accurate extended water table measurements were difficult to ascertain due to heavy precipitation a short time after drilling and due to poor surface drainage throughout the site. The elevation of the stabilized groundwater table is believed to be generally dependent on the water surface elevation of Guntersville Lake. Based on USGS quadrangle maps, OMI understands the normal pool elevation of Guntersville Lake is 595-ft MSL. Because of the geology of this region, the groundwater levels are also dependent upon seasonal precipitation and locally heavy rainfall events. Consequently, the groundwater levels can and do fluctuate with time.

#### 6.0 SITE GEOLOGY

The subject site is located within the Sequatchie Valley of the Appalachian Plateaus physiographic province. Published geologic information indicates the site is underlain by both the Inman Formation and the Undifferentiated Nashville and Stones River Group. Brief descriptions of these formations are provided below.

#### **Inman Formation**

The Inman Formation is of Ordovician age (440-490 million years old) and is composed of interbedded greenish-gray or moderate to dusky-red shale and light-gray peloidal limestone. The Inman Formation is mapped in the Sequatchie Valley.

# OMI, Inc.

#### Nashville and Stones River Groups Undifferentiated

The undifferentiated Nashville and Stones River Group is of the Ordovician age (310-345 million years). In the vicinity of the site, the limestone is composed of medium to dark gray, fine to coarse grained, fossiliferous limestone which is argillaceous in part. Typically, the formation contains yellowish-gray laminated silty limestone near the top. One or more thin beds of bentonite and bentonitic shale are usually present in this formation.

#### Sinkhole Activity

Sinkholes have occurred in this formation within the vicinity of this site. However, surface observations and the subsurface exploration did not disclose evidence of sinkhole activity on this site. This exploration does not, nor was it intended to, address the possibility of future sinkhole development.

#### 7.0 PROJECT INFORMATION

The following project information is based on site layout drawings and a site master plan provided by Barge Design Solutions. OMI understands the planned construction will consist of ten separate one-story or two-story structures including pavilions, batting cages, restrooms, concession buildings, and a maintenance building. Nine new athletic fields with high mast lighting will also be included. A splash pad will be located just west of the existing gym. Two new parking lots are planned along the west side of Sunset Drive, north of Highway 69 and near the southern end of the site. The existing parking lots located east of the tennis courts and east of the existing gym will be expanded for additional parking. A new deceleration lane and paved entrance to the existing boat ramp and trailer parking area will be located on the north side of Highway 69. A box culvert type pedestrian underpass is also planned under Highway 69. Recommendations for the Highway 69 deceleration lane and pedestrian underpass will be provided in a separate report.

OMI anticipates the maintenance building and restrooms/concession buildings will have CMU walls with a concrete slab on grade. Column and wall loads are expected to be less than 50 kips and 2 kips per linear foot, respectively. Floor loads will be less than 100 psf. The open-air pavilions may

use structural steel or wood framing with a concrete slab on grade. Pavilion column loads are expected to be less than 20 kips. Wind loads on the pavilions may result in uplift forces of up to 20 kips. Grading plans were not provided to OMI, but relatively little (<2-ft) of cut or fill is expected in pavement and building areas.

#### 8.0 BASIS FOR RECOMMENDATIONS

The following recommendations are based in part on the preceding project information. This study has utilized the subsurface data, historical information regarding the structural performance of similar structures, and past experience with similar geologic environments to develop professional opinions on which the recommendations are based. Because the structural elements of the design greatly influence the design recommendations, OMI must be provided the opportunity to review the following comments and recommendations in light of changes in building location, elevation, or structural loading.

Standard practice in geotechnical engineering is that all but a few special structures will tolerate 1-in of settlement. Therefore, 1-in is assumed acceptable. Unless otherwise stated, the recommendations in this report are intended to keep post-construction settlement to less than 1-in.

#### 9.0 DESIGN RECOMMENDATIONS

#### 9.1 Overview

Borings for the proposed building areas such as concession stands, restrooms, the splash pad, and the maintenance building encountered soft to firm soils in the upper 4-ft from the existing surface. Firm soils were also encountered in proposed pavement areas. OMI recommends these soils be removed and replaced with compacted fill. Undercutting should extend at least 5-ft outside the horizontal limits of each building area or parking area. OMI anticipates that undercut depths of up to 3 to 4-ft from the existing surface will be required to remove the low-strength soils underneath

the building areas. About 2-ft of undercut from the existing will be required in parking areas. This undercut and replacement should be funded with a contingency fund to be paid as needed. OMI should be retained by the owner during construction to authorize undercutting, to observe the excavations, and to record the volume of the undercut excavation before fill is placed. Once the unsuitable soils have been replaced, a typical shallow foundation system may be used to support the proposed buildings. Undercut quantities in parking areas may be significantly reduced if earthwork is performed during the drier summer months. OMI recommends a contingency of 750 cubic yards of soil removal and replacement be included in the contract to be paid to the contractor on an inplace volume as required and recommended by OMI. Positive drainage and dewatering of excavations may be required.

### 9.2 Foundation Design - High Mast Light Poles

OMI understands high mast light pole foundations will be designed by others. OMI has prepared passive pressure diagrams based on unconfined compressive strength tests performed on select split spoon samples. The passive pressure diagrams are included in the appendix of this report. OMI understands these diagrams will be used by others to design the foundations for the light poles. Appropriate factors of safety must be applied. Due to the relatively shallow depth to bedrock encountered across the site, some high mast light pole foundations may need to be socketed into the bedrock, anchored, or otherwise modified in order to provide adequate passive resistance.

#### 9.3 Foundation Design – Buildings

The following foundation design recommendations are intended to address the concession stands, restrooms, splash pad, and maintenance building. Provided the site is prepared in accordance with the recommendations contained in this text, the proposed structure may be supported by a conventional shallow foundation system bearing on stiff to very stiff residual soil or engineered fill. Footings should be designed based on a maximum allowable bearing pressure of 2,500 psf for individual column footings and 2,000 psf for continuous footings. These pressures include a factor of safety of at least three against general shear failure. To allow for minor inconsistencies in the soil subgrade, individual and continuous footings should have minimum widths of 24-in and 18-in, respectively, regardless of loading. Perimeter footings, and those within unheated areas, should bear at least 2-ft below finished exterior grade to provide adequate confinement and protection

against frost and movement due to moisture fluctuations. Interior footings should bear at least 1-ft below the soil subgrade. The ground surface around the building area should be graded to provide positive drainage away from the building.

#### 9.4 Uplift Resistance

The columns for concession stands and pavilions are may have uplift loads due to wind forces. For columns with slight to moderate net uplift loads, OMI recommends that the uplift be resisted by the weight of the concrete in the footings and by extending the footings deeper into the ground. If necessary, stone fill may be placed on top of the footings. Groundwater is expected to be near the bearing depth of the footings at some locations. Also, unusual conditions can occur from time to time allowing perched water to be trapped in footing excavations thus resulting in submerged or buoyant forces on the foundations. Buoyant forces should be considered. Assuming the footings are above the water table and perched conditions are not present, a unit weight of 150 pcf for concrete can be used and a unit weight of 110 pcf for compacted soil fill above the footings can be used. If desired, dense graded base stone, ALDOT no 825 B, can be used and compacted on top of the footings. For design purposes a unit weight of 145 pcf can be used for the dense graded base. If large uplift loads are present OMI can provide additional recommendations for the cohesion and friction forces between the face of the footings and the soil.

#### 9.5 Seismic Classification

OMI has reviewed the soils at the site with respect to the criteria for seismic classification. In accordance with Section 1615.1, Table 1615.1.1 of the 2003 International Building Code, OMI judges the soil to be Site Class C.

#### 9.6 On-Grade Slabs

The slab thickness, reinforcing, and stone base thickness are all a function of the traffic weight, loading frequency, and the soil subgrade strength. A typically loaded maintenance building or concession stand floor slab, where the design loads are less than 100 psf, should be placed on a 4-in thick layer of open-graded compacted gravel. The aggregate layer will distribute the load from the slab to the soil and provide protection against the migration of moisture upward through the floor

slab. For enclosed structures, a vapor barrier may be placed beneath the floor slab stone to provide

additional protection against moisture migration.

9.7 Fill Soils

Fill soils should be clayey soils free of organics, deleterious debris, or rocks larger than 3-in in

diameter. The soil should have a plasticity index (PI) of less than 30 and a maximum dry density of

at least 95 pcf as determined by the standard Proctor (ASTM D698). The fill should be compacted

to at least 95 percent of the soil's standard Proctor maximum dry density, SPMDD. The top 1-ft

beneath the building and pavement areas should be compacted to 100 percent SPMDD.

High plastic soils were encountered at this site. For economic considerations, these soils may be

used as fill provided that the Owner realizes that the risk of movement due to shrink/swell will be

present. These risks can be greatly reduced by placing the highly plastic soil near the base of the fill

and limiting the upper 3-ft of fill to moderate and low plasticity clays. The highly plastic clay will

be difficult to work when it is wet.

9.8 Pavement Areas

Surface parking and entrance drive areas should be prepared in accordance with the general

recommendations for stripping and fill placement stated elsewhere in this text, except the upper 1-ft

must be compacted to at least 100 percent of the standard Proctor maximum dry density. Topsoil

stripping depths may be reduced within flexible pavement areas to leave some slightly organic soil

in place. Close monitoring will be required to achieve this cost savings. Specific traffic frequency

and loading information has not been provided; however, assuming that the paved areas can be

broken into two categories with the listed frequencies and loading being acceptable, the following

pavement sections may be used.

AUTOMOBILE PARKING -

Maximum 1000 vehicles per day (VPD) consisting of

automobile traffic and less than 5 percent medium

truck traffic. No heavy trucks.

TRUCK PARKING/DOCKS -

Maximum 3000 VPD including not more than 2

heavy trucks per day.

OMI, Inc.

#### FLEXIBLE PAVEMENT DESIGN

PAVEMENT MATERIAL	AUTOMOBILE	TRUCK
ASPHALT SURFACE COURSE (Hot Mix) ALDOT No. 424A, 1/2-in Max. Agg. Size, ESAL Range A/B	2.0 inches	1.5 inches
ASPHALT BINDER COURSE ALDOT No. 424B, 3/4-in Max. Agg. Size, ESAL Range A/B	_	3.0 inches
STONE BASE COURSE ALDOT No. 825 B (Compacted to 100% Standard Proctor as per AASHTO T-99)	6.0 inches	6.0 inches
TOTAL THICKNESS	8.0 inches	10.5 inches

All pavement materials and construction methods should conform to the guidelines and requirements of the Alabama Department of Transportation. During placement of the aggregate base and asphalt courses, density tests and thickness measurements should be performed to compare the design section to the constructed section. The soil subgrade should be graded to provide a smooth transition from one pavement section to another. It is imperative that truck traffic be limited to areas specifically designed to carry those vehicles.

Immediately prior to placement of the aggregate base, the subgrade must be proofrolled to judge the stability of the soil. The soil may require recompaction. The stone base course should only be applied to a stable, compact soil subgrade. Asphalt paving should proceed closely after stone placement. If lengthy delays between stone and asphalt paving occur, the stability of the stone and soil subgrade should be checked prior to paving.

Rigid pavement should be specified for areas that will be used for the storage of refuse bins and the operation of waste removal vehicles.

#### 10.0 CONSTRUCTION CONSIDERATIONS

#### 10.1 Site Preparation

To prepare the site for construction, the construction area should be stripped of trees, topsoil, large root zones, and other organic or soft soil. Undercutting should be performed as described in Section 9.1 of this report. Stripping and undercutting should extend at least 5-ft beyond the limits of construction cut and fill. Subsequently, the areas approximately at grade or to receive fill should be proofrolled in the presence of a geotechnical engineer. Proofrolling is performed by repeated passes of a heavy rubber-tired vehicle, such as a loaded dump truck. Any areas judged to deflect excessively during proofrolling should be undercut to a stable soil horizon. Such over-excavation must be backfilled with structural fill placed as described below. Upon reaching subgrade elevation in cut areas, the exposed soil subgrade should be similarly proofrolled and repaired.

#### 10.2 Estimated Topsoil Removal

The presence and depth of topsoil varies across the site. OMI believes that the stripping depth to remove the topsoil in the grassed areas will average about 7-in. Close observation by OMI personnel during construction can allow the disturbed but only slightly organic soils to be compacted in-place or to be used as engineered fill.

#### 10.3 Fill Placement

After proofrolling is complete, placement of structural fill may begin, as necessary. Specific requirements of the soil properties are discussed previously. The soil should be placed in loose lifts, not exceeding 8-in in thickness, and systematically compacted to at least 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) except the top 1-ft should be compacted to 100 percent SPMDD.

#### 10.4 Density Testing

Field density testing should be performed on each lift prior to placement of additional lifts. Test locations should be evenly distributed throughout the fill area and should be performed at the frequencies shown on the following table.

AREA	METHOD OF PLACEMENT AND COMPACTION	INITIAL TEST FREQUENCY	RETEST FREQUENCY
AN CHARLEST AND COMMISSION OF THE COMMISSION OF	Large self-propelled equipment	1 test per 5000-ft <sup>2</sup> , minimum 3 tests per lift	1 test per failed test
Isolated Areas	Hand-guided equipment	1 test per lift	1 test per failed test
Trench backfill and behind retaining walls	Hand-guided equipment	1 test per 50 linear feet per 6-in of fill	1 test per failed test

Test frequencies may be increased during the early stages of earthwork construction. Compaction requirements should apply to all excavation/backfill operations conducted on the proposed development property.

#### 10.5 Footing Observations

The footing excavation process generates a disturbed layer of soft soil in the excavation bottoms. This soft compressible layer should be removed prior to placement of concrete. Each foundation excavation should be observed by a member of OMI's professional staff to check for local variations in the soil strength as well as the removal of the disturbed layer.

### 10.6 Foundation Construction

The deeper soils at this site are moderately to highly plastic. Exposing the soils to excessive wetting or drying during construction can cause problems such as heaving or settlement due to shrinking and swelling of the clay. The foundations should be excavated, hand cleaned, checked, and concrete placed as expeditiously as possible. Footing excavations that will be left open for more than 8 hours should be covered for protection.

### 10.7 Construction Monitoring

The foundation and site preparation recommendations contained in this report are based on the conditions encountered during the subsurface exploration and past experience in this geologic setting. Because subsurface conditions may vary from the anticipated, it is important to have a well-rounded quality control program. Construction monitoring on a project of this nature can serve as

an economical means to achieve the best possible foundation system and reduce the potential for future problems. The involvement in the subsurface exploration portion of this project uniquely qualifies OMI, Inc., to provide these services as a party responsible to the Owner. OMI, Inc., strongly recommends that all construction monitoring be performed under contract with the Owner or the Owner's representative.



GUNTERSVILLE PARK IMPROVEMENTS 1500 SUNSET DRIVE GUNTERSVILLE, ALABAMA

BORING

JOB NO.: 8883 DATE: 01-17-2020 SCALE: 1" = 200' DRAWN BY: DAH DWG NO: 8883 - 1

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB	NO.: <u>8883</u>		JOB:	Guntersville F	Park Improven	nents	_		LOG	OF BOI	RING:		B-1	
Drille	er: South B	Bros.	Drill Model: Mobi	le B-47	Hamme	r Type:	Auto			На	ımmer E	Efficien	су: <u>96%</u>	6
Logg	ed By: <u>Tyl</u>	er White			Boring Locati	on:								
City:	Guntersvi	ille		County:	M	arshall			State:	Alaba	Alabama			
ОБРТН, ЕТ	SAMPLES GRAPHIC		DES	CRIPTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	××	Y-7	SOIL			4	20	3.5						
		4	CLAYEY SAI			5	24	2.5						
- 5 -		20% brov SAN	IDY SILTY CLA ofine sand, 80° vn, firm, moist, IDY SILTY CLA s, high plasticit	% fines, low pl FILL, CL AY, 15% fine s	asticity, sand, 85%	5	32	2.5	68	21				
			moist, residuu											
- 10 -		CLA	Y WITH LIME	STONE FRAG	SMENTS	100+	26	4.5						
- 15 - 20 - 25 - 30 - 35 -			SER REFUSAL		8									
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5151 Research Drive, N.W., Suite A Huntsville, AL 35805

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рертн, вт	ELEVATION	SAMPLES GRAPHIC		DESCRIPTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				ASPHALT SANDY SILTY CLAY with 20% fine sand, 80% fines, annish gray, firm to stiff, n CH	high plasticity,	3	20	2.0						
5						9	22	4.5 3.5						
- 10 -			_	CLAY WITH LIMESTONE										
- 15 - 20 - 25 - 30 - 35 - 35 -			_	AUGER REFUSAL @ 10.5	5-ft									
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5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.: 8883 JOB: Guntersville Park Improve	ements			LOG (	OF BO	RING:		B-3	
Driller: South Bros. Drill Model: CME 45 Hamm				7					/ <sub>0</sub>
Logged By: Tyler White Boring Loca	tion:								
City: Guntersville County:	Marshall			State:	Alaba	ama			
SAMPLES GRAPHIC GRAPHIC	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
TOPSOIL	4	20	2.5						
SANDY SILTY CLAY with trace organics, 20% fine sand, 80% fines, low plasticity, dark tan, firm, moist, FILL, CL	8	19	3.5						
SANDY SILTY CLAY with trace organics and chert, 10% gravel, 20% coarse to fine	15	22	4.25	52	15				
sand, 70% fines, high plasticity, tannish orange, stiff to very stiff, moist, residuum,	18	23	4.5						
CH Tan Sandy Silty Clay	15	23	4.5						
	12	21	4.5						
BORING TERMINATED @ 15-ft									
- 20 -									
- 25 -									
- 30 -									
- 35 -									
COMPLETION DEPTH: 15 DEPTH TO INITIAL WATER: DEPTH TO EXTENDED WATER: 0	.25-ft	Dry on	12/	12/19	- 🕎		OMI, Page	Inc. 1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.: <u>8883</u>	JOB: Guntersville Park Improver	nents			LOG	OF BO	RING:_		B-4	
Driller: South Br	os. Drill Model: CME 45 Hamme	r Type:	Auto			На	ammer l	Efficien	cy: <u>88%</u>	6
Logged By: Tyle	r White Boring Locati	on:								
City: Guntersvil					State		ama			
DEPTH, FT ELEVATION SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
1444	TOPSOIL	2	46	0.75						
	SANDY SILTY CLAY with organics, 25% fine sand, 75% fines, low plasticity, tannish gray, soft, wet, alluvium, CL	2	28	0.5	39	16				
- 5 -	SANDY SILTY CLAY, 15% fine sand, 85%	3	28	2.0						
	fines, low plasticity, yellowish tan, firm, moist, residuum, CL	5	26	3.0	49	15				
- 10 -	AUGER REFUSAL @ 8-ft									
COMPLETION DE		5-ft	0.5-ft	10/	12/19	<b>-</b> ₹		OMI,		
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5151 Research Drive, N.W., Suite A Huntsville, AL 35805

Driller: South Bros. Drill Model: CME 45 Hammer Type: Auto Hammer Efficiency: 88  Logged By: Tyler White Boring Location:  City: Guntersville County: Marshall State: Alabama    County: Marshall State: Alabama	
City: Guntersville  County: Marshall  State: Alabama    County: Marshall   State: Alabama   County: Marshall   State: Alabama   County: Marshall   State: Alabama   County: Marshall   C	%
TOPSOIL  SANDY SILTY CLAY, 10% fine sand, 90% fines, high plasticity, gray fin, the moist, residuantion (%)  Best Core and Silty Clay workers (in, the moist of the core of th	
TOPSOIL  SANDY SILTY CLAY, 10% fine sand, 90% fines, high plasticity, gray, firm to very stiff, moist, residuum, CH Grey Sandy Silty Clay w/ red traces  DESCRIPTION  TABLE BISE OF THE BI	
SANDY SILTY CLAY, 10% fine sand, 90% fines, high plasticity, gray, firm to very stiff, moist, residuum, CH Grey Sandy Silty Clay w/ red traces 9	Fractures per Foot
fines, high plasticity, gray, firm to very stiff, 6 25 3.0 51 14 moist, residuum, CH Grey Sandy Silty Clay w/ red traces 9	
Grey Sandy Silty Clay w/ red traces 9	
11 22 3.5	
AUGER REFUSAL @ 8.5-ft	
COMPLETION DEPTH: 8.5 DEPTH TO INITIAL WATER: Dry  DATE: 12/4/19 DEPTH TO EXTENDED WATER: Backfilled on Page 1 of 1	L

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.: <u>8883</u>	JOB: Guntersville Park Improvements					LOG OF BORING: B-6						
Driller: South Bros.	Drill Model: Mobile B-47 Hamme	Hammer Type: Auto					Hammer Efficiency: 96%					
Logged By: Tyler Whit	e Boring Locati	on:										
City: Guntersville	County: N	arshall			State	Alaba	ama					
DEPTH, FT ELEVATION SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot		
_° TC	PSOIL	6	13	4.0								
che sai	NDY SILTY CLAY with gravel size ert, 10% gravel, 30% coarse to fine nd, 60% fines, low plasticity, reddish	12	23	4.5 4.25	41	19						
	Inge, stiff to very stiff, moist, FILL, CL		41	4.25								
fine	NDY SILTY CLAY, 25% fine sand, 75% es, low plasticity, tannish gray, very stiff, ist, possible alluvium, CL		24	3.5	76	23						
15 <sup>t</sup>	NDY SILTY CLAY with trace oxides, % fine sand, 85% fines, high plasticity, nish orange, stiff to very stiff, moist, iduum, CH	9	24	4.0								
AU	GER REFUSAL @ 13-ft											
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City: Guntersville	County:N	larshall			State:	Alaba	ıma			
DEPTH, FT ELEVATION SANDLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
	SOIL	5	20	4.0						
	IDY SILTY CLAY with trace oxides, fine sand, 80% fines, low plasticity,	9	22	4.5	53	22				
SAN	firm, moist, residuum, CL IDY SILTY CLAY with gravel size	9	24	4.25						
sand	t, 10% gravel 15% coarse to fine d, 75% fines, high plasticity, tannish	100+								
	ge, stiff, moist, residuum, CH GER REFUSAL @ 7-ft									
10 -	PER TREE GOVE 60 7 TO									
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0		1		SOIL					4	16	4.0						
			fines	s, high p	lasticitiy	, tannish	ne sand, orange,		6	30	4.0						
			to ve	∍ry stiπ,	moist, re	esiduum,	СН		10	24	4.0						
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Drill	er: South	Bros.	_ Drill Mode	I: CME 45	Hamme	r Type:	Auto			На	ımmer l	Efficien	cy: <u>88%</u>	6
Log	ged By: <u>Ty</u>	ler White	)		_ Boring Location	on:								
City	Gunters	ville		County:			State:	Alaba	ıma					
DEPTH, FT	ELEVATION SAMPLES GRAPHIC			DESCRIPTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0		SAI fine		Y CLAY, 15% fine asticity, tan, stiff, r		8	24 29	4.0						
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5151 Research Drive, N.W., Suite A Huntsville, AL 35805

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Dril	ler: <u>S</u>	outl	h Bro	os. Drill Model: Mobile B-47 Hamme	er Type:	Auto			На	ammer l	Efficien	cy: <u>96%</u>	
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овртн, гт	ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				ASPHALT CRUSHED LIMESTONE									
		1	/	SANDY SILTY CLAY with gravel size	7	12	4.5						
		K		chert, 10% gravel, 15% coarse to fine sand, 75% fines, high plasticity, stiff,	9	21	4.5						
-5-			1	moist, residuum, CH									
			107	BORING TERMINATED @ 5-ft									
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- 35 -		Щ	_						$\overline{\nabla}$				
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5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.:	8883	JOB: Guntersville Park Imp	rovements			LOG	OF BO	RING:_	/	<b>AP-4</b>	
Driller: So	uth Bro	os. Drill Model: Mobile B-47 Ha	ımmer Type	: Auto			На	ammer (	≣fficien	су: <u>96%</u>	′о
Logged By	y: Tyler	r White Boring L	ocation:								
City: Gun	tersvill	e County:	Marsha	II.		State	Alaba	ama			
DEPTH, FT ELEVATION	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	*****	TOPSOIL	4	22	4.0						
		SANDY SILTY CLAY, 25% fine sand, 7 fines, low plasticity, tannish yellow, firm		20	4.5	50	18				
5		moist, FILL, CL SANDY SILTY CLAY with trace oxides	+	18	4.5						
- 10 -		and chert, 10% gravel, 20% coarse to sand, 70% fines, high plasticity, tannisl orange, very stiff, moist, residuum, CH BORING TERMINATED @ 5-ft	n								
- 35 -	ION DE	EDTU: E DEDTU TO INITIAL WATED.		Dry	l:		Ţ.		OMI	Inc	
COMPLET DATE:		EPTH: 5 DEPTH TO INITIAL WATER:	Backfilled		12	2/4/19	<u>₹</u>			,inc. 1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.:	Guntersville Park Improvements LO	OF BORING:		LP-1	
Driller: Sou	Model: Mobile B-47 Hammer Type: Auto	Hammer	Efficien	cy: <u>96</u> %	<u>/</u> o
Logged By	Boring Location:				
City: Gunt	County: Marshall Sta	te: Alabama			
DEPTH, FT ELEVATION SAMPLES	N-VALUE (Uncorrected)  NATURAL MOISTURE  POCKET PENETROMETER TSF	Plastic Limit Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	L 8 3.0				
	SILTY CLAY with trace oxides e chert, 15% coarse to fine sand, es, high plasticity, tannish orange,				
- 5 -	ery stiff, moist, residuum, CH 10 29 4.5				
	14 4.5				
- 10	SILTY CLAY with gravel size % gravel, 15% coarse to fine % fines, high plasticity, orange, , moist, residuum, CH				
- 20 25 30 35	REFUSAL @ 12.5-ft		OMI	Inc	
- 25 -	DEPTH TO INITIAL WATER:  DEPTH TO EXTENDED WATER:  10.ft on 12/12/15			OMI	OMI,Inc.

