COMPLETE REQUEST FOR BIDS PACKAGE
ISSUED FOR BID
January 5, 2017
FOR
A NEW VOLUNTARY AIRPORT LOW EMISSIONS (VALE) COMpressed NATURAL GAS (CNG) FUELING STATION

REQUEST FOR BIDS PACKAGE CONTENTS:
1. General Requirements and Technical Specifications - (525) pages
2. Construction Plans Bid Set Drawing Index – (1) page
3. Construction Plans Bid Set - (32) sheets

BIRMINGHAM AIRPORT AUTHORITY
5900 MESSER AIRPORT HIGHWAY
BIRMINGHAM, ALABAMA 35212
BAA PROJECT #LA011.000.000

CONSULTANT:
AECOM
1000 ABERNATHY ROAD NE, SUITE 900
ATLANTA, GA 30328
AECOM PROJECT #60432525

BIRMINGHAM SHUTTLESWORTH INTERNATIONAL AIRPORT
GENERAL REQUIREMENTS AND TECHNICAL SPECIFICATIONS

FOR THE CONSTRUCTION OF
A NEW VOLUNTARY AIRPORT LOW EMISSIONS (VALE) COMPRESSED
NATURAL GAS (CNG) FUELING STATION

BID DOCUMENTS PREPARED FOR:
THE BIRMINGHAM AIRPORT AUTHORITY AND
THE BIRMINGHAM-SHUTTLESWORTH INTERNATIONAL AIRPORT
5900 MESSE AIRPORT HIGHWAY
BIRMINGHAM, ALABAMA 35212
BAA PROJECT #LA011.000.000

CONSULTANT:

AECOM®
1000 ABERNATHY ROAD NE, SUITE 900
ATLANTA, GA 30328
AECOM PROJECT #60432525

ISSUED FOR BID
December 8, 2016
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Section A: Request for Bids Announcement

VOLUNTARY AIRPORT LOW EMISSIONS (VALE) COMPRESSED
NATURAL GAS (CNG) FUELING STATION
LOCATED AT THE
BIRMINGHAM-SHUTTLESWORTH INTERNATIONAL AIRPORT

DECEMBER 21, 2016

The Birmingham Airport Authority (BAA) is inviting all qualified General Contractors to submit a bid for the construction of a new Compressed Natural Gas (CNG) Facility at the Birmingham-Shuttlesworth International Airport. Beginning Thursday, January 5, 2017, the complete Request for Bid (RFB) Package will be available for download from the BAA’s website at http://www.flybirmingham.com/aboutbhm-business.aspx. To obtain additional information regarding this RFB, please send your request, via email, to:

Tom Wesley, Project Manager
Birmingham Airport Authority
5900 Messer Airport Highway
Birmingham, AL 35212
Phone: (205) 599-0786
twesley@flybirmingham.com

All Bids, regardless of method of delivery, must be received by 2:00 p.m. CST on Tuesday, February 7, 2017. Electronic or faxed submissions will not be accepted. The Bids may, at the discretion of the Authority, be publicly opened and announced at time of delivery. Bids received after the deadline will be returned, unopened.

A Bid Bond or Certified Check, payable to the Birmingham Airport Authority, in the amount of Ten Thousand dollars ($10,000.00) must accompany each Bid as evidence of good faith. A Pre-Bid Conference will be held at 2:00 PM CST on Tuesday, January 24, 2017 inside Meeting Room A, located on the lower level of the Terminal at the Birmingham-Shuttlesworth International Airport, 5900 Messer Airport Highway, Birmingham, AL 35212. All participants in this RFB are strongly encouraged to attend this conference.

All information regarding this RFB (including any Addenda) will be distributed, electronically, by the BAA. Printing of the associated material will be the responsibility of the recipient. The BAA reserves the right to accept or reject any or all Bids, to award agreements for specific scope on a split-order basis by item number (when applicable), to waive any Bid informalities and to re-advertise for Bids when deemed in the best interest of the BAA. The selected firm(s) will contract directly with the BAA for this scope of services.