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOE	NO.: 888	3	_ JOB:	Gunters	sville Park Improver	nents			LOG	OF BOI	RING:_	L	_P-2	
Drill	er: South	Bros.	_ Drill Model	: Mobile B-47	Hamme	r Type:	Auto			На	ımmer l	Efficien	cy: <u>96%</u>	0
Log	ged By: <u>Ty</u>	ler Whit	e		Boring Locati	on:								
City	: Gunters	ville		Coun	ty: <b>N</b>	arshall			State	Alaba	ıma			
рертн, гт	ELEVATION SAMPLES GRAPHIC			DESCRIPTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	×	$\sim$	PSOIL			9		3.0						
				Y CLAY with tr	race organics and, 80% fines,	9	13							
- 5 -		∫low		dark brown ar		5		2.25						
- 5		che	ert, 10% gr	Y CLAY with g avel, 10% fine asticity, orange	sand, 80%	7	36	2.75						
			ist, residuu											
- 10 -		AU	GER REF	USAL @ 8-ft										
	B							1						
- 15 -														
					l									
- 20 -														
- 25 -					3									
-														
30 -														
35 -														
CON	/IPLETION			EPTH TO INITIAL W			Dry			<b>-</b> ₹		OMI,		
DAT	E:	12/4/1	9 DE	EPTH TO EXTENDE	D WATER: Bac	kfilled	on			_ =		Page	1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

#### Soil Boring Record

											D 2	
JOB NO.: <u>88</u>	883	JOB:	Guntersville Park Improv	ements		=====	LOG	OF BOR	ING:		.P-3	
Driller: Sout	h Bros.	Drill Model: CME 45	Hamr	ner Type:	Auto			Ha	mmer E	tticien	cy: <u>88%</u>	)
Logged By:	Tyler White	)	Boring Loca	ation:				A1-1				
City: Gunter	rsville		County:	Marshall			State:	Alaba	ma			_
DEPTH, FT ELEVATION SAMPLES	GRAPHIC	DESCRIPT	ION	N-VALUE (Uncorrected)	NATURAL MOLSTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	TO	PSOIL		7		2.0						
	∭ fin∈	NDY SILTY CLAY, es, low plasticity, ta	20% fine sand, 80 n, firm, moist, FILL	% , 3	20	1.5						
	₩ CL			5	21	2.0						
5 🕌	che sa	NDY SILTY CLAY ert, 10% gravel, 20° nd, 70% fines, high	% coarse to fine plasticity, tan, very	14	20	4.0						
- 10 -	Still	f, moist, residuum,	GH	15	22	4.5						
15 -	AL	IGER REFUSAL @	13.5-ft									
- 20 -												
				ļ								
- 25 -												
- 30 -	20											
COMPLET	ION DEPTI		NITIAL WATER:	Backfilled	5-ft	on		_ \\	-		MI,Inc. ge 1 of	1
DATE:	12/4	DEPTH TO	ATENDED WATER.	- autilior								

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB	NO.:	8883		JOB: _		Gunters	ville Park Im	proven	nents			LOG	OF BOF	RING:_	L	_P-4	
Drille	er: <u>S</u> c	outh B	ros.	Drill Mo	del: CME 4	5		Hamme	r Type:	Auto			На	mmer l	Efficien	cy: <u>88%</u>	0
Logg	ged B	y: Tyle	r White				Boring	Location	on:								
City:	Gur	ntersvil	lle			County	y:	M	arshall			State:	Alaba	ma			
DEPTH, FT	ELEVATION	SAMPLES GRAPHIC			DESCF	IPTION			N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0		<b>***</b>	_	PSOIL					7	21	4.0						
							ace orgar w plastic		9	21	3.5						
					, moist, F LTY CLA		ace oxide	es	10		3.0						
5 -			and san tanr	chert, d, 25% nish gra	10% grav fines, hig y, stiff to	el, 15% jh plastic	coarse to		13	25	4.5						
10 -				duum, (	EFUSAL	@ 8-ft											
COM		TION D		8		INITIAL WA		Deal	(GII c -l	Dry					OMI,		
DAT			12/3/19		DELIH IO	EXTENDE	WATER:_	Baci	cfilled	on			_ =		Page	1 of 1	

5151 Research Drive, N.W., Suite A

Huntsville, AL 35805

JOB	NO.:	8883		JOB:		Guntersville	Park Improver	nents			LOG	OF BOF	RING:_	Ł	_P-5	
Drille	er: <u>Sc</u>	outh Bi	ros.	Drill Mode	el: <u>CME 45</u>		Hamme	r Type:	Auto			На	mmer E	Efficien	cy: <u>88%</u>	0
Logg	jed B	y: Tyle	er White				Boring Locati	on:								
								arshall					ma			
Т	z									σ.						
<b>рертн, гт</b>	ELEVATION	SAMPLES GRAPHIC			DESCRIF	PTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0			TOF	PSOIL				6		3.5						
	ĺ						organics,	2	23	1.5						
	·	<u>-</u>	1			ines, low poist, FILL,		-	20	1.0						
		/‱	DIOV	vii, soit t	o stiii, iii	J131, 1 1EE,	OL.	2		2.0						
- 5 -						with trace										
							fine sand,	6	26	3.0						
						duum, CH	ed tan and									
_					USAL @											
10 -																
- 15 -																
20 -																
25 -																
- 30 -											,					
25																
35 - COM	PLET	ION D	EPTH:	7.5	EPTH TO II	NITIAL WATE	R:	W	3-ft			— <u>¥</u>		OMI,	Inc.	
DATE			12/3/19			XTENDED W		kfilled	on			_ 🚣			1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB	NO.:	8883	JOE	В:	Guntersvil	le Park Improver	nents			LOG	OF BOI	RING:_	ı	_P-6	
Drill	er: S	outh B	ros. Dril	II Model: <u>CME</u>	45	Hamme	r Type:	Auto			Ha	ammer	Efficien	cy: <u>88</u> %	6
Log	ged B	y: <u>Tyle</u>	r White			_ Boring Locati	on:								
City	: Gur	ntersvil	le		County:	N	larshall			State:	Alaba	ama			
рветн, ғт	ELEVATION	SAMPLES GRAPHIC		DES	CRIPTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0			RED SA	ANDY CLA	Y FILL		8		3.75						
			15% fine	e sand, 85 <sup>o</sup>	_	h plasticity,	3	26	2.0						
			tan, firm	n to stiπ, mo	oist, residuu	m, CH	4		2.0						
- 5 -			and che sand, 7	ert, 10% gra 5% fines, h	igh plasticity	parse to fine y, tannish	8	23	4.5						
- 10 -			orange, CH	stiff to ver	y stiff, moist	, residuum,	12	20	4.5						
			AUGER	REFUSAL	_ @ 13.5-ft										
- 15 -															
- 20 -															
- 25 -															
- 30 -															
- 35 -															
	IPLE1	TION D		5 DEPTH T	O INITIAL WAT	ER:		Dry			- <del>-</del>		OMI,	Inc.	
DAT	E:		12/3/19	DEPTH T	O EXTENDED V	VATER: Bac	kfilled	on			_ 🐳		Page	1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOE	3 NO.:	8883		JOB: _		Guntersvi	lle Park Impr	ovem	ents			LOG	OF BOI	RING:_	l	_P-7	
Dril	ler: S	outh B	ros.	Drill Mo	del: Mobile	B-47	Наг	mmer	Туре	Auto			Ha	ımmer E	Efficien	cy: <u>96%</u>	6
Log	ged E	By: <u>Tyl</u>	er White				Boring Lo	ocatio	n:								
City	: Gui	ntersvi	lle			County:		Ма	rshall			State:	Alaba	ıma			
ОЕРТН, ЕТ	ELEVATION	SAMPLES			DESCR.	IPTION			N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	L	<b>***</b>		SOIL				$\mathcal{A}$	4	17	3.0						
			25%	fine sa	and, 75%		ce organic / plasticity LL, CL		6		2.5						
- 5 -		//	1			Y with trac	ce chert, h plasticit	v	6	23	2.5						
							siduum, Cl		7	28	2.75						
- 10 -	0				H LIMES	TONE LE	NSES		100+	19							
			AUG	ER RE	EFUSAL (	@ 11.5-ft											
15 -																	
_																ı	
- 20 -																	
25 -																	
20																	
30 -																	
35 -																	
CON		TION D	EPTH:	11.5		INITIAL WAT EXTENDED		1.0		Dry on	12/	12/19	<u></u> = \( \frac{\fint}}}}}}{\frac{\fint}}}}}{\frac}}}}}}}}}{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac}}}}}}}{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\frac{\f{\frac{\frac{\frac{\fi		OMI, Page	Inc. 1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

									00010	•							
																	-
					del: Mobile												
City:	Gun	itersvi	lle			Coun	ty:	N	larshall			State	: Alaba	ama			
рертн, гт	ELEVATION	SAMPLES			DESCI	RIPTION			N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	TIMIT TIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	Ė		-	SOIL					4		2.5						
5 -			cher sand	t, 10% d, 75%	TY CLA gravel, 1 fines, hig to very	15% coa gh plasti	rse to fi city, tan	ne Inish	100+	23	4.5						
			AUG	ER RE	FUSAL	@ 13-ft											
15 -						_											
																- 1	
20 -																	
25 -																	
$\dashv$																	
30																	
_																	
35 -																	
COM	PLET	ION D	EPTH: 12/4/19			INITIAL W		R:0.	5-ft	Dry on	12/	12/19	- <del>=</del>		OMI,	Inc. 1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO	).: <u>8883</u>		JOB:		Gunter	sville Park lı	mproven	nents			LOG	OF BOI	RING:_		_P-9	
Driller:	South Br	os.	Drill Mo		Hamme	r Type:	Auto			На	ammer l	Efficien	cy: <u>88%</u>	0		
Logged	By: Tyle	r White			g Locati	on:			_							
						ty:					State					
- Z										l g						ب
DEPTH, FT	SAMPLES GRAPHIC			DESCI	RIPTION			N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0			PHALT	TY CLA	Y with a	ravel size										
						rse to fin		4		_ <del></del> _						
- 5 -		sand	d, 70% vn, firm	fines, lov , moist,	w plastic FILL, CI	ity, dark		5		3.5						
		15%	fine sa	and, 85%	6 fines,	high plas oist, resid	ticity,	100+	21	4.0						
		CH	lisii gia	y, 111111 to	, Suii, iii	oist, resid	idum,									
- 10 -			SER RE	FUSAL	@ 7.5-ff	t										
- 15 - 																
- 20 -																
- 25 -																
															84	
- 30 -																
- 35 -																
	ETION DI	EPTH:	7.5	DEPTH TO	O INITIAL W	VATER:		97.	Dry			- ₹		OMI	,lnc.	
DATE:		12/3/19		DEPTH TO	) EXTENDE	D WATER:	Bac	kfilled	on			_ \		Page	1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOE	NO.:	8883	JOB:Gu	ıntersville Park Improve	ments			LOG	OF BO	RING:_	L	P-10	
Dril	ler: <u>S</u>	outh Bi	os. Drill Model: CME 45	Hamm	er Type:	Auto			На	mmer l	Efficien	cy: <u>88</u> %	6
Log	ged E	By: <u>Tyle</u>	r White	Boring Locat	ion:			<u></u>					
City	: Gu	ntersvil	le	County:	/larshall			State:	Alaba	ma			
рертн, гт	ELEVATION	SAMPLES	DESCRIPTIO	N	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	TIĞIID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0		1.7.7	TOPSOIL		4		2.5						
			SANDY SILTY CLAY wi 15% fine sand, 85% fine	es, high plasticity,	13	19	4.5						
- 5			tan, firm to very stiff, mo	oist, residuum, CH	14	17	4.5						
					13		4.5						
- 10 -					16	23	4.5						
					12	34	4.0						
15		///	BORING TERMINATED										
			DOTATO TELAMINATED	- W 10 11									
20 -													
- 25 -													
- 30 -													
- 35 COI	MPI F	TION D	EPTH: 15 DEPTH TO INITI	AL WATER:		Dry			<u></u> ¥		OMI	Inc.	
DAT			12/3/19 DEPTH TO EXT	ENDED WATER: Bac	kfilled	on			<b>—</b> <del>—</del> <u>—</u> <u>—</u> —			1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.: 8883	JOB: Guntersville Park Improve	ments			LOG	OF BOF	RING:_	L	P-11	
Driller: South Bro	s. Drill Model: CME 45 Hamme	er Type:	Auto			На	mmer l	Efficien	cy: <u>88%</u>	6
Logged By: Tyler	White Boring Locat	ion:								
	County:									
DEPTH, FT ELEVATION SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
5	ASPHALT SANDY SILTY CLAY with trace oxides and trace chert, 15% coarse to fine sand, 85% fines, high plasticity, light tannish orange, stiff to very stiff, moist, residuum, CH	7 9 10	24 23 25	4.0 4.25 4.5						
- 10 -	AUGER REFUSAL @ 8.5-ft					₩				
COMPLETION DE DATE: 1	PTH: 8.5 DEPTH TO INITIAL WATER: 2/3/19 DEPTH TO EXTENDED WATER: 3	.5-ft	Dry on	12/	12/19			OMI, Page	Inc. 1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.: <u>88</u>	83 JOB: _	Guntersville Park Improv	ements			LOG	OF BOI	RING:_	L	P-12	
Driller: South	Bros. Drill M	lodel: CME 45 Hami	ner Type	Auto			Ha	ammer (	Efficien	cy: <u>88%</u>	6
Logged By: T	yler White	Boring Loca	ation:								
		County:									
A I	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
	TOPSOIL		3		1.75						
	~ <b>a</b>	ILTY CLAY with trace oxides 10% gravel, 15% coarse to find	e 7	31	4.5						
		fines, high plasticity, tan, stiff moist, residuum, CH	.O 8	20	4.0						
- 5 -											
			14	22	4.0						
	AUGER R	REFUSAL @ 8-ft									
- 10 -											
- 15 -											
- 20 -											
									i		
- 25 -											
- 30 -											
- 35							77				
COMPLETION DATE:	N DEPTH: 8 12/3/19	_ DEPTH TO INITIAL WATER: DEPTH TO EXTENDED WATER:	0.25-ft	Dry on	12/	12/19			OMI, Page	Inc. 1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB NO.: <u>8883</u>	JOB:	Guntersville Park Ir	nprovement	s			LOG	OF BOI	RING:_	L	P-13	
Driller: South Br	os. Drill Mo	del: CME 45	Hammer Ty	oe: Au	ıto			На	ımmer l	Efficien	cy: <u>88</u> %	6
Logged By: Tyle	r White	Boring	Location:_									
City: Guntersvill	le	County:	Marsh	all			_ State:	Alaba	ıma			
DEPTH, FT ELEVATION SAMPLES GRAPHIC		DESCRIPTION	N-VALUE	(OHCOLLECTED)	MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
° ¥	TOPSOIL	T ( O   A ) ( ) ( ) ( ) ( ) ( )	5			3.0						
	and chert,	LTY CLAY with trace oxide 10% gravel, 20% coarse to	o fine 13	2	0	4.0						
. 5 -		fines, high plasticity, tanni n to very stiff, moist, residu				4.5						
			16	20	0	4.5						
- 10 -			11	20	0	4.5						
			100	+								
- 20 -		ERMINATED @ 15-ft										
COMPLETION DE	EPTH: <u>15</u> 12/3/19	DEPTH TO INITIAL WATER: DEPTH TO EXTENDED WATER: _	0.5-ft	Dry	on _	12/	12/19	- <del>Ţ</del>		OMI, Page	Inc. 1 of 1	

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JOB NO.: 3	8883	JOB:		Guntersville	Park Improven	nents			LOG	OF BOR	RING:_	L	P-14	
Driller: Sou	uth Bros.	Drill Mod	del: <u>CME 45</u>		Hamme	r Type:	Auto			На	mmer E	≣fficien	cy: <u>88%</u>	0
Logged By	: Tyler Whi	te		Boring Locati	on:									
											ma			
DEPTH, FT ELEVATION SAMPLES	GRAPHIC		DESCRIP!	TION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0 1	XXXI —	PSOIL				2		1.25						
	∫∫∫fin	es, low p			sand, 80%, , wet, FILL,	9	29	4.5						
5 -		NDY SIL	TY CLAY		oxides, plasticity,	9	26	4.5						
	<b>√/</b> \tai	n, stiff, me	oist, residu H LIMESTO	ium, CH		22								
						100+								
20 -	AU	JGER RE	FUSAL @	10-ft										
COMPLETI			DEPTH TO IN			5-ft	Dry	12/	12/19	- 🚆		OMI,		
DATE:	12/4/	19	DELIH IO E	VIENDED M	AIEK:0.	J1-C	on	12/	14/19	=		Page	1 of 1	

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JOE	3 NO.:	8883	3	JOB: _		Guntersvi	ille Park Impr	over	nents			LOG	OF BOI	RING:_	L	P-15	
							Har										
							Boring Lo										
City	: Gur	ntersv	ille	X 115		County:		Ma	arshall			State:	Alaba	ıma			
рертн, гт		SAMPLES GRAPHIC			DESCR.	IPTION			N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0 :	_	$\otimes$	<i>x</i>	PSOIL				_/	2	17	2.0						
			fines	s, low p _, CL	lasticity,	orown, so	ne sand, 8 oft, moist, ce oxides	1	6		4.0						
- 5			sand	d, 75%		h plasticit	oarse to fi ty, tan, stif I		11	20	4.0						
- 10									24	26	4.5						
- 15			AUC	GER RE	EFUSAL (	@ 12-ft											
DA.		TION	DEPTH: 12/4/19	12	DEPTH TO DEPTH TO	INITIAL WA	TER: WATER:	0.	5-ft	Dry on	12	12/19	- <del>-</del>		OMI Page	,Inc. 1 of 1	

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JOB NO.: 8	883	JOB: Guntersville Park Improver	ments			LOG	OF BO	RING:	L	.P-16	
		Drill Model: CME 45 Hamme				7.		-			6
		Boring Locati									
City: Gunte	rsville	County:N	larshail			State:	Alaba	ama			
DEPTH, FT   ELEVATION   SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
	~~	PSOIL	5		2.0						
	20%	NDY SILTY CLAY with trace oxides, fine sand, 80% fines, low plasticity,	9	20	3.0						
- 5 -	SAN	wn, firm, moist, FILL, CL NDY SILTY CLAY with trace oxides, coarse to fine sand, 80% fines, high	13		3.5						
	plas	sticity, tan, stiff to very stiff, moist, duum, CH	16	20	4.0						
- 10 -	and sand	NDY SILTY CLAY with trace oxides chert, 10% gravel, 15% coarse to fine d, 75% fines, high plasticity, tannish nge, stiff to very stiff, moist, residuum,	15	21	4.5						
			6	31	3.5						
25 - 30 - 35 -	BOF	RING TERMINATED @ 15-ft									
COMPLETIC		15 DEPTH TO INITIAL WATER:		Dry	40:	40/40	- \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\		OMI,		
DATE:	12/3/19	DEPTH TO EXTENDED WATER: 4.	0-ft	on	121	12/19	_ =		Page	1 of 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB	NO.: <u>8883</u>		JOB:	Gunt	ersville Park Impro	ovem	ents			LOG	OF BOI	RING:_	L	P-17	
Drille	er: South B	ros.	Drill Model:	CME 45	Han	nmer	Туре:	Auto			На	mmer l	Efficien	cy: <u>88%</u>	0
Logg	ed By: Tyle	er White			catio	n:									
City:	Guntersvil	lle		Coı	unty:	Ma	rshall			State	Alaba	ma			
DEPTH, FT	ELEVATION SAMPLES GRAPHIC			DESCRIPTION			N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0 57	120	-	SOIL			$\mathcal{A}$	2	47							
	1353			VEL, 40% g		1	5	27	3.5						
- 5 -		∖plast SAN	tic, very lo DY SILTY		luvium, GC % fine sand, 85		8	22	4.0						
			s, nigh plas st, residuu		irm to very stif	rr,	11		3.75						
		AUG	ER REFL	JSAL @ 8-ft											
- 10 -															
_															
15 -															
20 -															
25 -															
- 30 -															
COM DATE	PLETION D	EPTH:		PTH TO INITIAL  PTH TO EXTENI		-1		1-ft on					OMI,	inc.	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB	NO.:	8883	JOB:Guntersville Park Improven	nents			LOG	OF BOI	RING:_	L	P-18	
Drill	er: So	outh B	ros. Drill Model: Mobile B-47 Hamme	r Type:	Auto			На	mmer l	Efficien	cy: <u>96%</u>	ó
Log	ged B	y: <u>Tyl</u> e	er White Boring Location	on:								
City	: Gun	ntersvi	lle County: M	arshall		No.	State:	Alaba	ama			
обртн, вт	ELEVATION	SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0			TOPSOIL	4	24	3.5						
		₩	SANDY SILTY CLAY, 25% fine sand, 75%	4	23	3.0						
	1	1	fines, low plasticity, red, firm, moist, FILL,		20	0.0						
- 5 -			SANDY SILTY CLAY with trace oxides	10	18	3.5						
	Z anne		and chert, 10% gravel, 20% coarse to fine sand, 70% fines, high plasticity, tannish orange, very stiff, moist, residuum, CH	11	22	4.5						
		//	AUGER REFUSAL @ 8-ft	-								
			AUGEN NEI OUAL @ U-II									
- 10 -												
- 15 -												
- 20 -												
									1			
						8						
- 25 -												
- 30 -												
- 35 -												
CON		ION D	EPTH: 8 DEPTH TO INITIAL WATER: 12/3/19 DEPTH TO EXTENDED WATER:		6-ft on	_		- Z		OMI,	Inc. 1 of 1	
ואטן	F-1		12010 DEI III IO EXTENDED WATER.		011			_		rage	- 01 1	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOE	NO.:	8883	JOB: Guntersville Park Improver	nents			LOG	OF BOR	RING:_	L	P-19	
Drill	er: S	outh B	ros. Drill Model: Mobile B-47 Hamme	r Type:	Auto			На	mmer E	Efficien	cy: <u>96%</u>	<u>′</u>
Log	ged E	By: <u>Tyle</u>	er White Boring Locati	on:								
City	: Gui	ntersvi	lie County:M	arshall			State:	Alaba	ıma			
БЕРТН, ЕТ	ELEVATION	SAMPLES	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0		XXX	TOPSOIL	6		4.0						
	3		SANDY SILTY CLAY, 35% fine sand, 65% fines, low plasticity, red, stiff, moist, FILL,	3	23	1.5						
- 5 -			SANDY SILTY CLAY, 20% fine sand, 80% fines, high plasticity, dark tan and gray,	11		4.5						
			firm, moist, possible FILL, CH SANDY SILTY CLAY with trace chert,	18	23	4.5						
- 10 -			20% coarse to fine sand, 80% fines, high plasticity, yellowish tan, very stiff, moist,	25	20	4.5						
			\residuum, CH CLAY WITH LIMESTONE LENSES									
			AUGER REFUSAL @ 12.5-ft									
- 15 -												
- 20 -												
- 25 -												
- 30 -												
- 35 -					Deci			$\nabla$			lmc	
DAT		TION D	PEPTH: 12.5 DEPTH TO INITIAL WATER: DEPTH TO EXTENDED WATER: Dry to	o 1.0-ft	Dry on	1/	10/20	<b>-</b> ₹		OMI, Page	Inc. 1 of 1	

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JOB NO.: <u>888</u>	33	_ JOB: _		Guntersvi	lle Park Improven	nents			LOG	OF BOI	RING:_	L	P-20	
Driller: South	Bros.	_ Drill Mo	del: CME 45	5	Hamme	r Type:	Auto			Ha	ımmer l	Efficien	cy: <u>88%</u>	6
Logged By: Ty	yler White	•			Boring Locati	on:								
City: Gunters									State:		ıma			
2					1811		1	Τ	-					
DEPTH, FT   ELEVATION   SAMPLES	Отильно		DESCR	IPTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0 7,33	TOI	PSOIL				2	39	1.25						
	fine	sand,	80% fines	s, low plas		7	25	2.0						
- 5 -	CL				t, alluvium,	9	25	3.5						
	/ fine	s, high	plasticity,		e sand, 80% ellow, stiff to I	11	25	4.0						
- 10 -	/ che	ert, 15%	gravel, 1	Y with gra	e to fine	20	30	2.5						
			tines, nig duum, CH		y, very stiff,									
			EFUSAL (											
				9										
- 15 -														
- 20 -														
- 25 -														
- 30 -														
- 35 -										$\leftarrow$				
COMPLETION DATE:	DEPTH: 12/4/19	11	DEPTH TO	INITIAL WAT	ER: WATER:		9-ft on			- 🚆		OMI, Page	Inc. 1 of 1	

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JOB NC	).: 8	883	JOB: Guntersville Park Improv	ements			LOG	OF BO	RING:	L	.P-21	
Driller:	Sout	th Br	ros. Drill Model: Mobile B-47 Hami	ner Type	: Auto			Ha	ammer	Efficien	су: <u>96</u> %	<u>6</u>
			er White Boring Loc									
City: G	unte	rsvil	lle County:	Marshal			_ State:	Alaba	ama			
DEPTH, FT ELEVATION	SAMPLES	GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	TIMIT TIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	Š	<b>XX</b>	TOPSOIL	3								
		$\bigotimes$	SANDY SILTY CLAY, 20% fine sand, 80° fines, low plasticity, brown, firm, moist,   FILL, CL	5	21	3.0						
- 5 -			SANDY SILTY CLAY with trace oxides and chert, 20% coarse to fine sand, 80%	13	20	4.5						
	P		fines, high plasticity, tannish orange, very stiff, moist, residuum, CH	12	22	4.0						
- 10 -				12	21	4.5						
			AUGER REFUSAL @ 12.5-ft									
- 15 -												
- 20 -												
- 25 -												
	П											
- 30 -												
	П											
35 -												
COMPLI DATE:	ETIC		EPTH: 12.5 DEPTH TO INITIAL WATER: 12/3/19 DEPTH TO EXTENDED WATER: Dr	to 1.0-ft	Dry on	1/	10/20	- \\		OMI	,Inc. 1 of 1	

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JOB	NO.: 8883	JOB: Gunter	rsville Park Improvements			LOG	OF BOI	RING:_	L	P-22	
Drille	er: South Br	os. Drill Model: Mobile B-47	Hammer Type	Auto			На	ımmer l	Efficien	cy: <u>96</u> %	ó
Logg	ged By: Tyle	r White	Boring Location:								
City:	Guntersvill	le Cour	nty: Marshal			State	Alaba	ama			
рертн, гт	SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	<b>XXX</b>	TOPSOIL	4	23	2.25						
		SANDY SILTY CLAY with o		18	4.0						
- 5 -		trace chert, 25% fine sand, plasticity, brown, firm to sti	ff, moist, FILL	19	2.5						
		fines, low plasticity, tannish moist, alluvium, CL	gray, firm,	26	1.5						
- 10 -		CLAYEY GRAVEL, 35% gr 35% coarse to fine sand, 30 plasticity, yellowish tan, stif residuum, GC	0% fines, high	17	4.5						
			100+		2.0						
- 20 -		BORING TERMINATED @					$\nabla$				
CON	IPLETION DE	EPTH: 15 DEPTH TO INITIAL V 12/4/19 DEPTH TO EXTEND		9-ft on			<u></u> <u>∓</u>		OMI, Page	<b>inc.</b> 1 of 1	

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JOB NO.:	8883		JOB:		Guntersville	e Park Improv	ements			LOG	OF BOI	RING:_	L	-P-23	
Driller: So	outh Bros	s	Drill Mode	el: Mobile B	-47	Hamr	mer Type	: Auto			На	ammer l	Efficien	cy: <u>96%</u>	6
Logged B	y: Tyler \	White				_ Boring Loca	ation:								
City: Gun	itersville				_ County:		Marsha	11		State	: Alaba	ama			
ā	SAMPLES			DESCRIF	PTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0				Y SAND			6		4.5						
					′, 20% fine rown, stif	e sand, 80° ff_moist	% 8	14	4.5						
- 5 -		FILL,	, CL DY SILT	ΓΥ CLAY	, 20% fine	e sand, 80°	% 5	21	1.25						
			s, nign pi st, residu		tan, firm to	<b>Σ</b> Sτιπ,	7	19	4.0						
20 -		AUG	EK KEF	USAL @	) <b>8-1</b> t										
COMPLET DATE:		PTH: 2/4/19			NITIAL WATE EXTENDED W		y to 1.0-f	Dry t on	1/	10/20	<b>-</b> ₹		OMł,	, <b>lnc</b> . 1 of 1	
DATE.	12	4113		LETTITOL	VILIADED AA	ATEIN. DI	/ 10 1.0-1	011		10,20			rage	1 01 1	

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JOB	NO.:	8883	JOB: Guntersville F	Park Improvem	ents			LOG	OF BOI	RING:_	L	P-24	
Drille	er: S	outh Bi	ros. Drill Model: Mobile B-47	Hamme	Type:	Auto			Ha	ımmer l	Efficien	cy: <u>96%</u>	6
			r White										
City:	Gui	ntersvil	lle County:	Ma	arshall			State:	Alaba	ıma			
рбртн, гт	ELEVATION	SAMPLES GRAPHIC	DESCRIPTION		N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0		<b>***</b>	TOPSOIL		3	18	2.0						
			SANDY SILTY CLAY, 20% fine s fines, low plasticity, tan, firm, mo		4	20	3.0						
 - 5 -			SANDY SILTY CLAY with trace of and gravel size chert, 10% grave		16	18	4.5						
	i e		coarse to fine sand, 70% fines, he plasticity, tannish orange, stiff to	igh	18	21	4.5						
- 10 -			moist, residuum, CH		10	21	4.5						
45					9	25	3.5						
-10			BORING TERMINATED @ 15-ft										
- 20 -													
_													
- 25 -													
												1	
- 30 -													
35 -													
COM		TION D	EPTH: 15 DEPTH TO INITIAL WATER: 12/3/19 DEPTH TO EXTENDED WATER:		filled	Dry on					OMI,	Inc. 1 of 1	

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	B NO.: 8883 JOB: Guntersville Park Improvements LOG OF BORING: LP-25												
Driller: South Bros. Drill Model: Mobile B-47 Hammer Type: Auto													
Log	ged E	3y: <u>T</u>	yler	r White Boring Loca	tion:								
City	: <u>Gu</u>	nters	svill	lle County:	Viarshall			State	: Alaba	ama			
ОЕРТН, FT	ELEVATION	SAMPLES	GKAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0		17	1	TOPSOIL	7	18	4.5						
		1	1	SANDY SILTY CLAY with gravel size	7	19	4.5	55	20				
			1	chert, 10% gravel, 15% coarse to fine sand, 75% fines, high plasticity, tannish									
- 5 -		1		orange, stiff to very stiff, moist, CH	13	18	4.5						
		1	1		20	22	4.5						
		/			100+								
10		1	1	ALICED DEFLICAL © 40 #	100-					-			
				AUGER REFUSAL @ 10-ft									
- 15 -						81							
20.													
- 20 -													
- 25 -													
- 30 -													
_													
		TION		EPTH: 10 DEPTH TO INITIAL WATER:		Dry on			— <del>¥</del>		OMI,	,Inc.	
DAT	E:	-		DEPTH TO EXTENDED WATER.		011			_ =		Page	1 of 1	

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JOB NO.: 8883	JOB: Guntersville Park Improve	ments			LOG	OF BOI	RING:_	L	P-26	
Driller: South Br	os. Drill Model: Mobile B-47 Hamme	er Type:	Auto			На	mmer l	Efficien	cy: <u>96</u> %	6
Logged By: Tyle	r White Boring Locat	ion:								
	e County:						ıma			
DEPTH, FT  ELEVATION SAMPLES  GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
<u>°</u> ₩	TOPSOIL	4	22	3.0						
	SANDY SILTY CLAY, 20% fine sand, 80% fines, low plasticity, tan, firm to stiff, moist,		23	4.0						
5 -	FILL, CL SANDY SILTY CLAY with trace oxides and chert, 10% gravel 20% coarse to fine	5	25	3.5						
	sand, 70% fines, high plasticity, tannish orange, firm to very stiff, moist, residuum, CH	7	26	4.0						
	GH	18	23	4.5						
- 20 -	AUGER REFUSAL @ 10-ft									
COMPLETION DI		.2-ft	8-ft on	1/	10/20	- 💆		OMI,	Inc. 1 of 1	

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JOE	NO.	8883	JOB: Guntersville Park Improver	nents			LOG	OF BOI	RING:_	L	.P-27	
Drill	ler: <u>S</u>	outh Br	os. Drill Model: Mobile B-47 Hamme	r Type:	Auto			На	ımmer l	Efficien	cy: <u>96%</u>	6
Log	ged E	By: <u>Tyle</u>	r White Boring Locati									
City	: <u>G</u> u	ntersvil	le County:M	arshall			State:	Alaba	ıma			
рертн, гт	ELEVATION	SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0		××	TOPSOIL	4	19	2.0						
			SANDY SILTY CLAY, 25% fine sand, 75% fines, low plasticity, tan, firm to very stiff,	10	19	3.0						
- 5 -			moist, FILL, CL SANDY SILTY CLAY with trace oxides and chert, 10% gravel, 20% coarse to fine	12	20	4.5						
			sand, 70% fines, high plasticity, tannish orange, very stiff, moist, residuum, CH	22	19	4.5						
- 10 -				17	19	4.5						
45			SANDY SILTY CLAY with gravel size chert, 10% gravel, 15% coarse to fine	11	31	4.5						
			sand, 75% fines, high plasticity, brown,									
			very stiff, moist, residuum, CH									
			BORING TERMINATED @ 15-ft									
- 20 -												
- 25 -												
- 30 -												
- 35	ADI E	TION D	EPTH: 15 DEPTH TO INITIAL WATER:		Dry			 <u>□</u>		OMI,	Inc	
DAT		TION D		o 4.0-ft		1/	10/20	- <del>∑</del>			1 of 1	

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JOB NO.: 8883     JOB: Guntersville Park Improvements     LOG OF BORING:       Driller: South Bros.     Drill Model: Mobile B-47     Hammer Type: Auto Hammer Efficie										
Driller: South B	ros. Drill Model: Mobile B-47 Hamme	r Type:	Auto			На	ammer l	Efficien	cy: <u>96%</u>	6
Logged By: Tyle	r White Boring Locati	on:								
City: <u>Guntersvi</u>		larshall								
DEPTH, FT ELEVATION SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	TOPSOIL	8	20	4.5						
	SANDY SILTY CLAY with trace oxides and chert, 10% gravel ,20% coarse to fine	11	19	4.5						
. 5 -	sand, 70% fines, high plasticity, tannish orange, stiff to very stiff, moist, residuum, CH	13	17	4.5						
		14								
- 10 -		18	20	4.5						
- 15 20	AUGER REFUSAL @ 11-ft		Dmy			$\Delta Z$		OM		
COMPLETION DI DATE:		o 2.0-ft	Dry on	1/1	0/20	- <del>¥</del>		OMI, Page	Inc. 1 of 1	

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JOE	NO.:	8883		JOB:	un	Gunt	ersville Pa	ark Improve	ments			LOG	OF BOI	RING:_	L	P-29	
Drill	er: <u>S</u>	outh B	ros.	Drill Mod	del: Mobil	e B-47		Hamme	er Type:	Auto		=: ======	На	ımmer l	Efficien	cy: <u>96</u> %	6
Log	ged B	y: <u>Tyl</u> e	er White				В	Boring Locati	ion:								
City	: <u>Gur</u>	ntersvi	lle			Co	unty:	N	larshall			State	Alaba	ıma			
ОЕРТН, ЕТ	ELEVATION	SAMPLES GRAPHIC			DESC	CRIPTION			N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0			-	PSOIL					4	21	2.5						
		<b> </b>			_TY CLA lasticity			and, 80%	8	21	4.5						
-	_			st, FILL		, yenow	non tan,	, 111111,									
- 5 -					TY CLA				10	20	4.5						
					10% gra fines, hi			se to fine									
								siduum,	14	21	4.5						
			СН						40	04	4.5						
- 10 -									12	21	4.5						
		//															
			AUG	SER RE	FUSAL	@ 12-	ft										
- 15 -																	
20 -																	
25 -																	
30 -																	
- 35 -																	
CON		TION D	EPTH:_ 12/3/19	12	DEPTH TO		WATER:	ER: 3	.5-ft	Dry on	1/	10/20	<b>-</b> ₹		OMI,	lnc.	

5151 Research Drive, N.W., Suite A Huntsville, AL 35805

JOB	NO.: 8883	JOB: Guntersville Park Improve	nents			LOG	OF BOF	RING:_	L	P-30	
Drill	er: South Br	os. Drill Model: Mobile B-47 Hamme	r Type:	Auto			На	ımmer l	Efficien	cy: <u>96</u> %	6
Log	ged By: <u>Tyle</u>	r White Boring Locati	on:								
City	Guntersvil	le County:	larshall			State:	Alaba	ıma			
рертн, вт	ELEVATION SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
0	1//	TOPSOIL	6	19	4.5						
		SANDY SILTY CLAY with trace oxides and chert, 10% gravel, 20% coarse to fine	9	17	4.0						
- 5 -		sand, 70% fines, high plasticity, tannish orange, stiff to very stiff, moist, residuum, CH	11	19	4.5						
			12	23	4.5						
		CLAY WITH LIMESTONE FRAGMENTS	21								
- 15 - 20 - 25 - 30 -		AUGER REFUSAL @ 10-ft									
	IPLETION DE			Dry		10100	- 🖳		OMI,		
DAT	E:	12/3/19 DEPTH TO EXTENDED WATER:2	0-ft	on	1/1	0/20	_		Page	1 of 1	

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JOB NO.: 8883	JOB: Guntersville Park Improve	ments			LOG	OF BOF	RING:	L	.P-31	
Driller: South Bros.	Drill Model: Mobile B-47 Hamme	∍r Type:	Auto			На	ımmer l	Efficien	cy: <u>96%</u>	6
Logged By: Tyler White		ion:								
City: Guntersville	County:	larshall			State:	Alaba	ma			
DEPTH, FT ELEVATION SAMPLES GRAPHIC	DESCRIPTION	N-VALUE (Uncorrected)	NATURAL MOISTURE	POCKET PENETROMETER TSF	LIQUID LIMIT	Plastic Limit	Percent Passing No. 200	Rock Core Recovery (in/%)	Rock Quality Designation (%)	Fractures per Foot
SAN fines	HALT IDY SILTY CLAY, 20% fine sand, 80% s, low plasticity, yellowish tan, firm,	4	20	2.0						
SAN and	st, FILL, CL DY SILTY CLAY with trace oxides chert, 10% gravel, 20% coarse to fine	4	20	2.75						
	d, 70% fines, high plasticity, tannish ge, firm to stiff, moist, residuum, CH	8								
10 -		9		4.5						
20 - 30 - 35 - 35 -	GER REFUSAL @ 13-ft									
COMPLETION DEPTH:	13 DEPTH TO INITIAL WATER: DEPTH TO EXTENDED WATER: 4.	.0-ft	6-ft on	1/1	0/20	- <del>\</del> -		OMI, Page	Inc. 1 of 1	

# **BORING LEGEND**

SOIL SYMBOLS

MAJOR DIVISIONS			ROUP MBOLS	TYPICAL NAMES		
	SIEVE	COARSE ED ON	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	SOILS ON NO. 200	GRAVELS MORE OF N RETAINE #4 SIEVE	CL GRA	볉	GP	POORLY GRADED GRAVELS AND GRAVEL—SAND MIXTURES, LITTLE OR NO FINES
COARSE GRAIN SOILS		GR D% OR MC FRACTION #4	ELS TH ES		GM	SILTY GRAVELS, GRAVEL—SAND— SILT MIXTURES
E GRAII	RETAINED	50% FR/	GRAVELS WITH FINES	从	GC	CLAYEY GRAVELS, GRAVEL— SAND—CLAY MIXTURES
COARS	50% RE	50% OF CTION SIEVE	CLEAN		SW	WELL-GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES
	THAN ANDS AN FRA	ANDS FRA	13 g		SP	POORLY GRADED SANDS AND GRAVELLY SANDS, LITTLE OR NO FINES
	AORE	S/ ORE TH COARSE PASSES	SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES
		§ Sog	S M M		SC	CLAYEY SANDS, SAND-CLAY MIXTURES
	SIEVE	AYS	50% OR LESS		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS
νį	200	SILTS AND CLAYS			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
FINE GRAIN SOILS	PASSES NO.	SILTS			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
FINE GR	MORE PA	AND CLAYS	AN 50%		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTS, ELASTIC SILTS
	OR M	TS AND CLA	H H		СН	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	20%	SILTS	GREATER THAN		ОН	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY
HIG	HLY	ORGANIC S	SOILS		PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS

ABBREVIATIONS:

SS- SPLIT SPOON SAMPLE

UD- UNDISTURBED SAMPLE

REC-SAMPLE RECOVERY

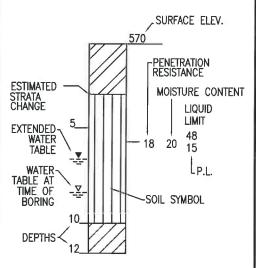
USC-VISUAL UNIFIED SOIL CLASSIFICATION

POCKET PENET— POCKET PENETROMETER READING, TSF

RQD-ROCK QUALITY DESIGNATION

FF- FRACTURE FREQUENCY PER FOOT OF CORE

KEY TO BORING RECORDS OR PROFILES



**ROCK SYMBOLS** 



SANDSTONE



SHALE



GNEISS OR SCHIST



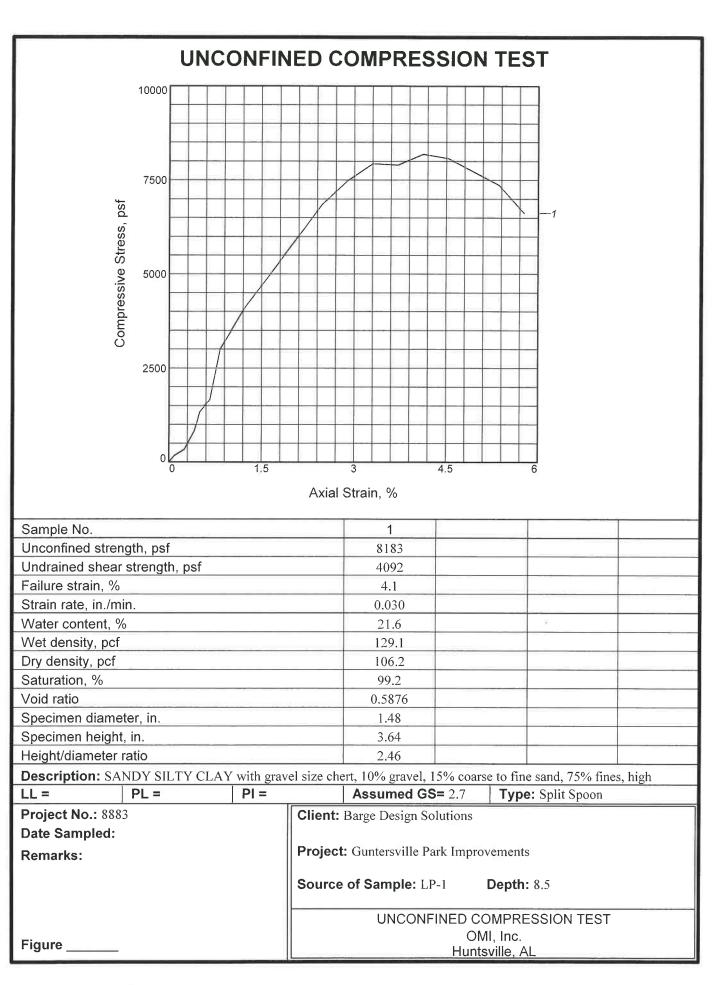
**CONGLOMERATE** 



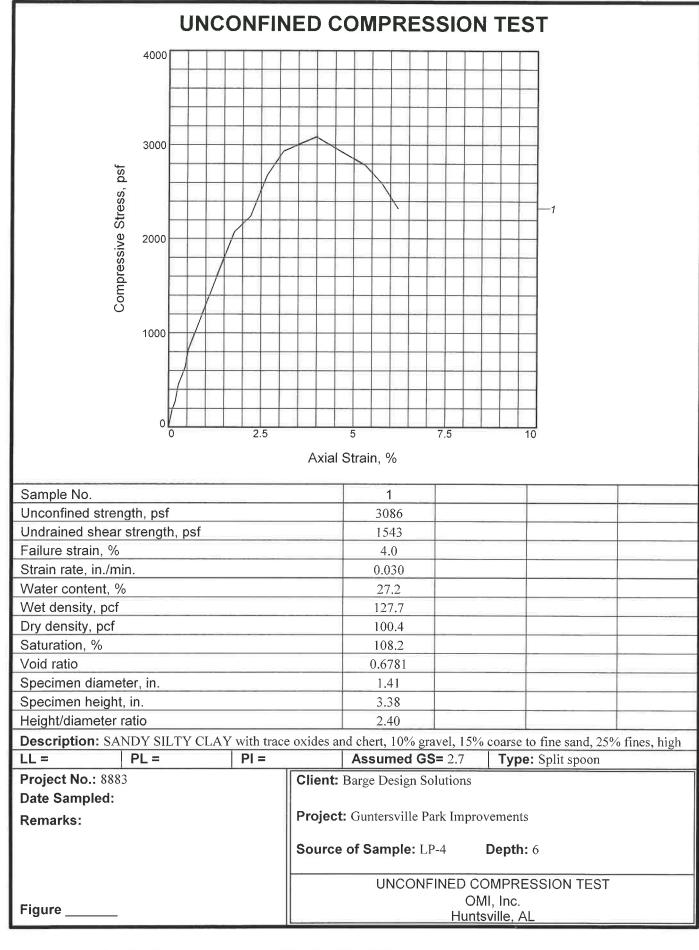
LIMESTONE OR DOLOMITE

OMI,INC.

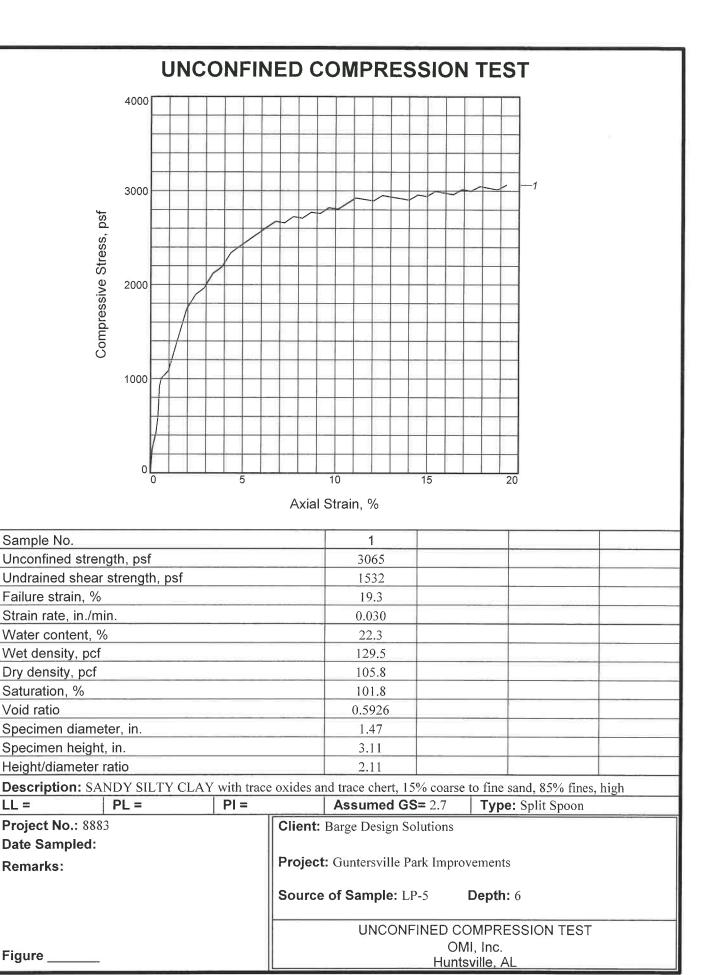
5151 Research Drive Huntsville, AL 35805



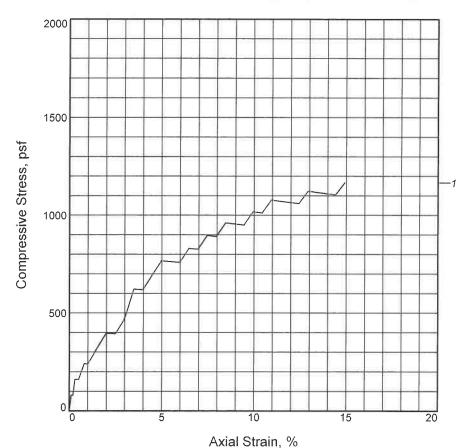
Tested By: JRC & NJW Checked By: TW



Tested By: JRC & NJW Checked By: TW



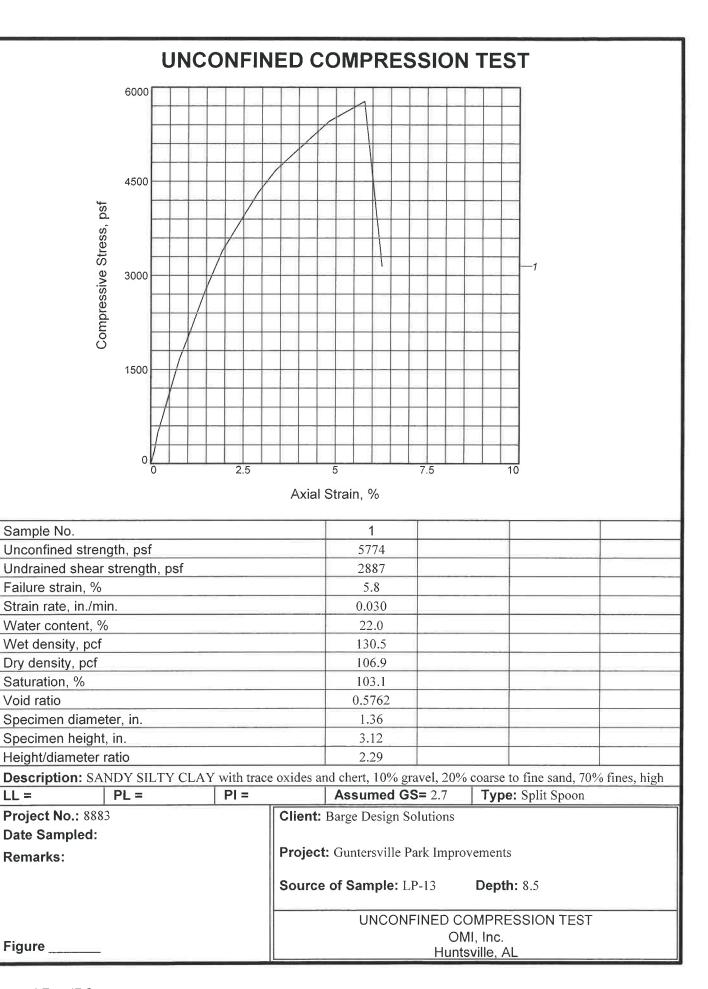


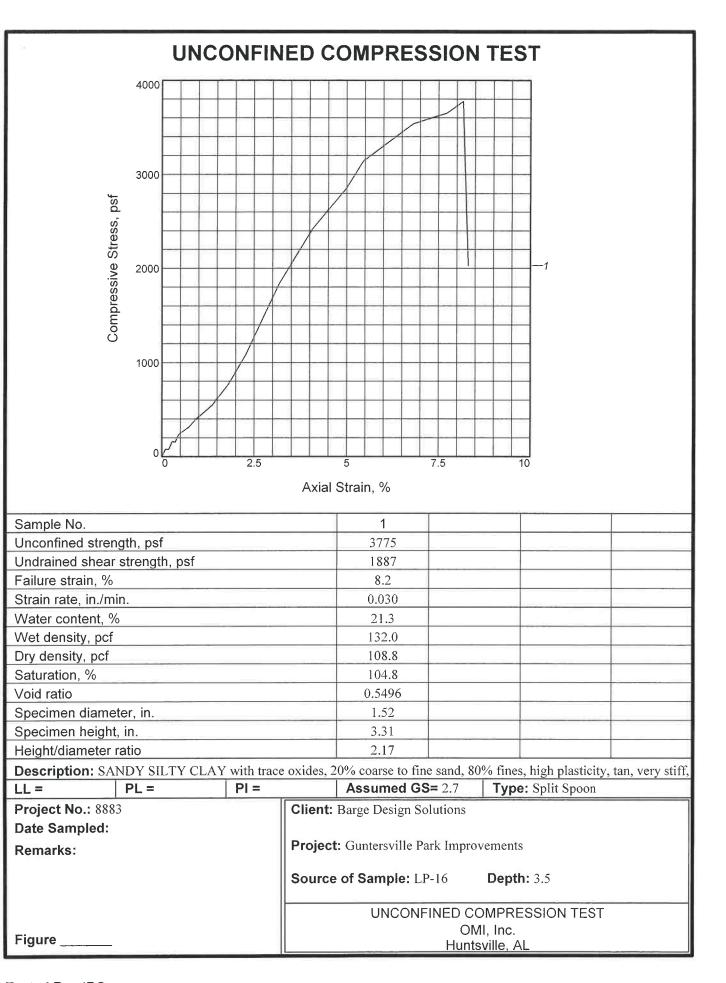


Sample No.	1	
Unconfined strength, psf	1166	
Undrained shear strength, psf	583	
Failure strain, %	14.9	
Strain rate, in./min.	0.030	
Water content, %	22.7	
Wet density, pcf	113.1	
Dry density, pcf	92.1	
Saturation, %	74.0	
Void ratio	0.8291	
Specimen diameter, in.	1.51	
Specimen height, in.	3.02	
Height/diameter ratio	2.00	

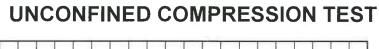
**Description:** SANDY SILTY CLAY with trace chert, 15% fine sand, 85% fines, high plasticity, tannish yellow, stiff,