DBE Policy: It is the policy of the Birmingham Airport Authority (Authority) that DBEs as defined in 49CFR Part 26, will have maximum opportunity to participate in the performance of all BAA projects and the bidders will take all necessary and reasonable steps to ensure that DBEs have the maximum opportunity to compete for and perform subcontracts. Additional DBE information is contained in the full Request for Bid package.

END OF ANNOUNCEMENT
Section B: Definitions of Terms

Addenda
Amendments or additions to the Contract Documents that are issued prior to the submission of Bids.

Advertisement
A public announcement, as required by local law, inviting Bids for Work to be performed and materials to be furnished.

Airport
Airport means the area of land or water which is used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any. As used herein, “Airport” means all of the area comprising the Birmingham-Shuttlesworth International Airport.

Award
The acceptance, by the Owner, of the successful Bidder’s Proposal.

Bid or Proposal
The written offer of the Bidder (when submitted on the required proposal forms) to perform the defined scope of work and to furnish the necessary materials, in accordance with the provisions of the Plans and Specifications.

Bidder
Any individual, partnership, firm, corporation or entity, acting directly through a duly authorized representative, who submits a Proposal for the defined scope of work.

Bid Documents
The documents available to Bidders before submission of Bids, including Drawings, Plans, Specifications, written Instructions to Bidders, Invitation to Bid, Addenda including the documents, reports and information referenced in such Bid Documents.

Bid Guaranty, Bid Bond or Proposal Guaranty
The security, furnished with a Proposal, to guarantee that the Bidder will enter into a Contract if its Proposal is accepted by the Owner.

Certification of Payment
The written certification by the Engineer or OAR to the Owner, based upon the Engineer’s and OAR’s observations at the site and the data comprising the Application for Payment, that the Work has progressed to the point indicated in the Contractor’s Application for Payment, that the quality of the Work is in accordance with the Contract Documents, and that Contractor is due to be paid the amount claimed in the Application for Payment.

Change Order
A written order, issued by the Owner to the Contractor, covering changes in the Plans, Specifications, or Proposal quantities and establishing the basis of payment and Contract Time adjustment, if any, for the Work affected by such changes. The Work, covered by a Change Order, shall be within the scope of the Contract.

Claim
A demand or assertion by the Owner or Contractor seeking, as a matter of right, adjustment or interpretation of Contract Document terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be made by written notice pursuant to the Contract.
Contract

The entire and integrated written agreement between the parties hereto which supersedes prior negotiations, representations or agreements, either written or oral. The Contract shall include, but is not limited to: the Advertisement for Bids; the Contract form; the Proposal; the Performance Bond; the Payment Bond; any required insurance certificates; the Specifications; the CBMPP; the Plans, and any Addenda issued to Bidders. The Contract may be amended only by a Contract Modification. The Contract shall also include, if applicable, conformed Contract Documents, which are the Bid Documents that have been revised to incorporate information contained within the Addenda. If the Contract Documents have been conformed, the Contractor is responsible for verifying that the Addenda are accurately incorporated into the Conformed Contract Documents before relying on them for purposes of construction. Conformed Contract Documents are for convenience and do not supersede the information contained within the Contract Documents.

Contract Documents

The executed documents between the Owner and Contractor comprising the Contract.

Contract Item (Pay Item)

A specific unit of Work for which a corresponding specific price is provided for in the Contract.

Contract Modifications

(a) A written amendment to the Contract signed by both parties, (b) a Change Order, (c) a Construction Change Directive, (d) a Field Change Order, or (e) a written order for a minor change in the Work issued by the Owner.

Contract Time

The number of Calendar Days or Working Days, stated in the Proposal, allowed for completion of the Contract, including authorized time extensions. If a Calendar Date of completion is stated in the Proposal, in lieu of a number of Calendar Days or Working Days, the Contract shall be completed by that date.

Contractor

The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the Work Contracted and for the payment of all legal debts pertaining to the Work who acts directly or through lawful agents or employees to complete the Contract Work.

DBE

A disadvantaged business enterprise.

Drawings or Plans

The official graphic and pictorial portions of the Contract Documents which show the design, location, character, dimensions and details of the Airport and the scope of Work to be completed and which are to be considered as a part of the Contract Documents supplementary to the Specifications. The Plans generally include plans, elevations, sections, details, schedules and diagrams.