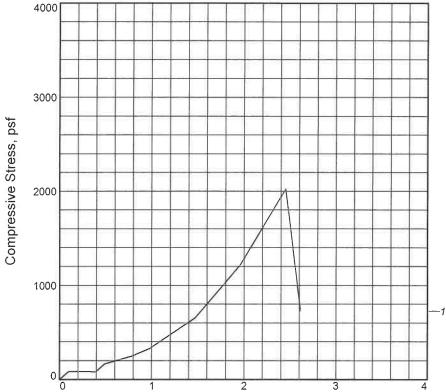
LL =	PL =	PI =		Assumed GS= 2.7	Type: Split Spoon	
Project No.: 8883			Client: Barge Design Solutions			
Date Sampled:						
Remarks:			Project: Guntersville Park Improvements			
			Source	of Sample: LP-7	Depth: 3.5	
				UNCONFINED C	OMPRESSION TEST	
F:				ON	/II, Inc.	
Figure				Hunts	sville, AL	





Tested By: JRC





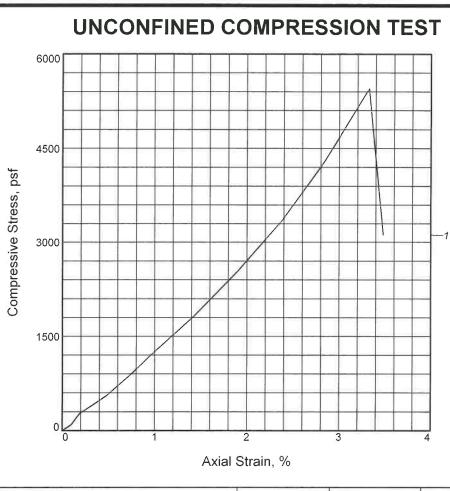
Axial Strain, %

Sample No.	1	
Unconfined strength, psf	2022	
Undrained shear strength, psf	1011	
Failure strain, %	2.5	
Strain rate, in./min.	0.030	
Water content, %	23.4	
Wet density, pcf	129.3	
Dry density, pcf	104.7	
Saturation, %	103.9	
Void ratio	0.6096	
Specimen diameter, in.	1.49	
Specimen height, in.	3.06	
Height/diameter ratio	2.06	

Description: SANDY SILTY CLAY with trace oxides and chert, 10% gravel, 20% coarse to fine sand, 70% fines, high

LL =	PL =	PI =		Assumed GS= 2.7	Type: Split Spoon	
Project No.: 8883			Client:	Client: Barge Design Solutions		
Date Sampled:						
Remarks:			Project	<b>Project:</b> Guntersville Park Improvements		
			Source	of Sample: LP-18	<b>Depth:</b> 3.5	
				UNCONFINED CO	OMPRESSION TEST	
Figure		OMI, Inc.				
i igui e				Hunts	sville, AL	

Tested By: JRC

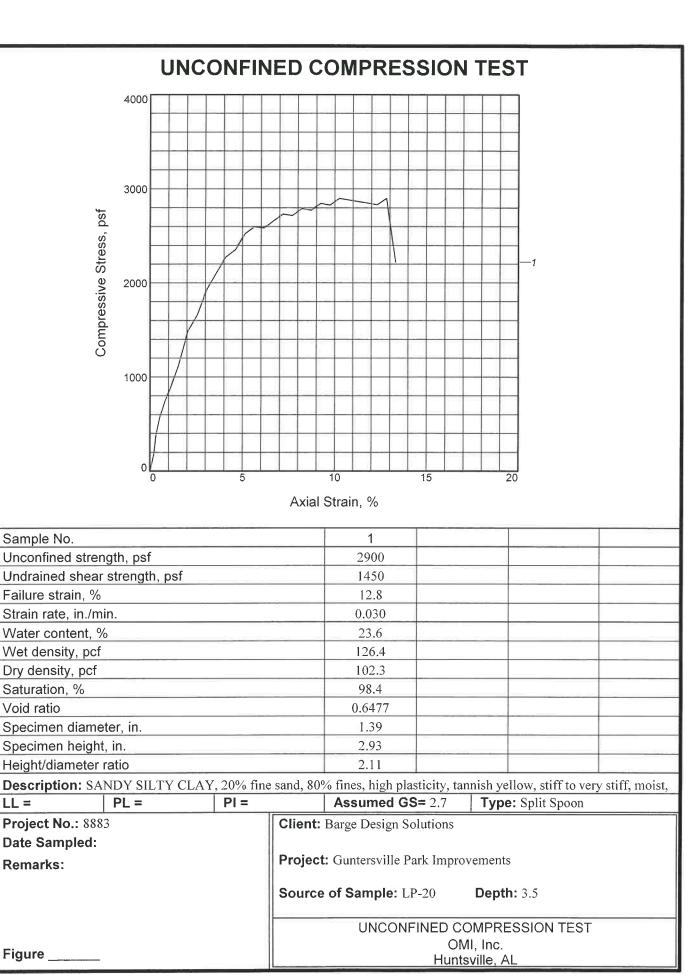


Sample No.	1	
Unconfined strength, psf	5446	
Undrained shear strength, psf	2723	
Failure strain, %	3.3	
Strain rate, in./min.	0.030	
Water content, %	19.3	
Wet density, pcf	126.4	
Dry density, pcf	105.9	
Saturation, %	88.3	
Void ratio	0.5911	
Specimen diameter, in.	1.41	
Specimen height, in.	3.16	
Height/diameter ratio	2.24	

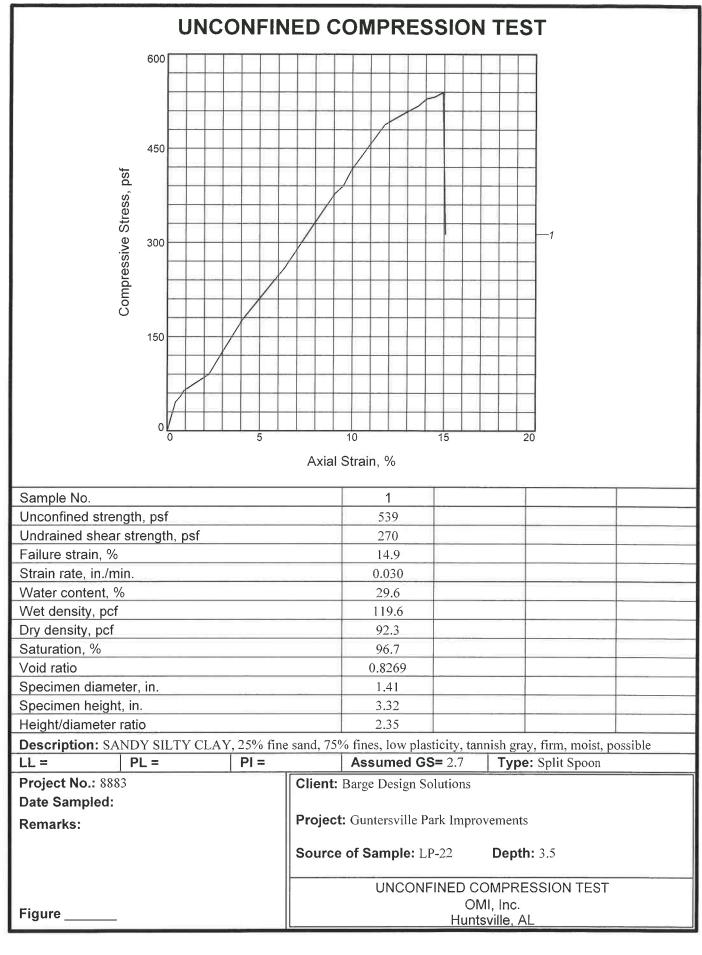
**Description:** SANDY SILTY CLAY with trace chert. 20% coarse to fine sand, 80% fines, high plasticity, yellowish tan

Description, SA.	NDI SILII CLAI	with trace	c chert, 2070 coarse to time saind, 6070 times, high plasticity, yellowish tan,			
LL =	PL =	PI =		Assumed GS= 2.7	Type: Split Spoon	
Project No.: 8883			Client:	Client: Barge Design Solutions		
Date Sampled:						
Remarks:			<b>Project:</b> Guntersville Park Improvements			
			Source	of Sample: LP-19	<b>Depth:</b> 3.5	
				UNCONFINED CC	MPRESSION TEST	
Figure					I, Inc. ville, AL	
				Traine		

Tested By: JRC

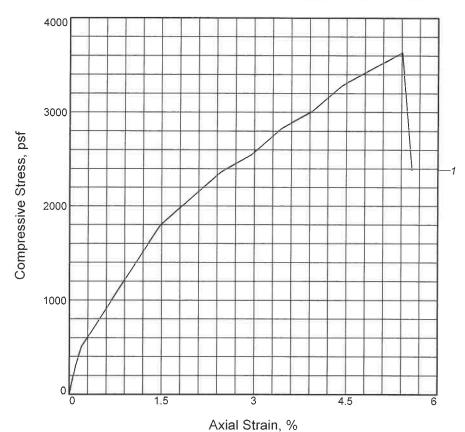


LL =



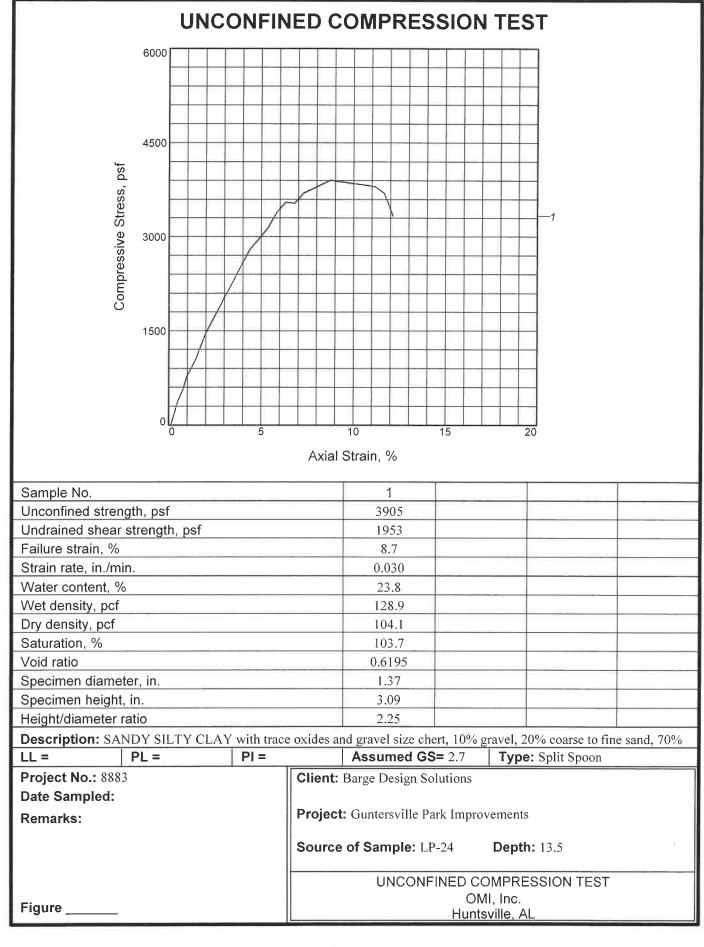
Tested By: JRC Checked By: TW



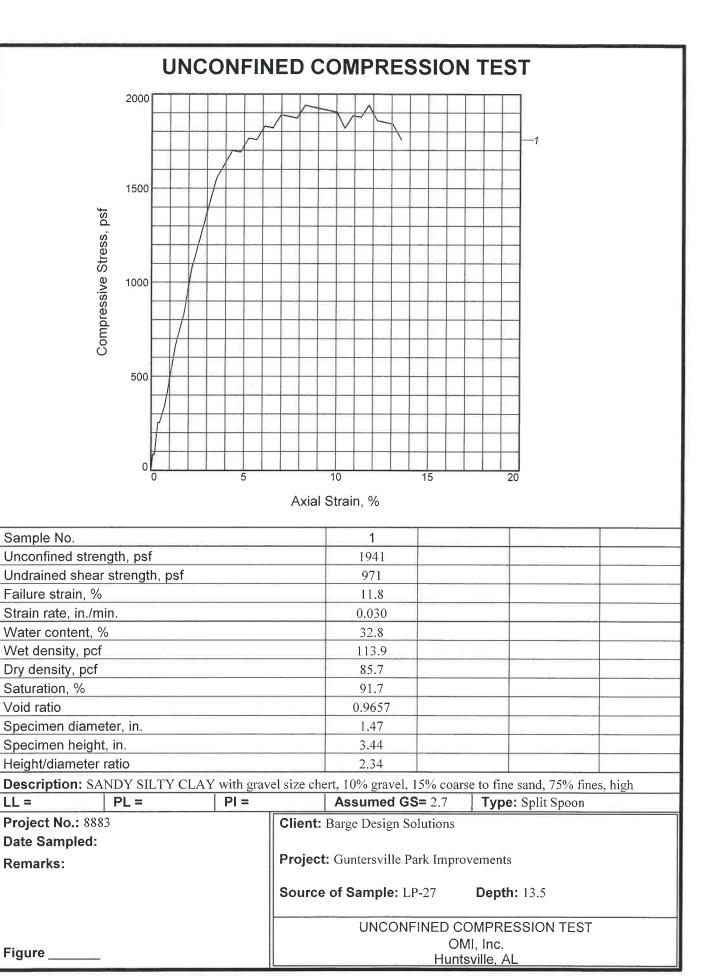


Sample No.	1	
Unconfined strength, psf	3632	
Undrained shear strength, psf	1816	
Failure strain, %	5.4	
Strain rate, in./min.	0.030	
Water content, %	22.7	
Wet density, pcf	129.1	
Dry density, pcf	105.2	
Saturation, %	101.6	
Void ratio	0.6021	
Specimen diameter, in.	1.35	
Specimen height, in.	3.05	
Height/diameter ratio	2.26	

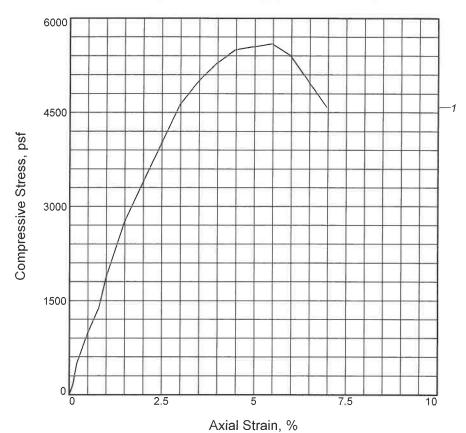
Description: SA	NDY SILTY CLAY	with trace	e oxides and gravel size chert, 10% gravel, 20% coarse to fine sand, 70%				
LL =	PL =	PI =		Assumed GS= 2.7	Type: Split Spoon		
Project No.: 8883			Client:	Client: Barge Design Solutions			
Date Sampled:							
Remarks:			<b>Project:</b> Guntersville Park Improvements			ĺ	
			Occurs of Occurs In 24 Double 2.5				
×			Source	of Sample: LP-24	Depth: 8.5		
			UNCONFINED COMPRESSION TEST			+	
					II, Inc.	1	
Figure			Huntsville, AL				



Tested By: JRC Checked By: TW





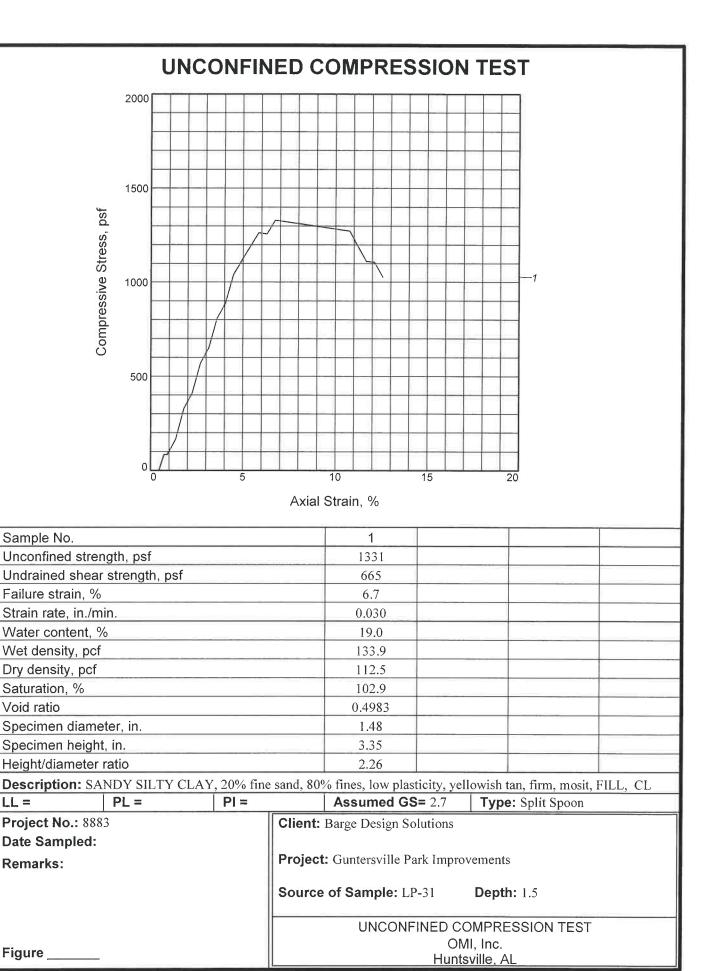


Sample No.	1	
Unconfined strength, psf	5591	
Undrained shear strength, psf	2795	
Failure strain, %	5.5	
Strain rate, in./min.	0.030	
Water content, %	20.3	
Wet density, pcf	129.4	
Dry density, pcf	107.6	
Saturation, %	96.7	
Void ratio	0.5671	
Specimen diameter, in.	1.49	
Specimen height, in.	3.02	
Height/diameter ratio	2.02	

**Description:** SANDY SILTY CLAY with trace oxides and chert, 20% coarse to fine sand, 70% fines, high plasticity,

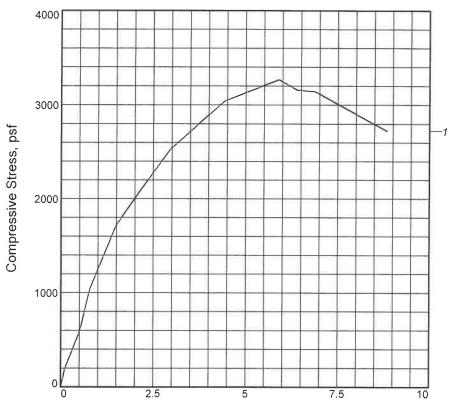
Description. 5A	NDI SILII CLAI	with trace	t oxides and enert, 2076 coarse to fine saild, 7076 fines, flight prasticity,			
LL =	PL =	PI =		Assumed GS= 2.7	Type: Split Spoon	
Project No.: 888	3		Client:	Barge Design Solutions		
Date Sampled:						
Remarks:			<b>Project:</b> Guntersville Park Improvements			
			Source	of Sample: LP-28	<b>Depth:</b> 3.5	
				UNCONFINED CC	MPRESSION TEST	
Figure					I, Inc.	
rigure			Huntsville, AL			

Tested By: JRC Checked By: TW



LL =





1	
3266	
1633	
5.9	
0.030	
28.4	
119.3	
92.9	
94.1	
0.8143	
1.38	
3.05	
2.21	
	1633 5.9 0.030 28.4 119.3 92.9 94.1 0.8143 1.38 3.05

Axial Strain, %

Description: SANDY SILTY CLAY with trace oxides and chert, 10% gravel, 20% coarse to fine sand, 70% fines, high

Description: SAND 1 SILT1 CLAT with trace oxides and chert, 10% graver, 20% coarse to fine sand, 70% lines, high					
LL =	PL =	PI =		Assumed GS= 2.7	Type: Split Spoon
Project No.: 8883			Client: Barge Design Solutions		
Date Sampled:					
Remarks:			<b>Project:</b> Guntersville Park Improvements		
			Source	of Sample: LP-31	<b>Depth:</b> 8.5
			UNCONFINED COMPRESSION TEST		
Figure		OMI, Inc. Huntsville, AL			
		Turitsville, AL			

Project number: 8883

County: Marshall

Description: LP-1  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\dot{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 127.7$ , c = 1543,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 3086 psf maximum and 1543 psf allowable. At 5 feet the passive pressures are 3660 psf maximum and 1830 psf allowable.

Layer 2 is best described as: Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 65.3$ , c = 1543,  $\dot{l} = 0$   $N\dot{l} = 1$ 

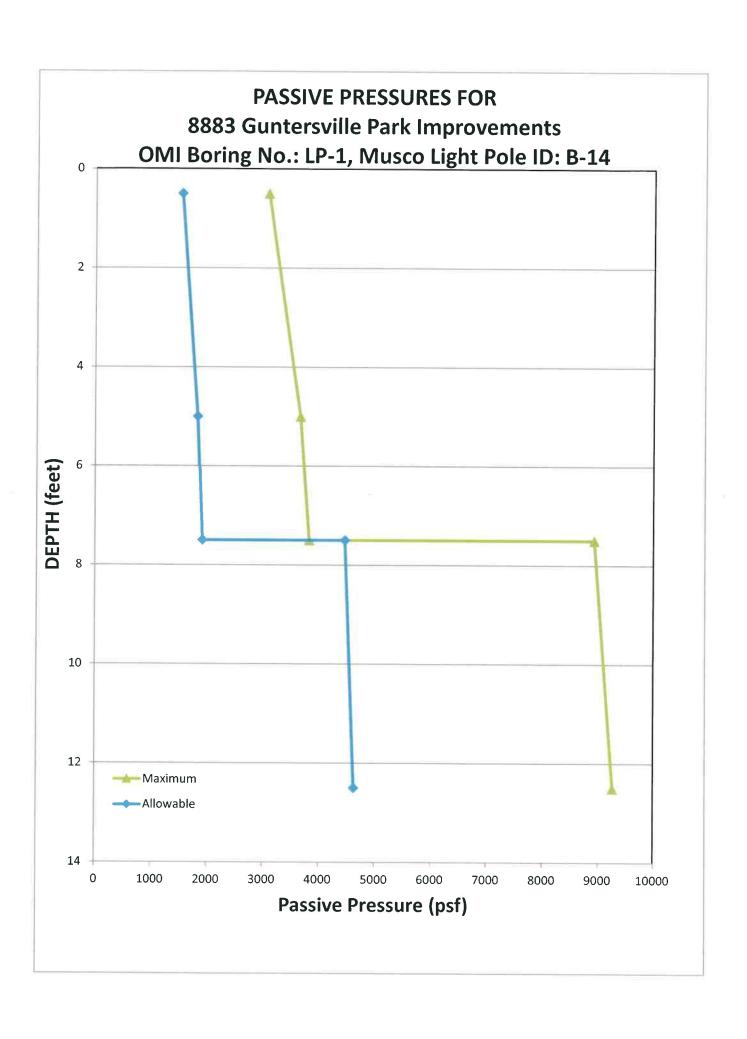
At 5 feet the passive pressures are 3660 psf maximum and 1830 psf allowable. At 7.5 feet the passive pressures are 3823 psf maximum and 1911 psf allowable.

Layer 3 is best described as: Moist Very Stiff Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 66.7$ , c = 4092,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 7.5 feet the passive pressures are 8921 psf maximum and 4460 psf allowable.

At 12.5 feet the passive pressures are 9255 psf maximum and 4627 psf allowable.



Project number: 8883

County: Marshall

Description: LP-2  $P = (\ddot{e})(z)(N\dot{f}) + (2)@*((\dot{u}N\dot{f})^0.5)$ 

Layer 1 is best described as: Moist Stiff Dark Brown Sandy Silty Clay Fill with organics

Layer values were:  $\ddot{e} = 133.9$ , c = 665,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3.5 feet the passive pressures are 1731 psf maximum and 865 psf allowable.

Layer 2 is best described as: Moist Firm to Stiff Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 113.1$ , c = 583,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 3.5 feet the passive pressures are 1567 psf maximum and 783 psf allowable.

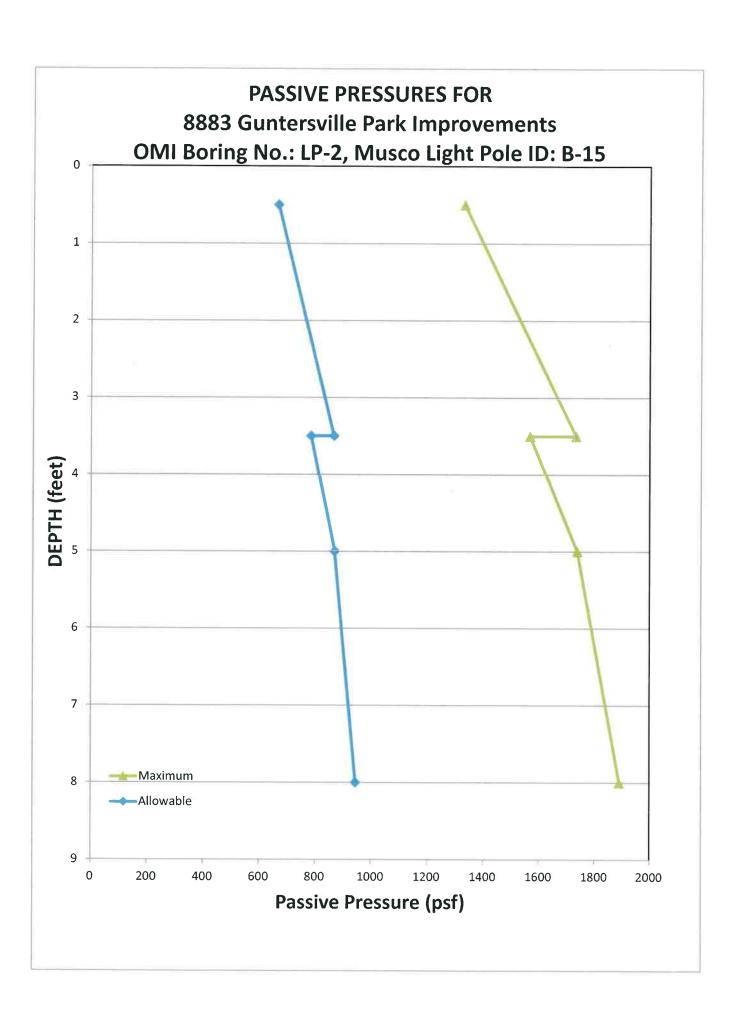
At 5 feet the passive pressures are 1737 psf maximum and 868 psf allowable.

Layer 3 is best described as: Moist Firm to Stiff Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 50.7$ , c = 583,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 1737 psf maximum and 868 psf allowable.

At 8 feet the passive pressures are 1889 psf maximum and 944 psf allowable.



Project number: 8883 County: Marshall Description: LP-3

 $P = (\ddot{e})(z)(N\dot{l}) + (2)©*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Moist Firm to Stiff Tan Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 5 feet the passive pressures are 1932 psf maximum and 966 psf allowable.

Layer 2 is best described as: Moist Very Stiff Tan Sandy Silty Clay

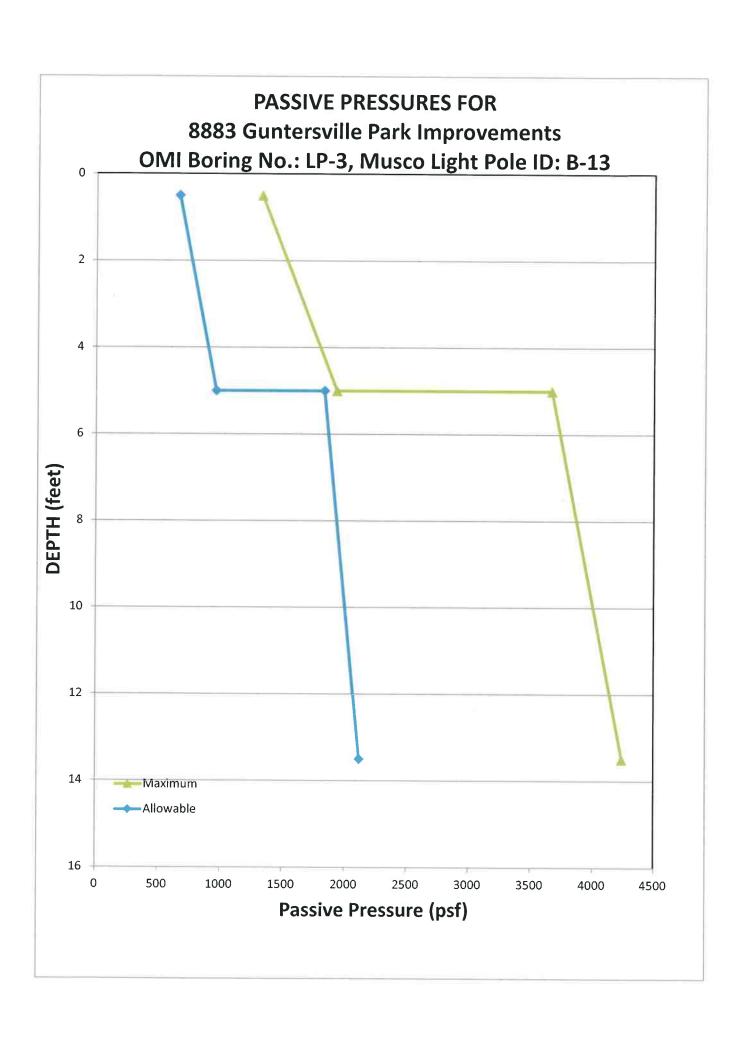
Layer values were:  $\ddot{e} = 67.1$  , c = 1532 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 3666 psf maximum and 1833 psf allowable. At 13.5 feet the passive pressures are 4236 psf maximum and 2118 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

### ###



Project number: 8883

County: Marshall

Description: LP-4  $P = (\ddot{e})(z)(N\dot{f}) + (2)@*((\hat{u}N\dot{f})^0.5)$ 

Layer 1 is best described as: Mo

Moist Stiff Brown Sandy Silty Clay Fill with Organics

Layer values were:

 $\ddot{e} = 133.9$ , c = 665,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 1.5 feet the passive pressures are 1463 psf maximum and 731 psf allowable.

Layer 2 is best described as:

Moist Stiff to Very Stiff Light Tannish Gray Sandy Silty Clay

Layer values were:

 $\ddot{e} = 127.7$  , c = 1543 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 1.5 feet the passive pressures are 3219 psf maximum and 1609 psf allowable. At 5 feet the passive pressures are 3666 psf maximum and 1833 psf allowable.

Layer 3 is best described as:

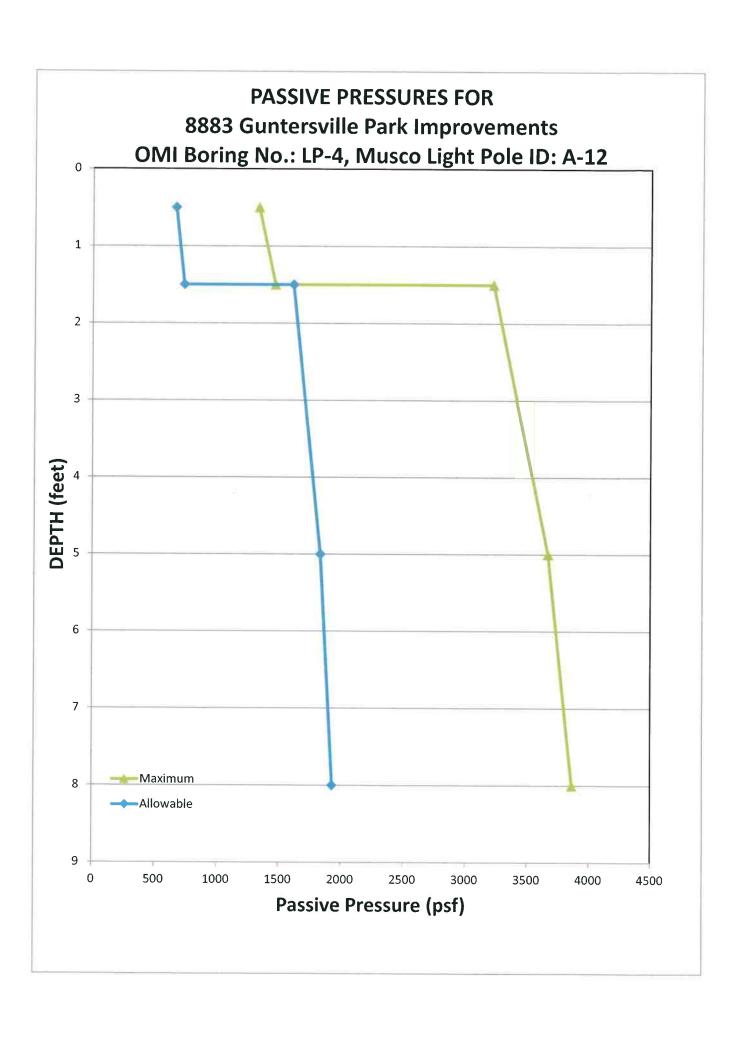
Moist Stiff to Very Stiff Light Tannish Gray Sandy Silty Clay

Layer values were:

 $\ddot{e} = 65.3$  , c = 1543 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 3666 psf maximum and 1833 psf allowable.

At 8 feet the passive pressures are 3862 psf maximum and 1931 psf allowable.



Project number: 8883 County: Marshall Description: LP-5

 $P = (\ddot{e})(z)(N\dot{I}) + (2)©*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as:

Moist Soft to Stiff Brown Sandy Silty Clay Fill with Organics

Layer values were:

 $\ddot{e} = 133.9$  , c = 665 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 5 feet the passive pressures are 1932 psf maximum and 966 psf allowable.

Layer 2 is best described as:

Moist Stiff Mottled Tan and Gray Sandy Silty Clay

Layer values were:

 $\ddot{e} = 67.1$  , c = 1532 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 3666 psf maximum and 1833 psf allowable. At 7.5 feet the passive pressures are 3834 psf maximum and 1917 psf allowable.

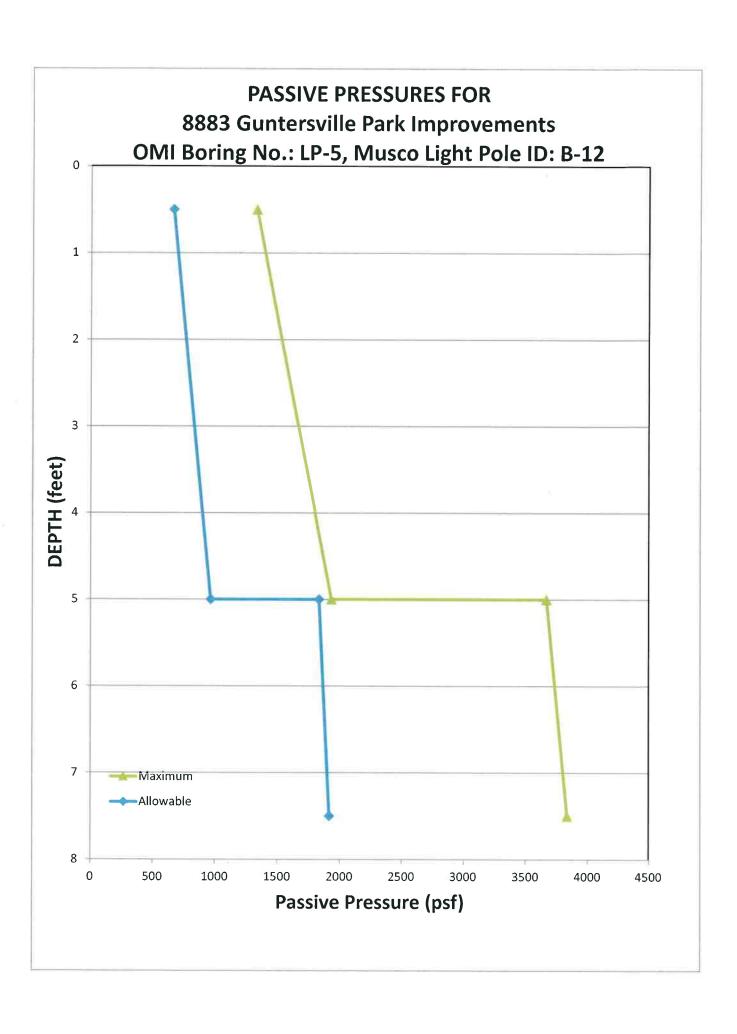
Layer 3 is best described as:

Layer values were:

 $\ddot{e} = 0$  , c = 0 ,  $\hat{l} = 0$   $N\hat{l} = 1$ 

###

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Project number: 8883 County: Marshall Description: LP-6

 $P = (\ddot{e})(z)(N\dot{I}) + (2)©*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Firm Tan Sandy Silty Clay Layer values were:  $\ddot{e} = 113.1$ , c = 583, f = 0 Nf = 1

At 0.5 feet the passive pressures are 1166 psf maximum and 583 psf allowable. At 5 feet the passive pressures are 1674 psf maximum and 837 psf allowable.

Layer 2 is best described as: Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

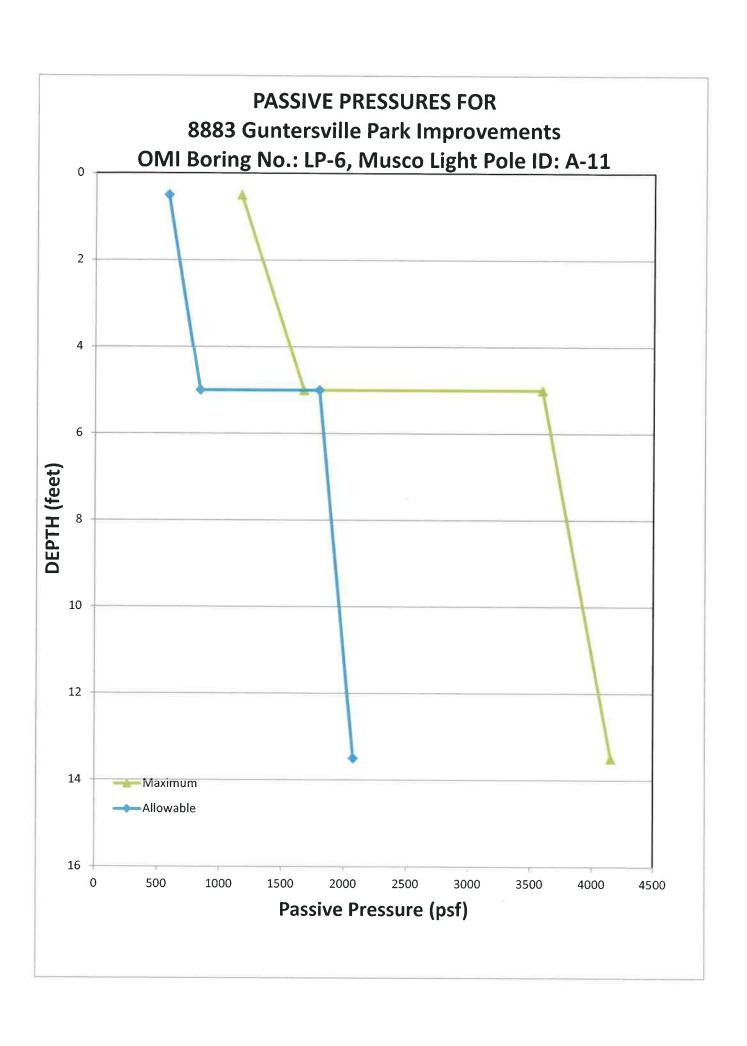
Layer values were:  $\ddot{e} = 65.3$ , c = 1543,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 3594 psf maximum and 1797 psf allowable. At 13.5 feet the passive pressures are 4150 psf maximum and 2075 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{f} = 0$  N $\dot{f} = 1$ 

### ###



Project number: 8883 County: Marshall Description: LP-7  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Firm Brown and Red Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665, f = 0 Nf = 1

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 1.5 feet the passive pressures are 1463 psf maximum and 731 psf allowable.

Layer 2 is best described as: Moist Stiff Tannish Yellow Sandy Silty Clay

Layer values were:  $\ddot{e} = 113.1$ , c = 583,  $\dot{l} = 0$   $N\dot{l} = 1$ 

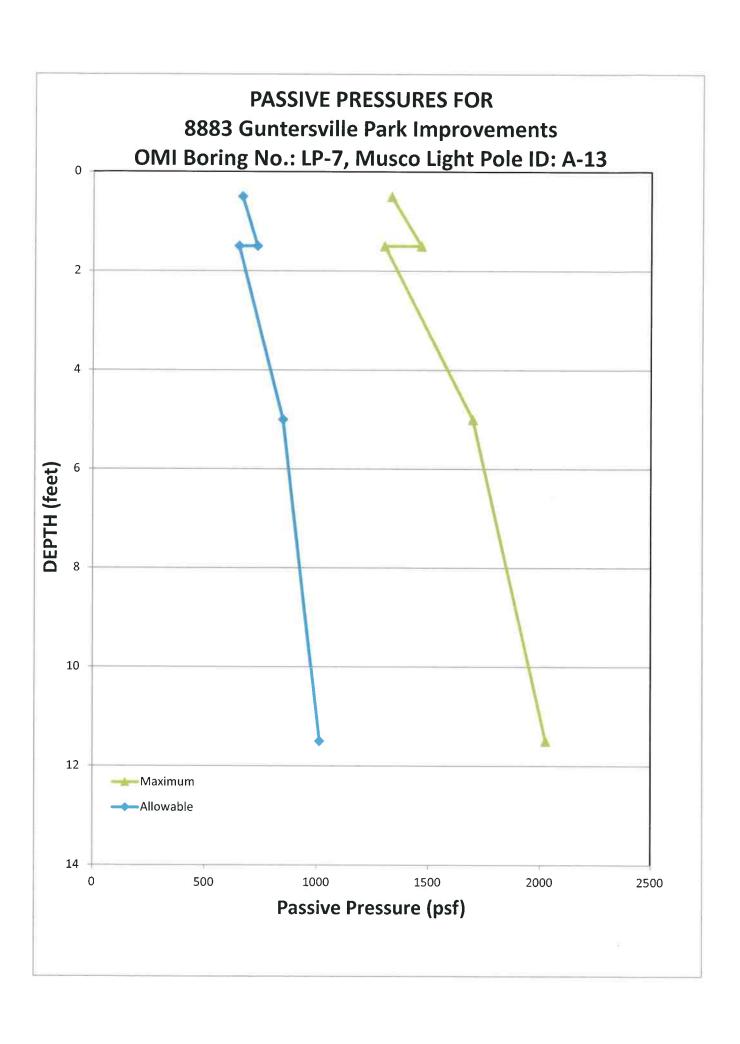
At 1.5 feet the passive pressures are 1299 psf maximum and 649 psf allowable. At 5 feet the passive pressures are 1695 psf maximum and 847 psf allowable.

Layer 3 is best described as: Moist Stiff to Very Stiff Tannish Yellow Sandy Silty Clay

Layer values were:  $\ddot{e} = 50.7$ , c = 583,  $\dot{i} = 0$   $N\dot{i} = 1$ 

At 5 feet the passive pressures are 1695 psf maximum and 847 psf allowable.

At 11.5 feet the passive pressures are 2025 psf maximum and 1012 psf allowable.



Project number: 8883 County: Marshall Description: LP-8

 $P = (\ddot{e})(z)(N\dot{l}) + (2)©*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Moist Firm to Very Stiff Tannish Yellow Sandy Silty Clay

Layer values were:  $\ddot{e} = 113.1$ , c = 583,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1166 psf maximum and 583 psf allowable. At 5 feet the passive pressures are 1674 psf maximum and 837 psf allowable.

Layer 2 is best described as: Moist Firm to Very Stiff Tannish Yellow Sandy Silty Clay

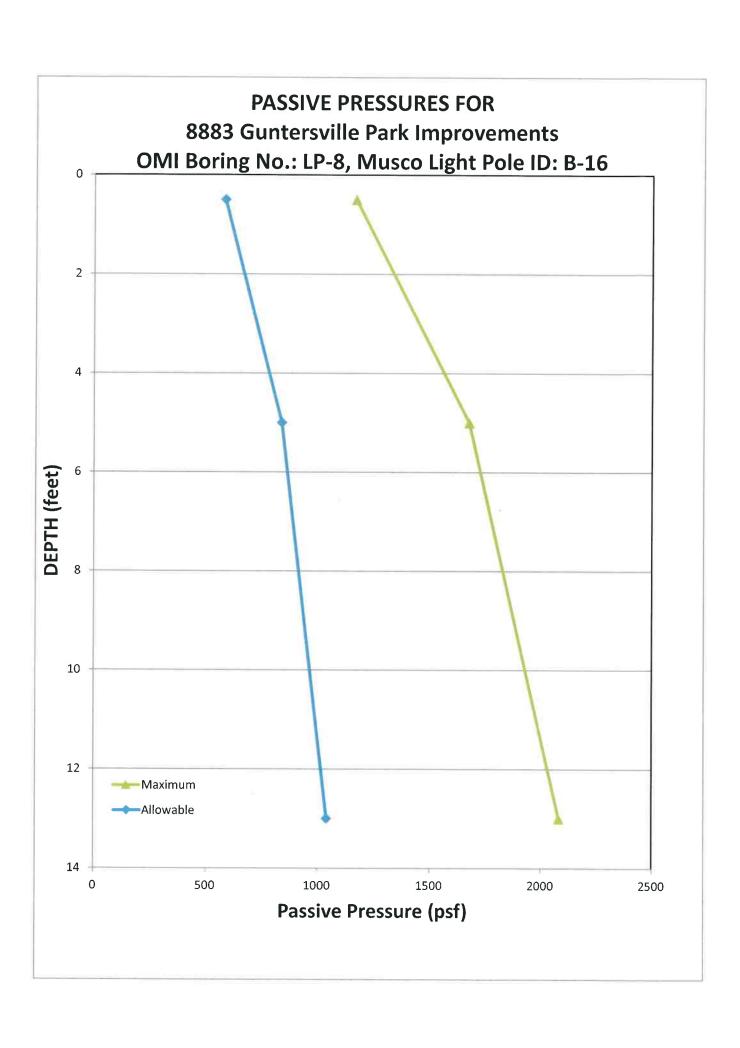
Layer values were:  $\ddot{e} = 50.7$ , c = 583,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 1674 psf maximum and 837 psf allowable. At 13 feet the passive pressures are 2080 psf maximum and 1040 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

### ###



Project number: 8883

County: Marshall

Description: LP-9  $P = (\ddot{e})(z)(N\dot{f}) + (2)@*((\hat{u}N\dot{f})^0.5)$ 

Layer 1 is best described as: Moist Firm Dark Brown Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665, f = 0 Nf = 1

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3 feet the passive pressures are 1664 psf maximum and 832 psf allowable.

Layer 2 is best described as: Moist Firm Tannish Gray Sandy Silty Clay

Layer values were:  $\ddot{e} = 113.1$ , c = 583,  $\dot{f} = 0$   $N\dot{f} = 1$ 

At 3 feet the passive pressures are 1500 psf maximum and 750 psf allowable.

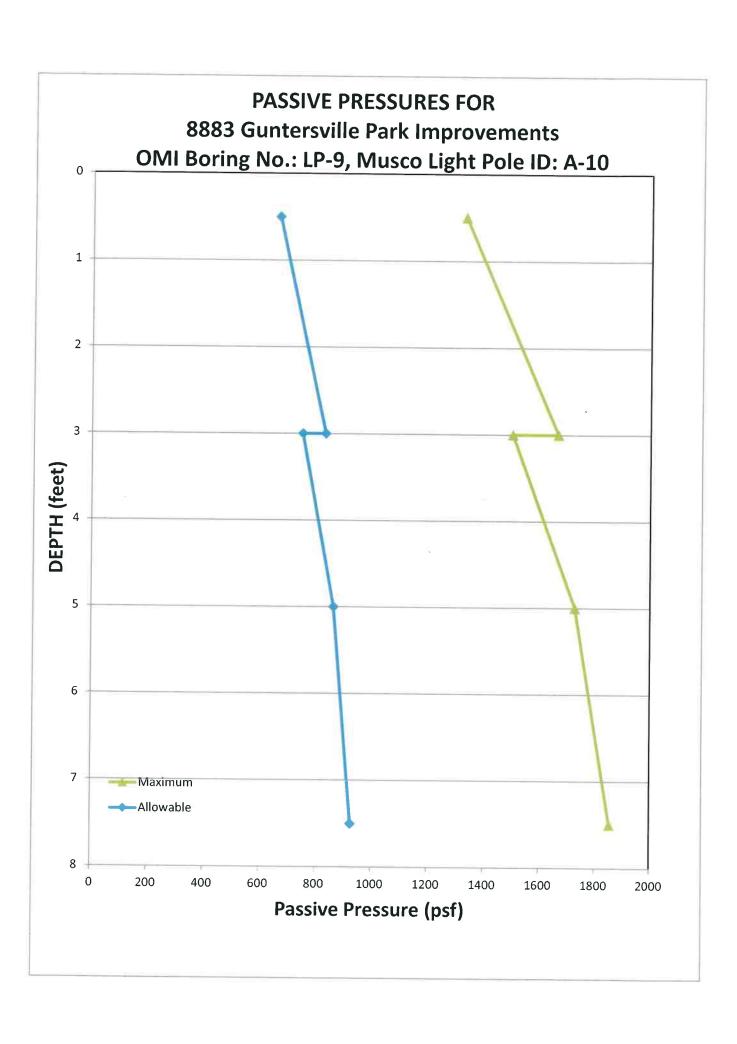
At 5 feet the passive pressures are 1726 psf maximum and 863 psf allowable.

Layer 3 is best described as: Moist Firm to Very Stiff Tannish Gray Sandy Silty Clay

Layer values were:  $\ddot{e} = 50.7$ , c = 583,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 1726 psf maximum and 863 psf allowable.

At 7.5 feet the passive pressures are 1853 psf maximum and 926 psf allowable.



Project number: 8883 County: Marshall Description: LP-10  $P = (\ddot{e})(z)(N\dot{l}) + (2)@*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as:

Moist Firm to Very Stiff Tan Sandy Silty Clay Fill

Layer values were:

 $\ddot{e} = 130.5$  , c = 2887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 5774 psf maximum and 2887 psf allowable. At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable.

Layer 2 is best described as:

Moist Very Stiff Tan Sandy Silty Clay

Layer values were:

 $\ddot{e} = 68.1$  , c = 2887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable. At 15 feet the passive pressures are 7042 psf maximum and 3521 psf allowable.

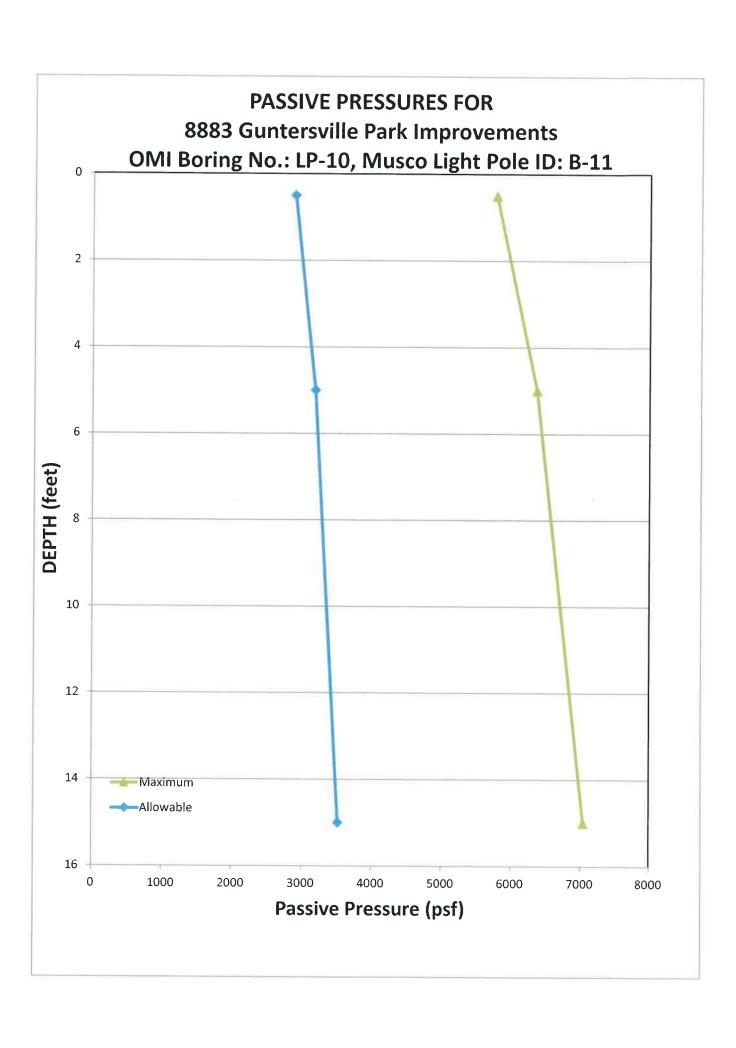
Layer 3 is best described as:

Layer values were:

 $\ddot{e} = 0$  , c = 0 ,  $\hat{l} = 0$   $N\hat{l} = 1$ 

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Project number: 8883 County: Marshall Description: LP-11  $P = (\ddot{e})(z)(N\dot{l}) + (2)@*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Moist Stiff Tannish Orange Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 130.5$  , c = 2887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 5774 psf maximum and 2887 psf allowable. At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable.