Equipment

All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the Work.

Extra Work

An item of Work not provided for in the awarded Contract as previously modified by Change Order or Supplemental Agreement, but which is found by the Engineer to be necessary to complete the Work within the intended scope of the Contract as previously modified.

FAA

The Federal Aviation Administration of the U.S. Department of Transportation; when used to designate a person, FAA shall mean the Administrator or its duly authorized representative.
Federal Specifications

The Federal Specifications and Standards, and supplements, amendments, indexes thereto, prepared and issued by the General Services Administration of the Federal Government.

Final Acceptance

The final acceptance, in writing, of the Work by the Engineer or OAR after the Final Inspection.

Final Completion

The date on which all of the Work required by the Contract is completed in accordance with the Contract Documents, Plans and Specifications.

Final Inspection

The final inspection of the Work by the Engineer that reveals that all construction provided for and contemplated by the Contract is completed in accordance with the Contract Documents, Plans and Specifications.

Final Payment

The Final Payment under the Contract by the Owner to the Contractor, including release of the Retainage. Final Payment will be made only after all of the conditions and requirements for the close out of the Contract have been satisfied.

Inspector

An authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the Work performed or being performed, or of the materials furnished or being furnished by the Contractor.

Intention of Terms

Whenever in these Specifications or on the Plans, the words “directed,” “required,” “permitted,” “ordered,” “designated,” “prescribed,” or words of the like are important are used, it shall be understood that the direction, requirement, permission, designation, or prescription of the Engineer is intended; and similarly, the words “approved,” “acceptable,” “satisfactory,” or words of like import, shall, mean approved by, or acceptable to, satisfactory to the Engineer, subject in each case to the final determination of the Owner.

Any reference to a specific requirement of the Contract Specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such a specific reference.

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

Liquidated Damages

The agreed upon amount of daily damages set forth in the Contract that Owner may assess against Contractor if the Work is not substantially completed and finally completed within the time set forth in the Contract Documents.

Major and Minor Contract Items

A Major Contract Item shall be any item that is listed in the Proposal, the total cost of which is equal to or greater than twenty percent (20%) of the total amount of the awarded Contract. All other items shall be considered Minor Contract Items.

Materials

Any substance specified for use in the construction of the Contract Work.
Notice of Intent to Award

A written notice, issued to a Bidder by the Owner, in which the Owner states its intentions to Award the Contract to such Bidder.

Notice to Proceed / NTP

A written notice issued to the Contractor to begin the actual Contract Work, on a previously agreed upon date. If applicable, the Notice to Proceed shall state the date on which the Contract Time begins.

OAR

The Owner’s authorized representative.

Owner

The term Owner shall mean Birmingham Airport Authority, an Alabama public corporation. For AIP Contracts, the term “Sponsor” shall be used in place of the term Owner.

Payment Bond

The approved form of security, furnished by the Contractor and its Surety, as a guaranty that the Contractor will pay, in full all bills and accounts for materials and labor used in the construction of the Work.

Performance Bond

The approved form of security, furnished by the Contractor and its Surety, as a guaranty that the Contractor will complete the Work in accordance with the terms of Contract Documents.

Plans

The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.

Project

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

Record Documents

Those documents assembled by the design consultant of record at the conclusion of the Contractor’s performance of construction or service. Record Documents are developed from as-built Drawings, as-built Specifications and any other documents required by the Contractor for closing out the Project.

Specifications

Those portions of the Contract Documents containing the written directions and requirements for materials, equipment, construction systems, and workmanship for Work and the performance of related services. Standards for specifying materials or testing which are cited in the Contract Specifications by reference shall have the same force and effect as if included in the Contract physically.

Subcontract

A contract, between the Contractor and a supplier of materials, equipment and/or labor, for the completion of all, or a portion, of the Work. All Subcontracts shall be subject to the terms of the prime contract with the Owner and no Subcontract shall alter or limit the Contractor’s liability to the Owner to complete the Work as provided in the Contract.

Subcontractor

A person or entity that enters into a Subcontract with the Contractor.