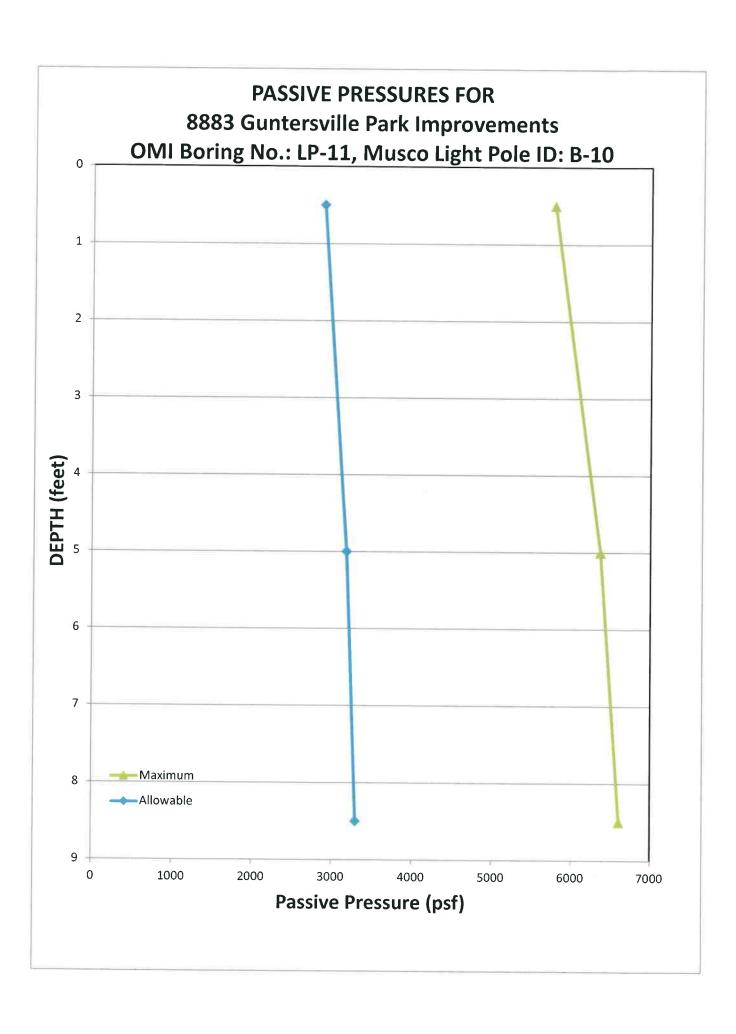
Layer 2 is best described as: Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 68.1$  , c = 2887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable. At 8.5 feet the passive pressures are 6599 psf maximum and 3299 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{f} = 0$  N $\dot{f} = 1$ 



Project number: 8883 County: Marshall Description: LP-12

 $P = (\ddot{e})(z)(N\dot{I}) + (2)©*((\mathring{u}N\dot{I})^0.5)$ 

Layer 1 is best described as:

Moist Stiff Tan Sandy Silty Clay

Layer values were:

 $\ddot{e} = 130.5$  , c = 2887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 5774 psf maximum and 2887 psf allowable. At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable.

Layer 2 is best described as:

Moist Very Stiff Tan Sandy Silty Clay

Layer values were:

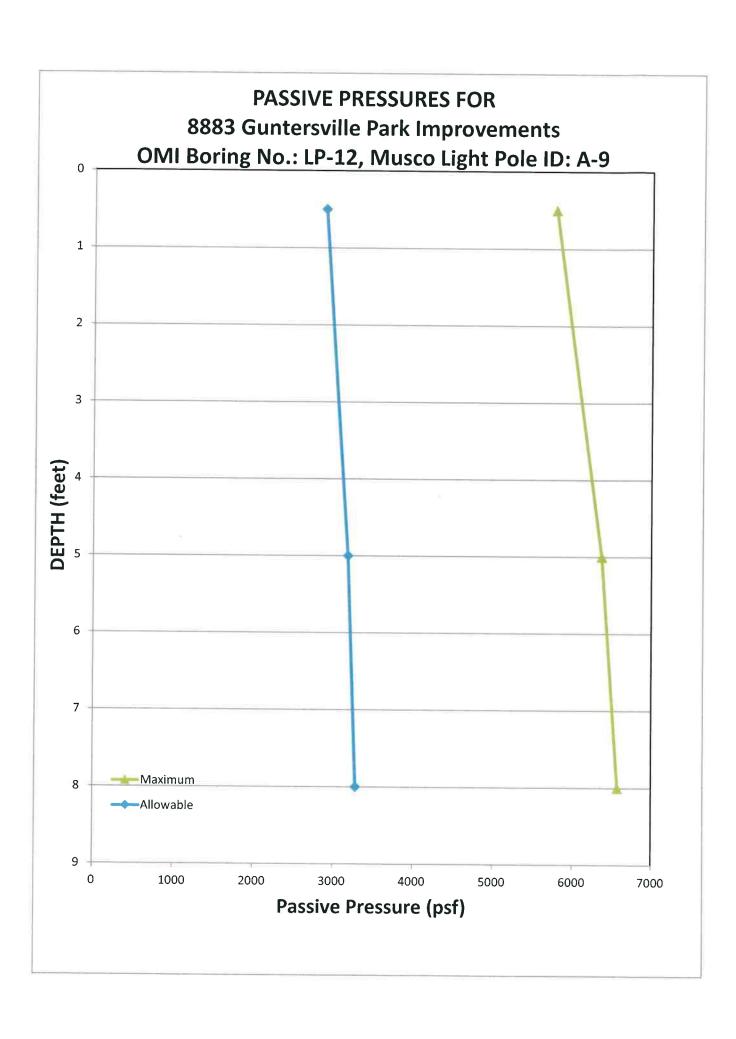
 $\ddot{e} = 68.1$  , c = 2887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable. At 8 feet the passive pressures are 6565 psf maximum and 3282 psf allowable.

Layer 3 is best described as:

Layer values were:

 $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 



Project number: 8883 County: Marshall Description: LP-13  $P = (\ddot{e})(z)(N\dot{l}) + (2)©*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as:

Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 130.5$  , c = 2887 ,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 0.5 feet the passive pressures are 5774 psf maximum and 2887 psf allowable. At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable.

Layer 2 is best described as:

Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 68.1$  , c = 2887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

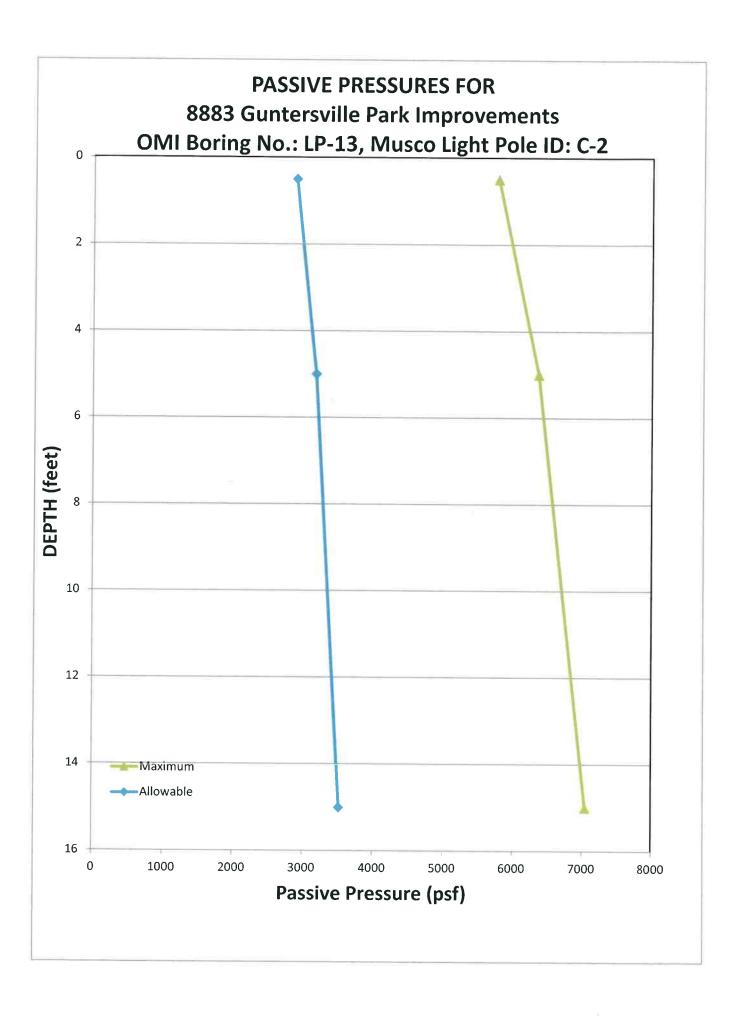
At 5 feet the passive pressures are 6361 psf maximum and 3180 psf allowable. At 15 feet the passive pressures are 7042 psf maximum and 3521 psf allowable.

Layer 3 is best described as:

Layer values were:

ë = 0  $, c = 0 , \hat{I} = 0 , \hat{N} = 1$ 

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Project number: 8883 County: Marshall Description: LP-14  $P = (\ddot{e})(z)(N\dot{l}) + (2)©*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Moist Soft Brown Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$  , c = 665 ,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 1.5 feet the passive pressures are 1463 psf maximum and 731 psf allowable.

Layer 2 is best described as: Moist Stiff Tan Sandy Silty Clay  $\ddot{e}$  = 132.0 , c = 1887 ,  $\dot{l}$  = 0  $N\dot{l}$  = 1 Layer values were:

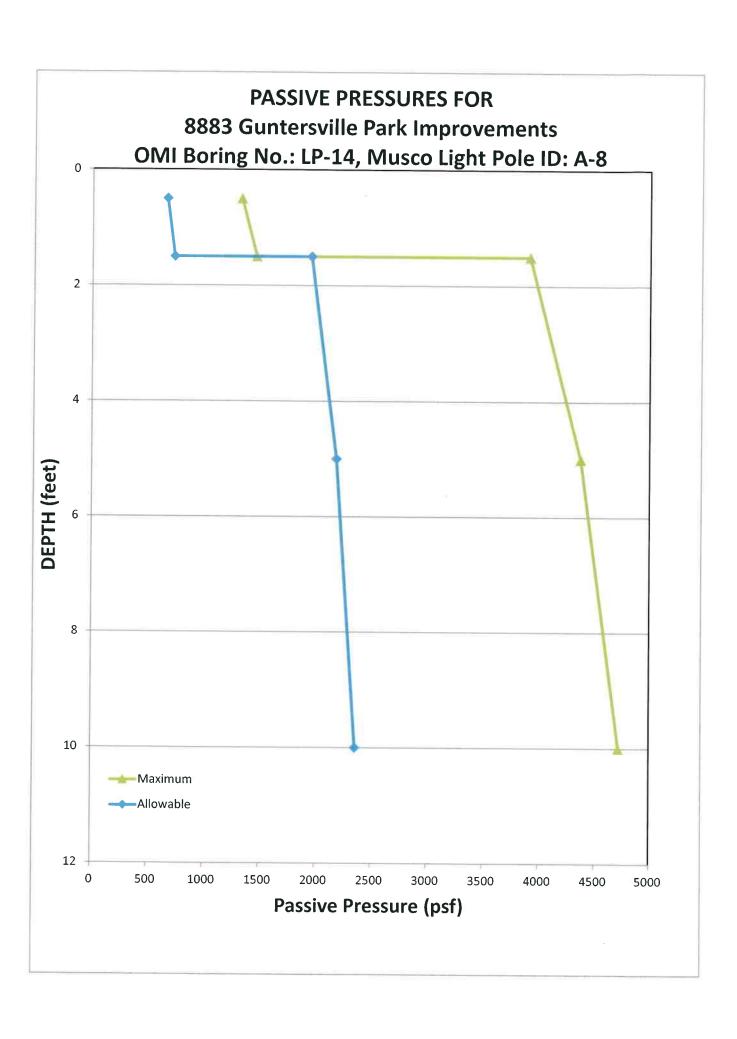
At 1.5 feet the passive pressures are 3907 psf maximum and 1953 psf allowable. At 5 feet the passive pressures are 4369 psf maximum and 2184 psf allowable.

Layer 3 is best described as: Moist Very Stiff Tan Sandy Silty Clay

Layer values were:

 $\ddot{e} = 69.6$  , c = 1887 ,  $\dot{l} = 0$   $N\dot{l} = 1$ At 5 feet the passive pressures are 4369 psf maximum and 2184 psf allowable.

At 10 feet the passive pressures are 4717 psf maximum and 2358 psf allowable.



Project number: 8883 County: Marshall Description: LP-15  $P = (\ddot{e})(z)(N\dot{l}) + (2)@*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Moist Soft Brown Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665, f = 0 Nf = 1

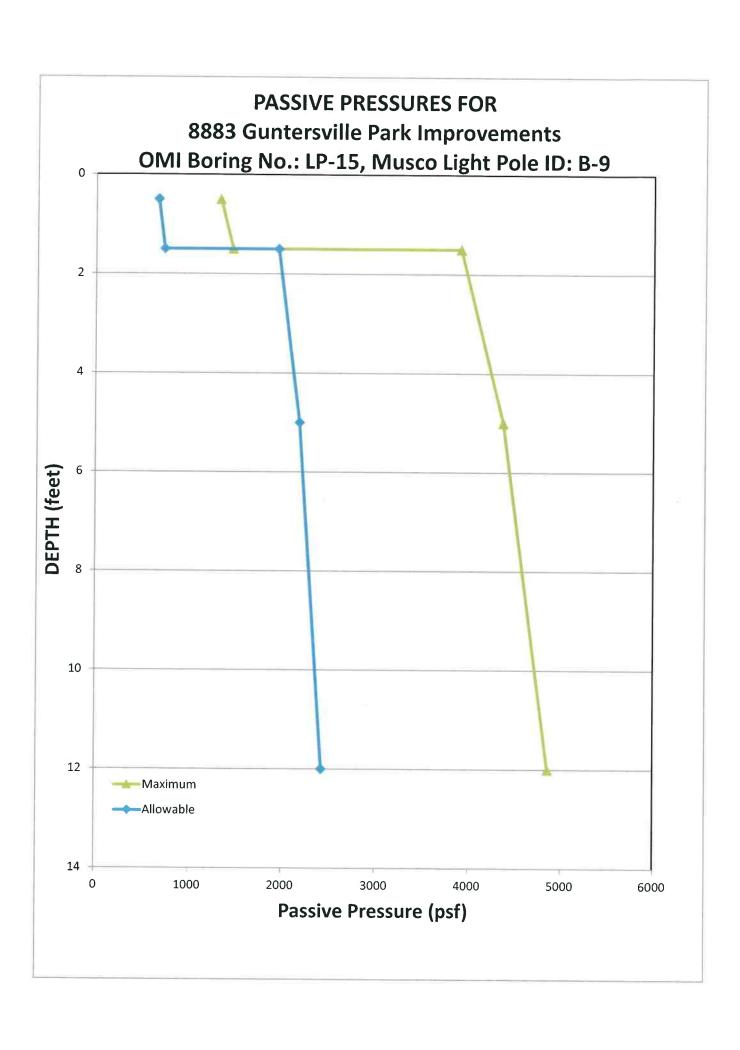
At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 1.5 feet the passive pressures are 1463 psf maximum and 731 psf allowable.

Layer 2 is best described as: Moist Stiff Tan Sandy Silty Clay Layer values were:  $\ddot{e} = 132.0$ , c = 1887,  $\dot{f} = 0$   $N\dot{f} = 1$ 

At 1.5 feet the passive pressures are 3907 psf maximum and 1953 psf allowable. At 5 feet the passive pressures are 4369 psf maximum and 2184 psf allowable.

Layer 3 is best described as: Moist Very Stiff Tan Sandy Silty Clay Layer values were:  $\ddot{e} = 69.6$ , c = 1887,  $\acute{l} = 0$  Ní = 1

At 5 feet the passive pressures are 4369 psf maximum and 2184 psf allowable. At 12 feet the passive pressures are 4857 psf maximum and 2428 psf allowable.



Project number: 8883 County: Marshall Description: LP-16

 $P = (\ddot{e})(z)(N\dot{I}) + (2)©*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Firm Brown Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665, f = 0 Nf = 1

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 1.5 feet the passive pressures are 1463 psf maximum and 731 psf allowable.

Layer 2 is best described as: Moist Stiff to Very Stiff Tan Sandy Silty Clay

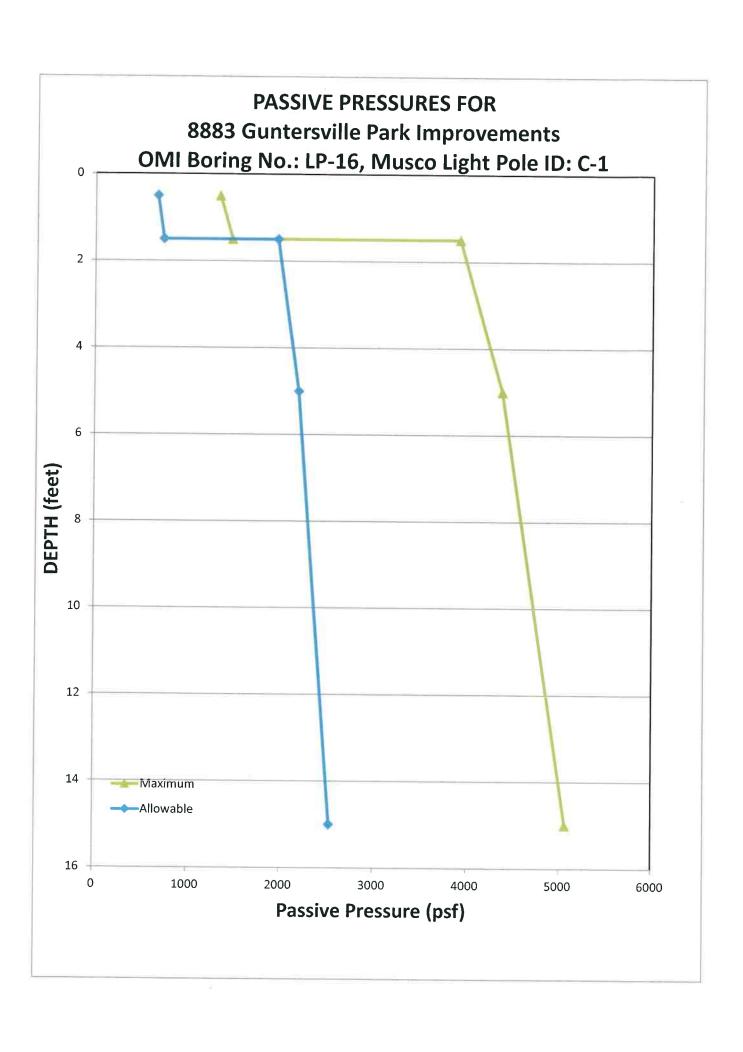
Layer values were:  $\ddot{e} = 132.0$ , c = 1887,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 1.5 feet the passive pressures are 3907 psf maximum and 1953 psf allowable. At 5 feet the passive pressures are 4369 psf maximum and 2184 psf allowable.

Layer 3 is best described as: Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 69.6$  , c = 1887 , f = 0 Nf = 1

At 5 feet the passive pressures are 4369 psf maximum and 2184 psf allowable. At 15 feet the passive pressures are 5065 psf maximum and 2532 psf allowable.



Project number: 8883

County: Marshall

Description: LP-17  $P = (\ddot{e})(z)(N\dot{l}) + (2)@*((\mathring{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Wet Very Loose Brown Clayey Gravel

Layer values were:  $\ddot{e} = 57.2$ , c = 244, f = 0 Nf = 1

At 0.5 feet the passive pressures are 488 psf maximum and 244 psf allowable. At 2 feet the passive pressures are 573 psf maximum and 286 psf allowable.

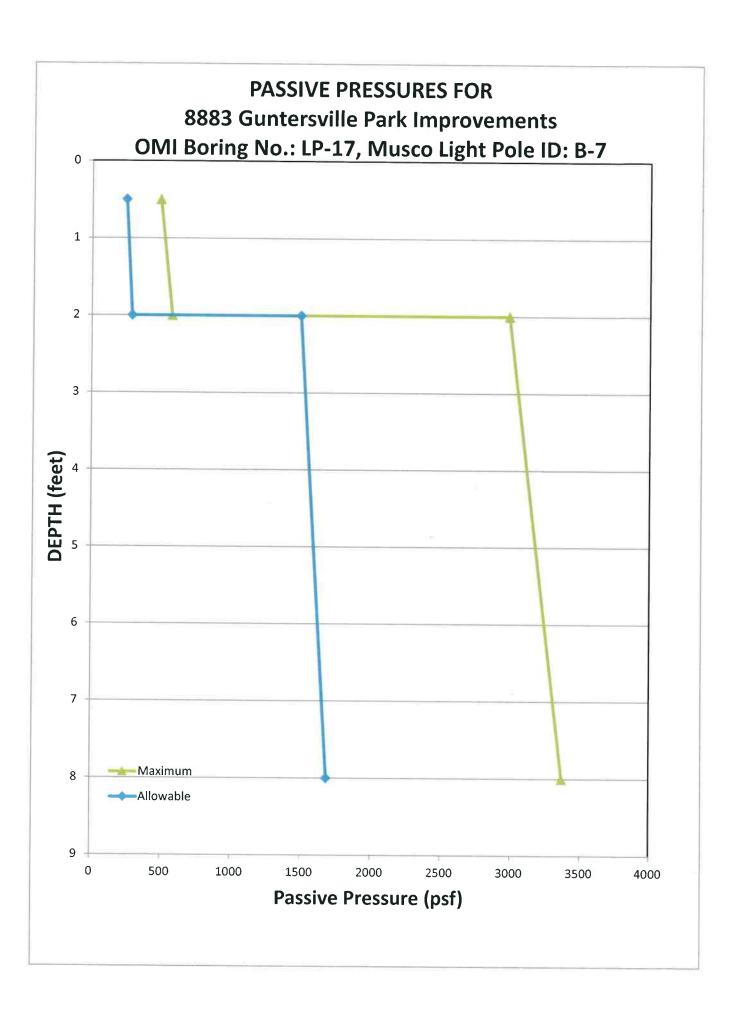
Layer 2 is best described as: Moist Firm to Very Stiff Tan Sandy Silty Clay

Layer values were:  $\ddot{e} = 64.0$  , c = 1450 ,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 2 feet the passive pressures are 2985 psf maximum and 1492 psf allowable. At 8 feet the passive pressures are 3369 psf maximum and 1684 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 



Project number: 8883

County: Marshall

Description: LP-18  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Firm Red Sandy Silty Clay Fill Layer values were:  $\ddot{e} = 71.5$ , c = 665, f = 0 Nf = 1

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 2.5 feet the passive pressures are 1473 psf maximum and 736 psf allowable.

Layer 2 is best described as: Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 129.3$ , c = 1011,  $\dot{l} = 0$   $N\dot{l} = 1$ 

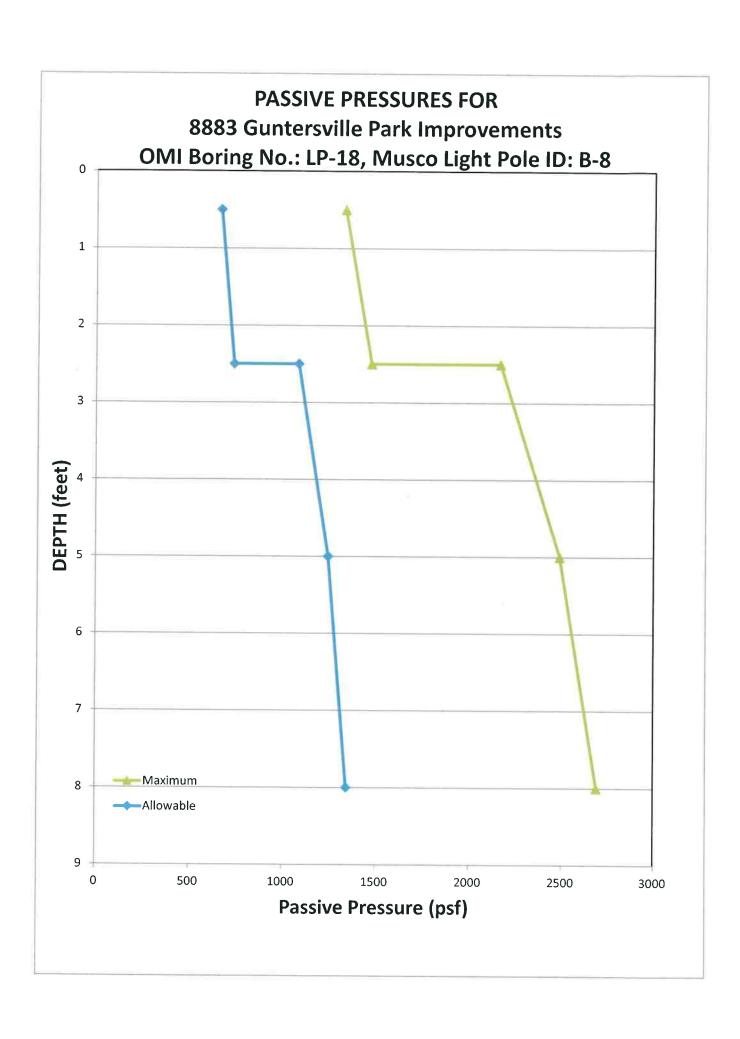
At 2.5 feet the passive pressures are 2165 psf maximum and 1082 psf allowable. At 5 feet the passive pressures are 2488 psf maximum and 1244 psf allowable.

Layer 3 is best described as: Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 66.9$  , c = 1011 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 2488 psf maximum and 1244 psf allowable.

At 8 feet the passive pressures are 2688 psf maximum and 1344 psf allowable.



Project number: 8883 County: Marshall Description: LP-19

 $P = (\ddot{e})(z)(N\dot{I}) + (2)©*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Firm to Stiff Red, Brown, and Gray Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665, f = 0 Nf = 1

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3.5 feet the passive pressures are 1731 psf maximum and 865 psf allowable.

Layer 2 is best described as: Moist Very Stiff Yellowish Tan Sandy Silty Clay

Layer values were:  $\ddot{e} = 126.4$ , c = 2723,  $\dot{l} = 0$   $N\dot{l} = 1$ 

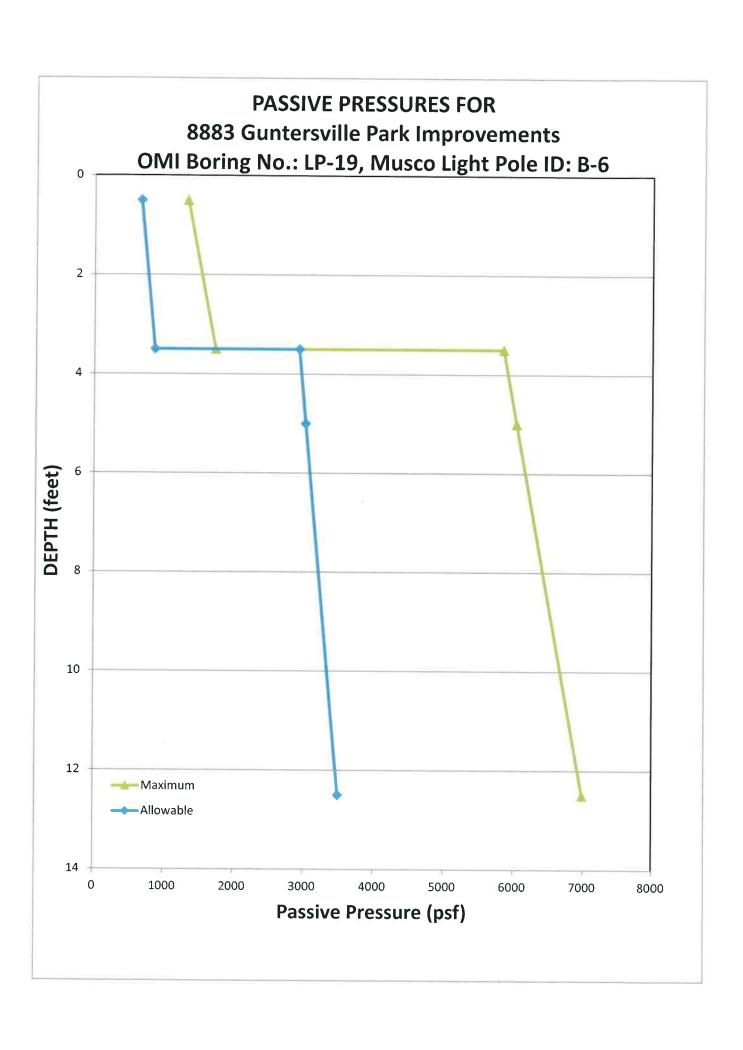
At 3.5 feet the passive pressures are 5847 psf maximum and 2923 psf allowable. At 5 feet the passive pressures are 6037 psf maximum and 3018 psf allowable.