Substantial Completion
The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents and when all required occupancy permits, if any, have been issued so the Owner can occupy or utilize the Work for its intended use.

**Superintendent**

The Contractor’s executive representative who is present on the Work during progress, authorized to receive and fulfill instructions from and Engineer, and who shall supervise and direct the Work.

**Supplemental Agreement**

A written agreement between the Contractor and the Owner covering: (a) Work that would increase or decrease the total amount of the awarded Contract, or any Liquidated Damages, by more than 25 percent, such increased or decreased Work being within the scope of the originally awarded Contract; or (b) Work that is not within the scope of the originally awarded Contract.

**Surety**

The corporation, partnership, or individual, other than the Contractor, executing Payment Books or Performance Bonds which are furnished to the Owner by the Contractor.

**Total Contract Price**

The total price the Owner will pay to the Contractor for the Work, when fully completed, subject to such additions and deductions as may be provided for in the Contract Documents. The initial Total Contract Price will be set forth by the Contractor in the Bid and will be accepted by the Owner in the Contract Agreement. The Total Contract Price may be changed only on written agreement from time to time as set forth in the Contract Documents.

**Work**

The construction and services, including the furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor’s performance of all duties and obligations of the Contractor imposed by the Contract Documents, Plans and Specifications. The Work may constitute the whole or a part of the Project.

**Working Day**

Working Day shall be any Day other than a legal holiday, Saturday or Sunday on which the normal Working forces of the Contractor may proceed with regular Work for at least (6) hours toward completion of the Contract. Unless Work is suspended for causes beyond the Contractor’s control, Saturdays, Sundays, and holidays on which the Contractor’s forces engage in regular Work, requiring the presence of an Inspector, will be considered as Working Days.

Other capitalized terms may be defined in other Sections of the Contract Documents. Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.
Section C - Project Directory

**OWNER:**
Birmingham Airport Authority
Tom Wesley, Project Manager
Phone: (205) 599-0786
Email: twesley@flybirmingham.com
5900 Messer Airport Highway
Birmingham, AL 35212
www.flybirmingham.com

Marcelo Lima, Airport Planner
Phone: (205) 599-0748
Email: mlima@flybirmingham.com

**CONSULTANTS:**

**AECOM**
Dale Stubbs, P.E.
Phone: (678) 808-8800
Email: dale.stubbs@aecom.com
400 Northpark Town Center
1000 Abernathy Road N.E., Suite 900
Atlanta, GA 30328
www.aecom.com

**BLOC Global Services**
Mike Carpenter, Principal
505 20th Street N, Suite 900
Birmingham, AL 35203
Phone: (205) 328-4435
www.blocglobal.com

**Formworks Architects**
Angela Nash, Architect
3000 7th Avenue South
Birmingham, AL 35233-3503
Phone: (205) 581-1600
www.formworks.biz
Section D: Instructions to Bidders and Bid Submission Requirements

ANTICIPATED BID PHASE SCHEDULE
(The following dates and times are tentative and subject to change)

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<tr>
<td>Pre-Submittal Conference at 2:00 PM CST</td>
<td>1/24/17</td>
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<td>Deadline for Submittal of Written Questions at 4:00 p.m.</td>
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<td>Bid Submittals Due by 2:00 PM CST</td>
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<td>Evaluation of Proposals</td>
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<td>BAA Board of Directors Approval</td>
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DELIVERY OF BID RESPONSE PACKAGES

**Deadline:** Bids will be received until **2:00 CST on February 7, 2017** and shall remain sealed until, at the same time and at the sole discretion of the Birmingham Airport Authority, they may be opened and read aloud. Bids received after the time and date specified herein (or issued under Addendum) will not be considered and will be deemed unresponsive and returned to Bidder unopened.