Layer 3 is best described as: Moist Very Stiff Yellowish Tan Sandy Silty Clay

Layer values were:  $\ddot{e} = 126.4$ , c = 2723,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 6037 psf maximum and 3018 psf allowable.

At 12.5 feet the passive pressures are 6985 psf maximum and 3492 psf allowable.



Project number: 8883 County: Marshall Description: LP-20  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as:

Moist Soft to Stiff Tannish Gray Sandy Silty Clay

Layer values were:

 $\ddot{e} = 57.2$  , c = 244 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 488 psf maximum and 244 psf allowable. At 3.5 feet the passive pressures are 659 psf maximum and 329 psf allowable.

Layer 2 is best described as:

Moist Stiff to Very Stiff Tannish Yellow Sandy Silty Clay

Layer values were:

 $\ddot{e} = 64.0$  , c = 1450 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

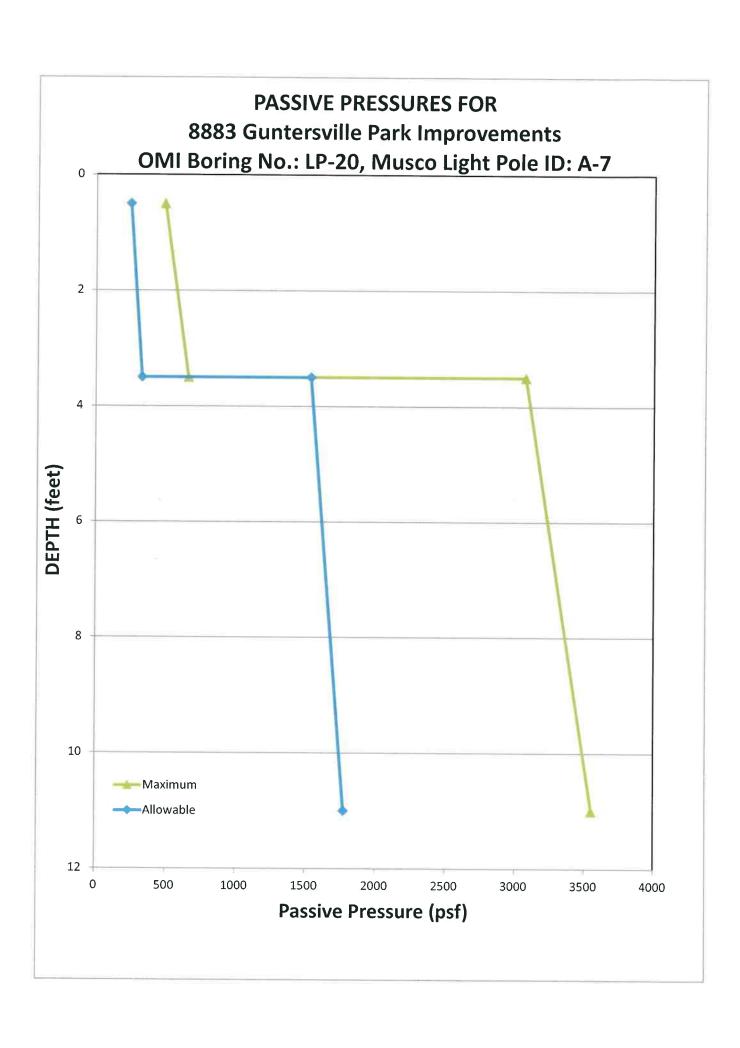
At 3.5 feet the passive pressures are 3071 psf maximum and 1535 psf allowable. At 11 feet the passive pressures are 3551 psf maximum and 1775 psf allowable.

Layer 3 is best described as:

Layer values were:

 $\ddot{e} = 0$  , c = 0 ,  $\hat{l} = 0$   $N\hat{l} = 1$ 

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Project number: 8883

County: Marshall

Description: LP-21  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as:

Moist Firm Brown Sandy Silty Clay Fill

Layer values were:

 $\ddot{e} = 133.9$  , c = 665 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3.5 feet the passive pressures are 1731 psf maximum and 865 psf allowable.

Layer 2 is best described as:

Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 129.3$  , c = 1011 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 3.5 feet the passive pressures are 2423 psf maximum and 1211 psf allowable. At 5 feet the passive pressures are 2617 psf maximum and 1308 psf allowable.

Layer 3 is best described as:

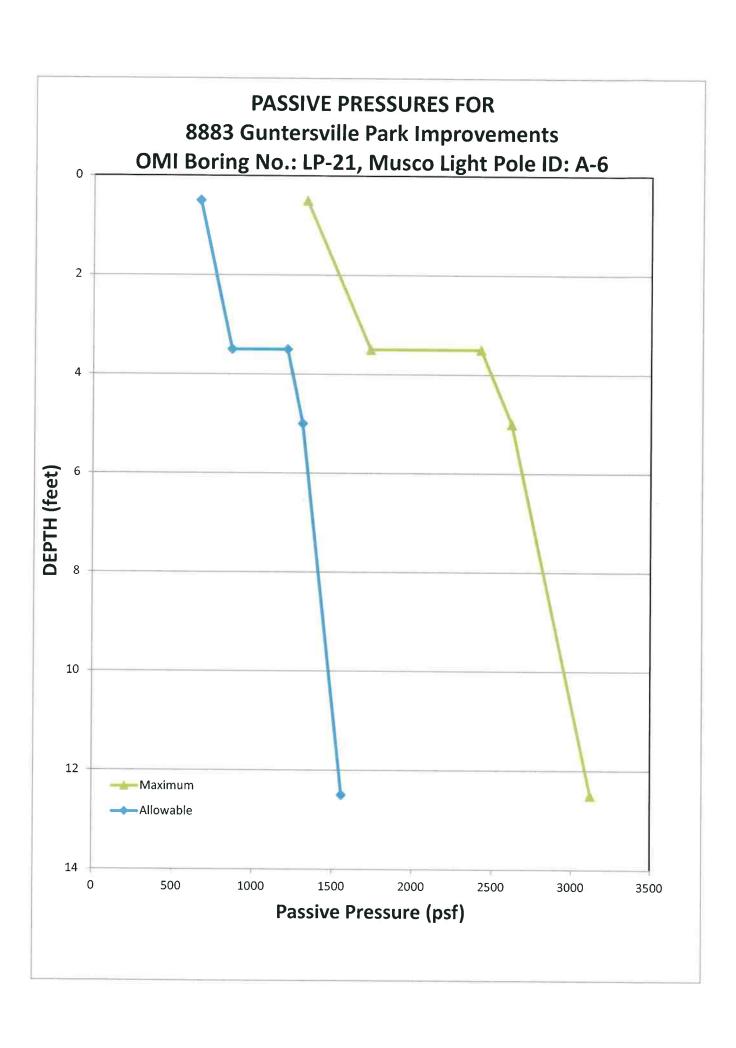
Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 66.8$  , c = 1011 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 2617 psf maximum and 1308 psf allowable.

At 12.5 feet the passive pressures are 3118 psf maximum and 1559 psf allowable.



Project number: 8883

County: Marshall

Description: LP-22  $P = (\ddot{e})(z)(N\dot{f}) + (2)@*((\hat{u}N\dot{f})^0.5)$ 

Layer 1 is best described as: Moist Firm to Stiff Tannish Gray Sandy Silty Clay

Layer values were:  $\ddot{e} = 119.6$ , c = 244,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 0.5 feet the passive pressures are 488 psf maximum and 244 psf allowable. At 5 feet the passive pressures are 1026 psf maximum and 513 psf allowable.

Layer 2 is best described as: Moist Firm Tannish Gray Sandy Silty Clay

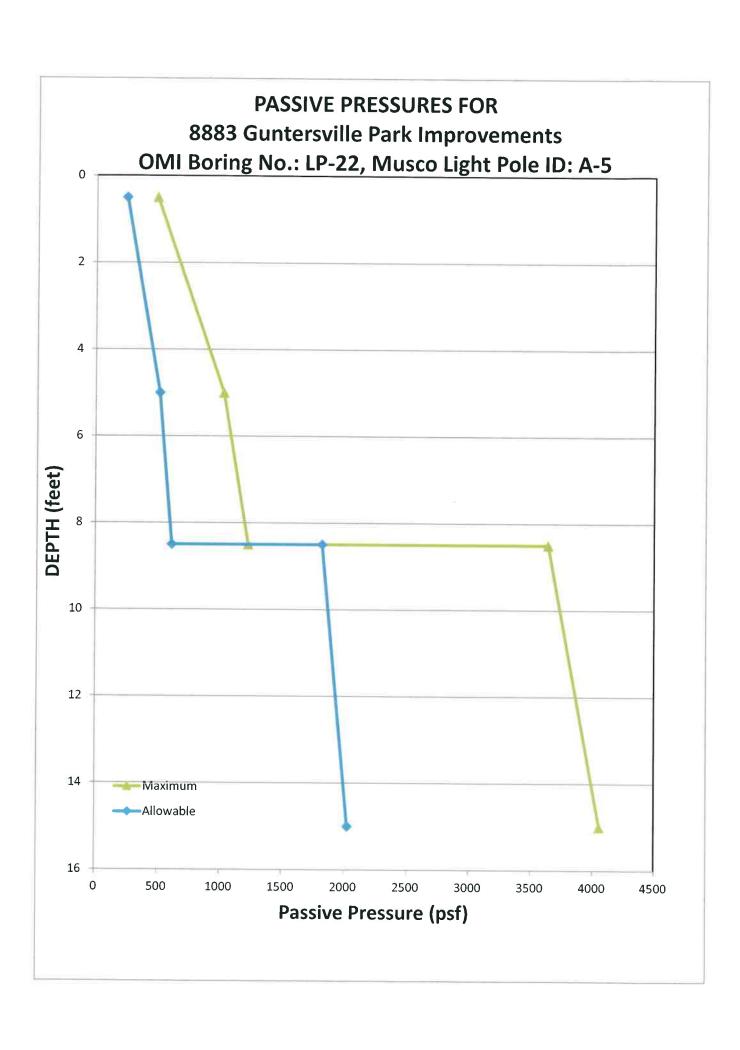
Layer values were:  $\ddot{e} = 57.2$  , c = 244 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 1026 psf maximum and 513 psf allowable. At 8.5 feet the passive pressures are 1226 psf maximum and 613 psf allowable.

Layer 3 is best described as: Moist Stiff to Very Stiff Yellowish Tan Clayey Gravel

Layer values were:  $\ddot{e} = 64$  , c = 1450 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

At 8.5 feet the passive pressures are 3638 psf maximum and 1819 psf allowable. At 15 feet the passive pressures are 4054 psf maximum and 2027 psf allowable.



Project number: 8883 County: Marshall Description: LP-23  $P = (\ddot{e})(z)(N\dot{f}) + (2)@*((\hat{u}N\dot{f})^0.5)$ 

Layer 1 is best described as: Moist Stiff Brown Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665,  $\dot{l} = 0$   $N\dot{l} = 1$ 

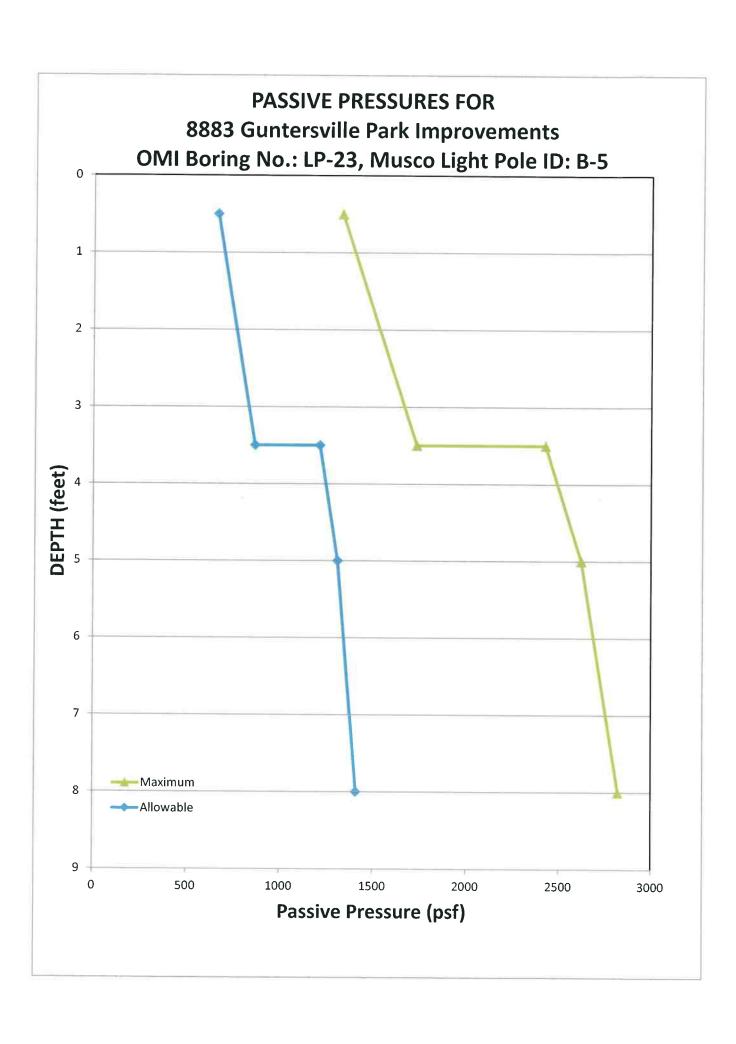
At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3.5 feet the passive pressures are 1731 psf maximum and 865 psf allowable.

Layer 2 is best described as: Moist Firm Tan Sandy Silty Clay Layer values were:  $\ddot{e} = 129.3$ , c = 1011, f = 0 Nf = 1

At 3.5 feet the passive pressures are 2423 psf maximum and 1211 psf allowable. At 5 feet the passive pressures are 2617 psf maximum and 1308 psf allowable.

Layer 3 is best described as: Moist Stiff Tan Sandy Silty Clay Layer values were:  $\ddot{e} = 66.9$  , c = 1011 , f = 0 Nf = 1

At 5 feet the passive pressures are 2617 psf maximum and 1308 psf allowable. At 8 feet the passive pressures are 2818 psf maximum and 1409 psf allowable.



Project number: 8883 County: Marshall Description: LP-24  $P = (\ddot{e})(z)(N\dot{l}) + (2)@*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Moist Firm Tan Sandy Silty Clay Fill Layer values were:  $\ddot{e} = 133.9$ , c = 665,  $\dot{l} = 0$  N $\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3.5 feet the passive pressures are 1731 psf maximum and 865 psf allowable.

Layer 2 is best described as: Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 129.1$ , c = 1816,  $\dot{l} = 0$   $N\dot{l} = 1$ 

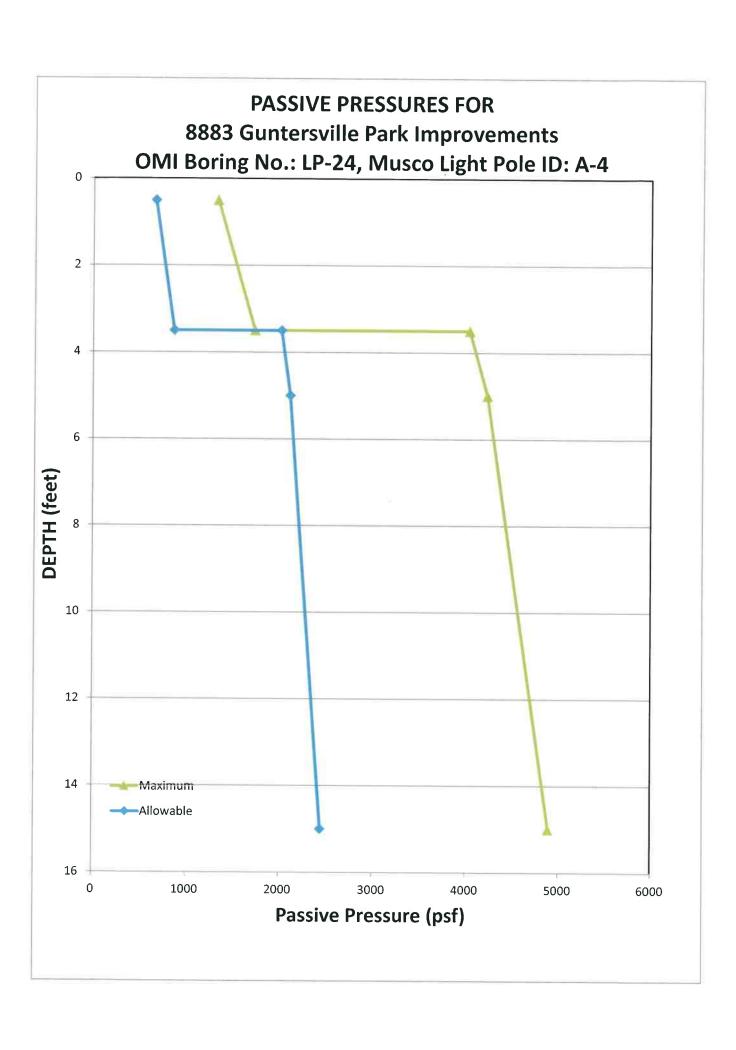
At 3.5 feet the passive pressures are 4033 psf maximum and 2016 psf allowable. At 5 feet the passive pressures are 4227 psf maximum and 2113 psf allowable.

Layer 3 is best described as: Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 66.7$  , c = 1816 , f = 0 Nf = 1

At 15 feet the passive pressures are 4227 psf maximum and 2113 psf allowable.

At 15 feet the passive pressures are 4894 psf maximum and 2447 psf allowable.



Project number: 8883 County: Marshall Description: LP-25  $P = (\ddot{e})(z)(N\dot{l}) + (2)@*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as:

Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 129.1$  , c = 1816 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 3632 psf maximum and 1816 psf allowable. At 5 feet the passive pressures are 4212 psf maximum and 2106 psf allowable.

Layer 2 is best described as:

Moist Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

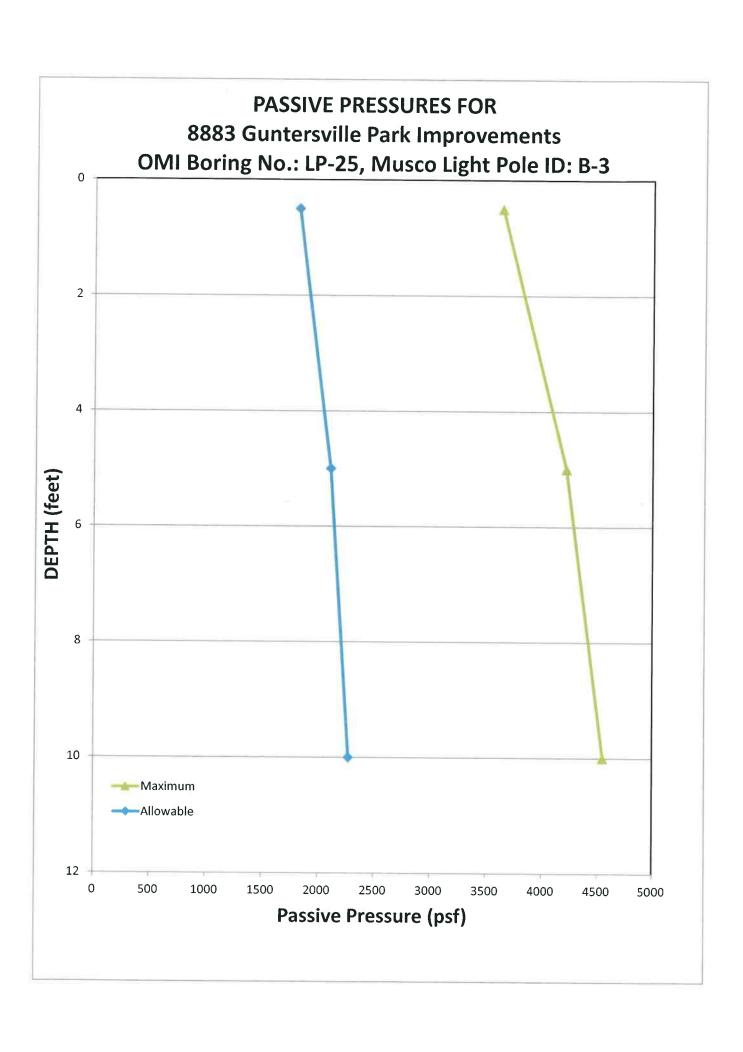
 $\ddot{e} = 66.7$  , c = 1816 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 5 feet the passive pressures are 4212 psf maximum and 2106 psf allowable. At 10 feet the passive pressures are 4546 psf maximum and 2273 psf allowable.

Layer 3 is best described as:

Layer values were:

 $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 



Project number: 8883 County: Marshall Description: LP-26  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as:

Moist Firm to Stiff Tan Sandy Silty Clay Fill

Layer values were:

 $\ddot{e} = 133.9$  , c = 665 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 5 feet the passive pressures are 1932 psf maximum and 966 psf allowable.

Layer 2 is best described as:

Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 51.5$  , c = 971 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

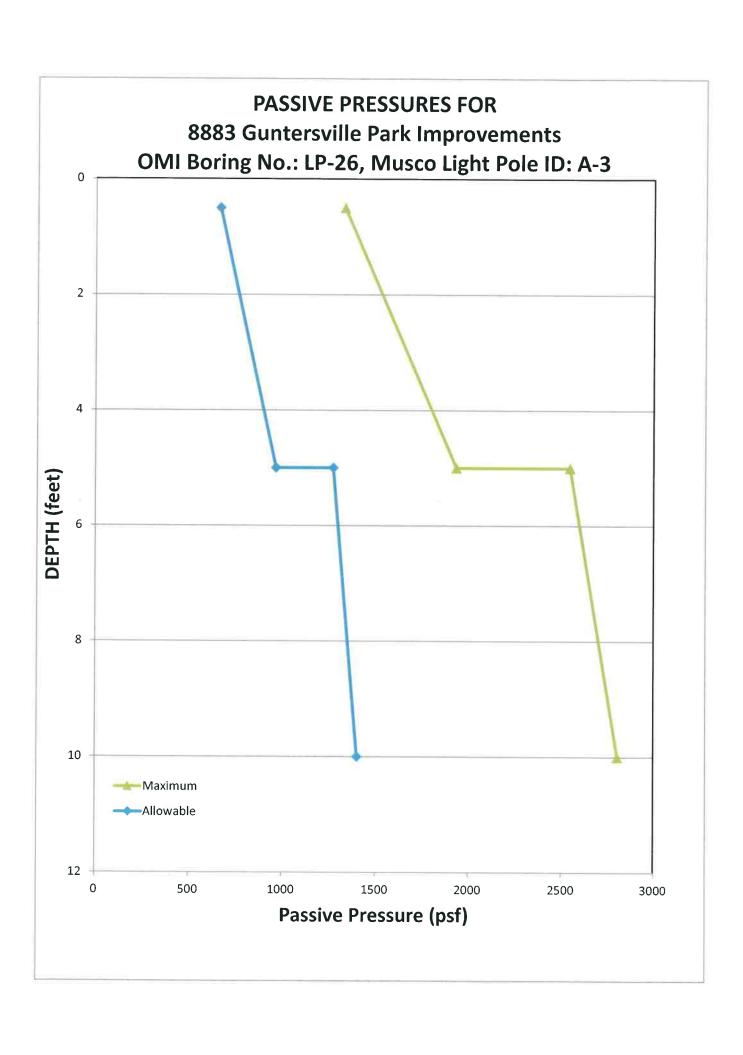
At 5 feet the passive pressures are 2544 psf maximum and 1272 psf allowable. At 10 feet the passive pressures are 2802 psf maximum and 1401 psf allowable.

Layer 3 is best described as:

Layer values were:

 $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

###



Project number: 8883 County: Marshall Description: LP-27  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Firm to Very Stiff Tan Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3.5 feet the passive pressures are 1731 psf maximum and 865 psf allowable.

Layer 2 is best described as: Moist Very Stiff Tannish Orange Sandy Silty Clay

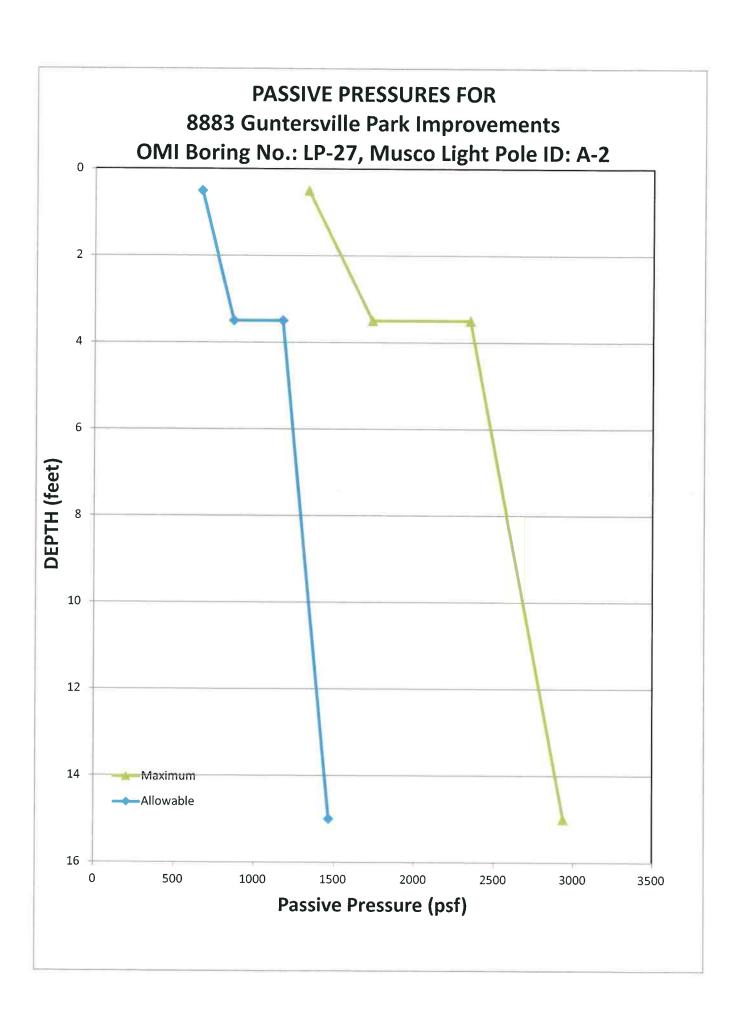
Layer values were:  $\ddot{e} = 51.5$  , c = 971 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 3.5 feet the passive pressures are 2343 psf maximum and 1171 psf allowable. At 15 feet the passive pressures are 2935 psf maximum and 1467 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

###



Project number: 8883 County: Marshall Description: LP-28  $P = (\ddot{e})(z)(N\dot{l}) + (2)©*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as:

Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 129.4$  , c = 2795 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 5590 psf maximum and 2795 psf allowable. At 5 feet the passive pressures are 6172 psf maximum and 3086 psf allowable.

Layer 2 is best described as:

Moist Very Stiff Tannish Orange Sandy Silty Clay

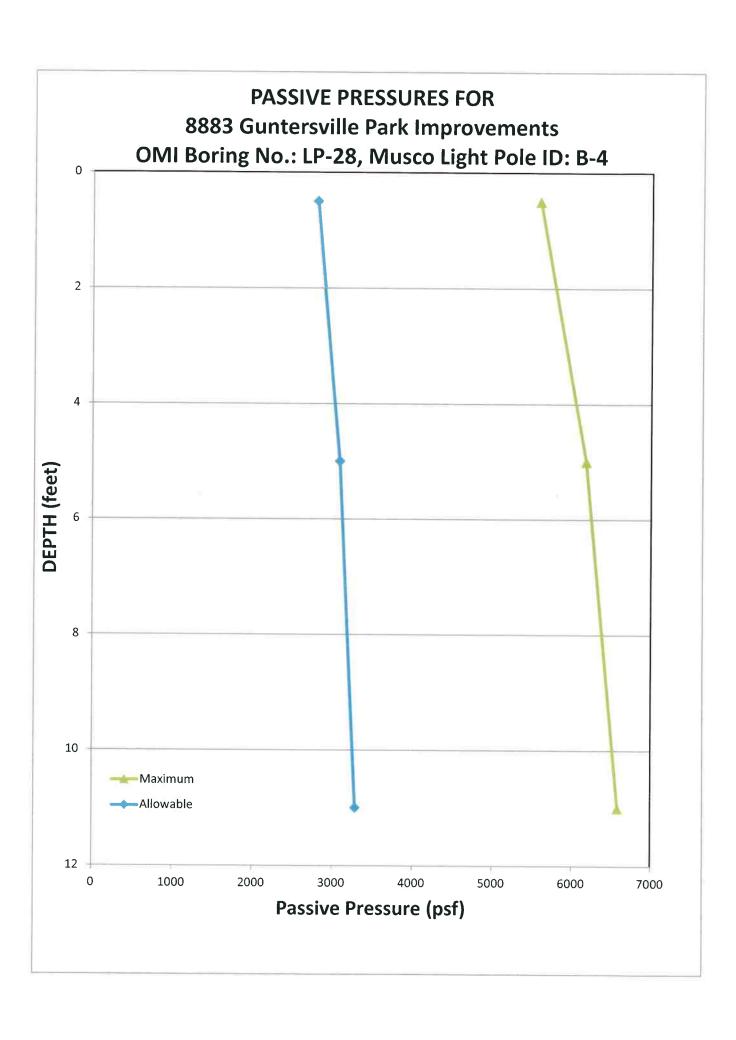
Layer values were:

 $\ddot{e} = 67.0$  , c = 2795 ,  $\hat{l} = 0$   $N\hat{l} = 1$ 

At 5 feet the passive pressures are 6172 psf maximum and 3086 psf allowable. At 11 feet the passive pressures are 6574 psf maximum and 3287 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{f} = 0$  N $\dot{f} = 1$ 



## Passive Pressure Analysis

Project number: 8883

County: Marshall

Description: LP-29  $P = (\ddot{e})(z)(N\dot{f}) + (2)@*((\mathring{u}N\dot{f})^0.5)$ 

Layer 1 is best described as:

Moist Firm Yellowish Tan Sandy Silty Clay Fill

Layer values were:

 $\ddot{e} = 133.9$  , c = 665 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 2 feet the passive pressures are 1530 psf maximum and 765 psf allowable.

Layer 2 is best described as:

Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:

 $\ddot{e} = 51.5$  , c = 971 , f = 0 Nf = 1

At 2 feet the passive pressures are 2142 psf maximum and 1071 psf allowable. At 12 feet the passive pressures are 2657 psf maximum and 1328 psf allowable.

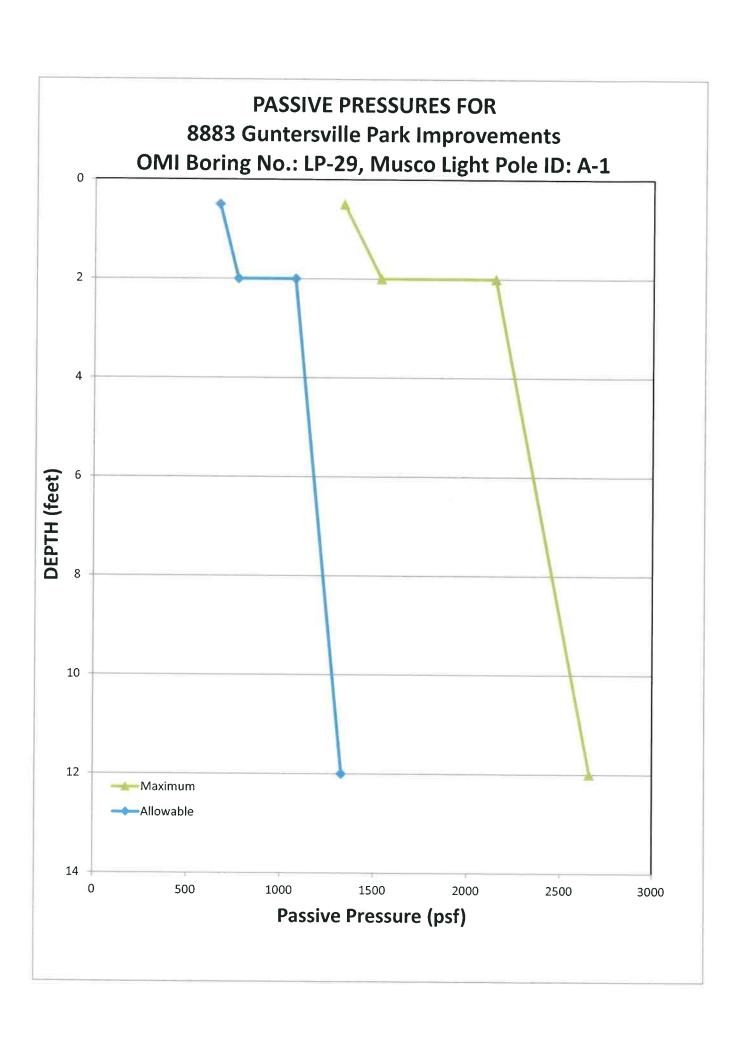
Layer 3 is best described as:

Layer values were:

 $\ddot{e} = 0$  , c = 0 ,  $\dot{f} = 0$  N $\dot{f} = 1$ 

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## Passive Pressure Analysis

Project number: 8883 County: Marshall Description: LP-30  $P = (\ddot{e})(z)(N\dot{l}) + (2)@*((\hat{u}N\dot{l})^0.5)$ 

Layer 1 is best described as: Moist Stiff to Very Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 129.4$ , c = 2795,  $\dot{l} = 0$   $N\dot{l} = 1$ 

At 0.5 feet the passive pressures are 5590 psf maximum and 2795 psf allowable. At 5 feet the passive pressures are 6172 psf maximum and 3086 psf allowable.

Layer 2 is best described as: Moist Very Stiff Tannish Orange Sandy Silty Clay

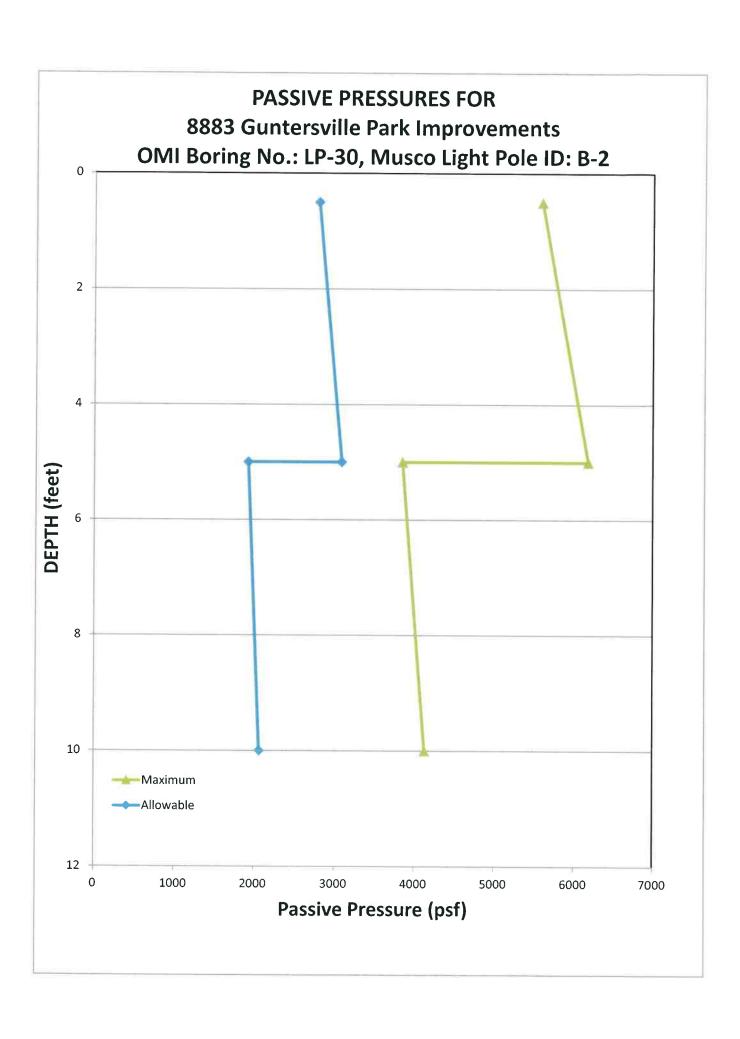
Layer values were:  $\ddot{e} = 56.9$  , c = 1633 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

At 5 feet the passive pressures are 3848 psf maximum and 1924 psf allowable. At 10 feet the passive pressures are 4132 psf maximum and 2066 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\hat{l} = 0$  N $\hat{l} = 1$ 

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# Passive Pressure Analysis

Project number: 8883 County: Marshall Description: LP-31  $P = (\ddot{e})(z)(N\dot{I}) + (2)@*((\hat{u}N\dot{I})^0.5)$ 

Layer 1 is best described as: Moist Firm Yellowish Tan Sandy Silty Clay Fill

Layer values were:  $\ddot{e} = 133.9$ , c = 665, f = 0 Nf = 1

At 0.5 feet the passive pressures are 1330 psf maximum and 665 psf allowable. At 3 feet the passive pressures are 1664 psf maximum and 832 psf allowable.

Layer 2 is best described as: Moist Firm to Stiff Tannish Orange Sandy Silty Clay

Layer values were:  $\ddot{e} = 56.9$  , c = 1633 ,  $\dot{l} = 0$   $N\dot{l} = 1$ 

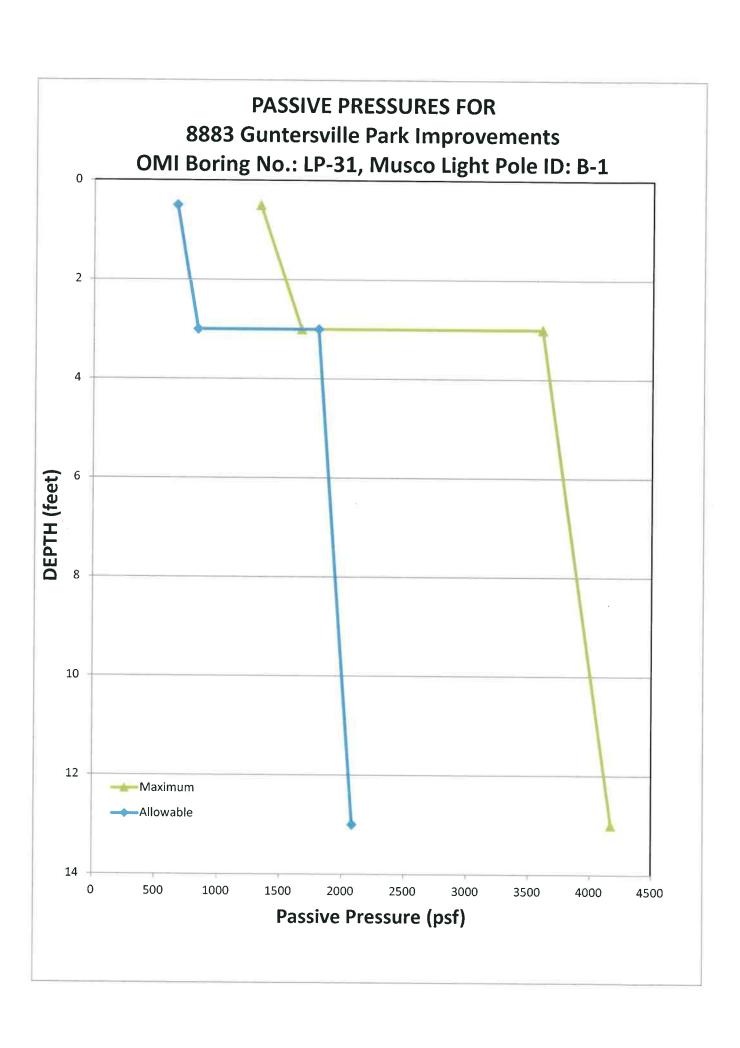
At 3 feet the passive pressures are 3600 psf maximum and 1800 psf allowable. At 13 feet the passive pressures are 4169 psf maximum and 2084 psf allowable.

Layer 3 is best described as:

Layer values were:  $\ddot{e} = 0$  , c = 0 ,  $\dot{l} = 0$  N $\dot{l} = 1$ 

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#### FIELD TEST PROCEDURES

OMI, Inc., generally follows field and laboratory testing procedures as outlined by the American Society for Testing and Materials (ASTM) and the U. S. Army Corps of Engineers. Field procedures are outlined and an overview description is provided in ASTM Standard D-420, "Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes." This document is a guide to the selection of various standards for investigating soil, rock, and ground water for earth related construction. Applicable procedures include geophysical, in-situ, and boring methods. A summary of each procedure used during this study is presented below.

# SOIL DRILLING PROCEDURES

Several techniques are used to advance borings for collection of soil, rock, or ground water samples. Different techniques are used, depending on the samples desired and the soil and water conditions. Depths for sample intervals, strata changes, and boring termination or refusal are recorded to the nearest 1/10 of a foot. The techniques include the following.

#### Soil Borings

- A) Solid stem continuous flight augers (ASTM D-1452)
- B) Hollow stem continuous flight augers (ASTM D-1452)
- C) Rotary drilling techniques using roller cone bits or drag bits and water with or without drilling mud or other additives to flush the hole
- D) Hand augers
- E) Backhoes or other excavating equipment.

## Rock Borings

- A) Core borings with diamond bits with double or triple core barrels (ASTM D-2113)
- B) Rock borings with roller cone bit
- C) Rotary hammer drilling.

Hollow and Solid Stem Auger: An auger is a center post with a continuous spiral flange wrapped around it. The post is called the stem. Augers are usually constructed in 5-foot long sections that can be coupled together. As the auger is turned and advanced into the ground; the soil "cuttings" are brought to the surface. Solid stem augers have a solid core and have to be removed from the boring to allow access for sampling tools. Hollow stem augers have the spiral flange connected to a hollow tube (stem). Sampling tools can access the bottom of the boring without removing the augers from the hole.

Rotary Borings: Rotary drilling involves the use of roller cone or drag type drill bits attached to the end of hollow drill rods. A flushing medium, normally water or bentonite slurry, is pumped through the rods to clear the cuttings from the bit face and flush them to the surface. Casing is sometimes set behind the advancing bit to prevent the hole from collapsing and to restrict the penetration of the drilling fluid into the surrounding soils. Cuttings returned to the surface by the drilling fluid are usually collected in a settling tank to allow the fluid to be re-circulated.

Hand Auger Borings: Hand auger borings are advanced by manually twisting a 4-inch diameter steel bucket auger into the ground and withdrawing it when filled to observe the sample collected. Other equipment such as post-hole diggers is sometimes used in lieu of augers to obtain shallow soil samples. Occasionally, these hand auger borings are used for driving 3-inch diameter steel tubes to obtain intact soil samples.

**Test Pits:** A backhoe or other construction equipment is sometimes used to excavate into soils to observe the soil and collect samples.

Core Drilling: Soil drilling methods are not normally capable of penetrating through hard cemented soil, weathered rock, coarse gravel or boulders, thin rock seams, or sound continuous rock. Material which cannot be penetrated by auger or rotary soil drilling methods at a reasonable rate is designated as "refusal material." Core drilling procedures are required to penetrate and sample refusal materials.

Prior to coring, casing may be set in the drilled hole through the overburden soils to keep the hole from caving and to prevent excessive water loss. The refusal materials are then cored according to ASTM D-2113 using a diamond bit fastened to the end of a hollow, double, or triple tube core barrel. This device is rotated at high speeds and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core is brought to the surface, recovery is measured, and the core is sequentially placed in boxes and transported to our laboratory for review and storage.

### SAMPLING AND TESTING IN BOREHOLES

Several techniques are used to obtain samples and data in soils; however, the most common methods in this area are:

- A) Standard Penetration Testing
- B) Undisturbed Sampling
- C) Dynamic Cone Penetration Testing
- D) Hand-Held Static Cone Penetrometer
- E) Water Level Readings.

These procedures are presented below. Any additional testing techniques employed during this exploration are contained in other sections of the Appendix.

Standard Penetration Testing: At regular intervals, the drilling tools are removed and soil samples are obtained with a standard 2-inch diameter split tube or "split spoon" sampler connected to a drill rod. The sampler is first seated 6 inches to penetrate any loose cuttings then driven an additional 12 inches with blows of a 140 pound safety hammer falling 30 inches. Generally, the number of hammer blows required to drive the sampler the final 12 inches is designated the "penetration resistance" or "N" value, defined in blows per foot (bpf). The split spoon sampler is designed to retain the soil penetrated so it may be returned

to the surface for observation. Representative portions of the soil samples obtained from each split spoon sample are placed in jars, sealed, and transported to the laboratory.

The standard penetration test, when properly evaluated, provides an indication of the soil strength and compressibility. The tests are conducted according to ASTM Standard D-1586. The depths and N-values of standard penetration tests are shown on the Boring Records. Split spoon samples are suitable for visual observation and classification tests, but generally are not sufficiently intact for quantitative laboratory testing.

Undisturbed Sampling: Relatively undisturbed samples are obtained by pushing 3 inch outside diameter (OD), 30 inch long steel tubes with hydraulic pressure supplied by the drill rig into the soil at the desired sampling levels (ASTM Standard D-1587). These tubes are also known as Shelby tubes. Each tube, together with the encased soil, is removed from the ground, sealed, and transported to the laboratory. Locations and depths of undisturbed samples are shown on the Boring Records.

**Dynamic Cone Penetrometer:** The dynamic cone is a hand-operated penetrometer used in hand auger borings and observation pits. This test is intended to provide data that can be correlated to the standard penetration test. A 1.5-inch OD cone is seated to penetrate any loose cuttings, and then driven for 3 intervals of 1.75 inch with blows from a 15-pound weight falling 20 inches. The average number of blows required to drive the cone over 1 increment is an index to soil strength and compressibility.

Water Level Readings: Water table readings are normally taken in the borings and are recorded on the Boring Records. In sandy soils, these readings indicate the approximate location of the hydrostatic water table at the time of the field exploration. In clayey soils, the rate of water seepage into the borings is low and it is generally not possible to establish the location of the hydrostatic water table through short-term water level readings. Also, fluctuation in the water table should be expected with variations in precipitation, surface run-off, evaporation, and other factors. For long-term monitoring of water levels, it is necessary to install piezometers.

The water level reported on the Boring Records is determined by field crews immediately after the drilling tools are removed, and again several hours after the borings are completed, if possible. The time lag is

intended to permit stabilization of the ground water table which may have been disrupted by the drilling operation.

Occasionally, the borings will cave in, preventing water level readings from being obtained or trapping drilling water above the cave-in zone. The cave-in depth is measured and recorded on the Boring Records.

#### **BORING RECORDS**

The subsurface conditions encountered during drilling are reported on a Boring Record. The record contains information concerning the boring method, samples attempted and recovered, indications of the presence of coarse gravel, cobbles, etc., and observations of ground water. It also contains the driller's and the geotechnical engineer's interpretation of soil conditions between samples. Therefore, these boring records contain both factual and interpretative information. A geotechnical engineer visually classifies the soil samples and prepares the Boring Records which are the basis for all evaluations and recommendations.

#### **ELECTRICAL RESISTIVITY**

Electrical resistivity is a non-destructive, non-intrusive method of searching for the presence of sinkholes. The process includes driving a series of electrical probes into the ground at set spacings and along a line. Electrical current is then pushed between two probes and the resistivity of the soil is measured at intermediate probes. The depth of the area studies increases as the distance between the electrical probes increases. As soil materials change in consistency, which may be a result of mineralogy, moisture content, or density, the electrical resistivity or conductivity changes. Therefore, if a sinkhole is present near the resistivity profile, a change in resistivity will show up due to the changed conditions in the sinkhole. This methodology assists in looking for sinkholes in an area such as this.

OMI uses a multiple probe resistivity meter that allows 56 probes to be placed in the ground and attached to the machine at one time. A computer systematically switches between the probes sending current between two probes and measuring the resistivity between two additional probes. The computer switches through the combinations of probes to collect approximately 750 separate readings during each setup. Mathematical modeling techniques are then used to evaluate the data and the resulting resistivity is plotted using a graphical contouring program.

# LABORATORY TEST PROCEDURES

OMI, Inc., generally follows laboratory testing procedures as outlined by the American Society for Testing and Materials (ASTM), the U. S. Army Corps of Engineers, and other applicable procedures. All work is initiated and supervised by qualified engineers. Laboratory tests are performed by technicians trained to perform the work according to the appropriate procedures. The equipment is well maintained and inspected and calibrated annually or as specified by ASTM.

A description of the procedures used during this exploration or study are included in this Appendix.

## SOIL CLASSIFICATION

Classification of soils provides a record and general guide to the engineering properties of the soils encountered during this study. Samples obtained during the field testing (drilling) operations are visually examined and classified by the geotechnical engineer. OMI, Inc., generally follows ASTM procedure No. D-2488 "Visual-Manual Procedure for Classifying Soils." Soil consistency and relative density is based on the number of blows from the standard penetration test. Representative or special samples are then selected for laboratory testing. Soil Boring Records are developed which present the data from the field testing as well as the soil description, water level information, and other data.

#### MOISTURE CONTENT

Moisture content values, when used in conjunction with other data, can be a useful and inexpensive tool to the engineer as an indicator of the engineering characteristics and parameters of the soil when compared to other data. Moisture content is performed by weighing a moist sample, drying, then re-weighing the dry sample. The moisture content is expressed as a percent of the dry weight of the soil. ASTM Method D-2216 is used to determine the moisture content of soil.

#### ATTERBERG LIMITS

Atterberg limits include the liquid limit (LL), plastic limit (PL), and shrinkage limit (SL) tests. These tests are performed to aid in the classification of soils and to determine the plasticity and volume change characteristics of the soil. The liquid limit is the minimum moisture content at which the soil will flow as a heavy viscous fluid. The plastic limit is the minimum moisture content at which the soil behaves as a plastic material. The shrinkage limit is the moisture content below which no further volume change will occur with continued drying. The plasticity index (PI) is the difference between the liquid limit and the plastic limit. The PI is the range of moisture at which the soil remains plastic. Many engineering characteristics have been correlated to the Atterberg limits. These are ASTM procedures D-4318, D-4943, and D-427.

## STANDARD PROCTOR COMPACTION TEST

This test is used to establish a curve that predicts the effect of moisture and compactive effort on the dry density of the soil sample. It is useful as a comparative value in monitoring contractors' efforts during fill placement and compaction during construction. Also, correlations of engineering parameters such as strength, compressibility, and permeability are related to the percent compaction and soil type.

A representative sample of the proposed fill material (soil or stone) is collected. The sample is divided into four or more samples. Each sample is then brought to a different moisture content about 2% apart. Each sample is then placed in a standard 4-inch diameter mold in 3 equal layers with each layer being compacted with 25 blows from a 5.5-pound hammer falling 12 inches. The sample is trimmed to a known volume of 1/30 cubic foot then weighed. The moisture content of the sample is determined and the dry density is calculated. A graph of dry density (pcf) versus moisture content is developed. The maximum density and its corresponding moisture content known as the optimum moisture content are derived from the curve. A graph of the moisture-density relationship is given in the Appendix. ASTM D-698 describes the procedure.

# **UNCONFINED COMPRESSION TESTS - ROCK CORES**

The strength of rock is important in many engineering applications. This strength is usually desired and reported as the unconfined or simple shear strength. Selected samples of rock cores are cut using a diamond saw. The cores are usually cut to a length equal to about twice the core diameter. The capped length and diameter of each core is measured and recorded. The cores are then loaded to failure in a compression machine. The unconfined compressive strength is calculated by dividing the cross-sectional area of the core

into the maximum load required to crush the sample. If the length to diameter ratio is less than 2.0, then the maximum strength is adjusted mathematically. The results are reported in psi. This procedure is similar to ASTM D-2938.

# **CONSOLIDATION TESTING**

The consolidation test provides data for estimating the settlement and time rate of settlement of the soil in response to the applied loads. Representative soil samples are collected from undisturbed samples, trimmed into a disk about 2.5 inches in diameter and 1 inch thick, then placed in the consolidometer. The disk is confined in a brass ring and sandwiched by porous stones on the top and bottom. The sample ring and stones are placed in a testing device, inundated, then loaded in increments. The sample height is measured as each load caused it to compress. The resulting loads and deformations are reduced to a graph which is presented in the Appendix. These results may be presented in load versus percent strain or load versus void ration. This procedure is described in ASTM D-2435.