**Quantity:** Respondents shall deliver (4) original hard copies and (1) electronic copy on flash drive.

**Method:** Respondents are strongly encouraged to deliver their Bids using a reliable resource, capable of providing proof of delivery, and are also encouraged to require signatures for all packages delivered in response to this RFB. Regardless of method of delivery, Bids must be received by & acknowledged by a Birmingham Airport Authority representative who will stamp the date & time received on all Bids. Recommended methods of delivery are as follows:

1. **Hand delivered to the BAA Receptionist inside the BAA Offices located at 5900 Messer Airport Highway, Birmingham, AL 35212.** The offices are located on the lower level of the Birmingham-Shuttlesworth International Airport Terminal, just past the escalators at Concourse C. For additional assistance in locating the offices, the receptionist can be reached by phone at (205) 595-0533.

2. **United States Postal Service addressed as shown below:**

   BIRMINGHAM AIRPORT AUTHORITY  
   ATTN: TOM WESLEY, PROJECT MANAGER  
   5900 MESSER AIRPORT HIGHWAY  
   BIRMINGHAM, AL 35212  
   PHONE: (205) 595-0533

3. **UPS, FEDEX or other similar carrier, addressed as shown below:**

   BIRMINGHAM AIRPORT AUTHORITY  
   ATTN: TOM WESLEY, PROJECT MANAGER  
   1710 40th STREET NORTH, SUITE D  
   BIRMINGHAM AL 35217  
   PHONE: (205) 599-0771

4. **Bids sent via email or facsimile will not be accepted.**
ORGANIZATION OF BID RESPONSE PACKAGES AND REQUIRED ITEMS FOR A COMPLETE BID SUBMITTAL

All Bids, in response to this Request for Bid, shall be bound using a standard 3-ring binder and organized in accordance with the outline below. All items defined in this outline are required to be included with the Bid. Failure to include all items may result in rejection of the Bid, in its entirety, and shall entitle the Owner to the full amount of the Bid Bond as damages to the Owner resulting from the Bidder’s failure to meet those requirements.

1. Clearly displayed on exterior of binder:
   **CONTRACTOR’S SEALED BID FOR:**
   a. Title of Project
   b. Name, Address and License Number of Company submitting the Bid

2. Contents of the Bid Response Package shall be organized, using a standard, 3-ring binder under separate divider sections (tabs), using the outline shown below. Bids requiring multiple binders, for a single copy, shall be further identified as Volume “X of Y”.

<table>
<thead>
<tr>
<th>SECTION (TAB)</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>A.</td>
<td>Company Profile</td>
</tr>
<tr>
<td>B.</td>
<td>Executive Summary - each Respondent shall submit a summary of the prime features of the Bid and a brief statement of how the Respondent meets the requirements of the Request for Bid.</td>
</tr>
<tr>
<td>C.</td>
<td>Contractor’s Bid Form with Cover Sheet</td>
</tr>
<tr>
<td>D.</td>
<td>Bid Bond / Form of Bid Security</td>
</tr>
<tr>
<td>E.</td>
<td>Respondent Questionnaire Response</td>
</tr>
<tr>
<td>F.</td>
<td>Experience, Background and Qualifications</td>
</tr>
<tr>
<td>G.</td>
<td>Litigation Disclosure Form</td>
</tr>
<tr>
<td>H.</td>
<td>Federal Regulation Bid Submittal Requirements</td>
</tr>
<tr>
<td>i.</td>
<td>Buy American Certification</td>
</tr>
<tr>
<td>ii.</td>
<td>Equal Opportunity Report Statement</td>
</tr>
<tr>
<td>iii.</td>
<td>Certificate of Non-Segregated Facilities</td>
</tr>
<tr>
<td>iv.</td>
<td>Disadvantage Business Enterprise Letter(s) of Intent</td>
</tr>
<tr>
<td>v.</td>
<td>Non-Disadvantaged Business Enterprise Letter(s) of Intent</td>
</tr>
<tr>
<td>vi.</td>
<td>Disadvantage Business Unavailability Certification</td>
</tr>
<tr>
<td>vii.</td>
<td>Information Determining Joint Venture Eligibility</td>
</tr>
<tr>
<td>I.</td>
<td>Corporate Financial Information: current fiscal year-to-date balance sheet and income statement</td>
</tr>
<tr>
<td>J.</td>
<td>Section J shall be used for additional information provided by the respondent, which is not required by the Specifications or identified above.</td>
</tr>
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</table>

**Note:** See section entitled General Requirements Exhibits for sample forms for items E, F, G & H listed above.
EXAMINATION OF CONTRACT DOCUMENTS AND SITE

The Bidder is required to carefully examine the site of the Work and the Plans, Specifications and other Contract Documents for the Work contemplated. By submitting a Bid, the Bidder represents to the Owner that it has investigated and is fully informed of the conditions to be encountered, of the character, quality and quantities of Work to be performed and materials to be furnished and of all of the requirements of the Plans, Specifications and other Contract Documents.

OBLIGATION OF BIDDERS

The Bidder must inform itself fully of the construction and labor conditions under which the Work is to be performed. The Bidder shall not be relieved of its obligation to furnish all material, equipment, labor, and services necessary to carry out the provisions of the Contract Documents and to complete the contemplated Work for the consideration set forth in its Bid by reason of having failed to inform itself with respect to those matters.

ADDENDA - CHANGES WHILE BIDDING

No interpretation of the Plans, Specifications or other Contract Documents or correction of any apparent ambiguity, inconsistency or error therein, will be made to any individual Bidder. Every request for an interpretation or correction should be in writing, addressed to the BAA Airport Planner and must be received at least seven (7) Calendar Days prior to the date fixed for the opening of Bids. All interpretations, corrections and supplemental instructions will be in the form of written Addenda to the Contract Documents which, if issued, may be distributed by E-Mail, Facsimile or hand-delivered to all prospective Bidders (at the respective addresses furnished for such purposes) not later than four (4) Calendar Days prior to the date fixed for the opening of Bids. If the Bidder fails to acknowledge receipt of any such Addendum in the space provided on the Bid Form, its Bid may be deemed unresponsive and subject to rejection by the Owner.

Only the interpretation or correction issued by the Engineer, via written Addendum, shall be binding. Bidders are warned that no other source or form of communication is authorized to give information concerning, or to explain or interpret, the Contract Documents.
CONTRACTOR'S BID COVER SHEET

SUBMITTED BY: ____________________________________________

________________________________________________________

DATE:  ___________________________________________________

SUBMITTED TO:   The Birmingham Airport Authority 
                      Attn: Tom Wesley, Project Manager 
                      5900 Messer Airport Highway 
                      Birmingham, AL 35212

The undersigned, as Bidder, hereby declares that the only person or persons interested in this Bid as principal or principals is or are named herein and that no person other than herein mentioned has any interest in this Bid or in the Contract to be entered into; that this Bid is made without connection with any other person, company or parties making a Bid; and that it is in all respects fair and in good faith without collusion or fraud.

The Bidder further represents that it has examined the site of the Work and informed itself fully in regard to all conditions pertaining to the place where the Work is to be done; that it has examined the Plans and Specifications for the Work and other Contract Documents relative thereto and has read all of the Addenda furnished prior to the opening of the Bids, as acknowledged below; and that it has otherwise fully informed itself regarding the nature, extent, scope and details of the Work to be performed.

If provided with a Notice of Intent to Award the Contract by the Owner, the Bidder shall:

1. Contract with the Owner in the form of Contract Agreement contained in the General Conditions Specifications;

2. Furnish all necessary permits, licenses, materials, equipment, machinery, maintenance, tools, apparatus, means of transportation and labor necessary to complete the Work provided for in the Contract Documents

3. Furnish the Performance Bond and Payment Bond

4. Furnish the required evidence of the specified insurance coverages

5. Shall commence with the Work specified herein, within the time limits set forth in the Contract Documents, which time limits the Bidder acknowledges are reasonable.

If the Bidder fails or refuses to execute the Contract Documents, or furnish the required Bonds and other required documents as set forth in the Instructions to Bidders within ten (10) Days after the date of the Notice of Intent to Award the Contract to it, the Bid Bond accompanying this Bid, and the money payable thereon shall become the property of the Owner.
BIDDER ACKNOWLEDGEMENTS

1. Bidder acknowledges, upon signature below, that they have reviewed the contents of the Request for Bid package, in its entirety, and is hereby submitting this Bid in agreement of the Terms contained therein.

2. Bidder acknowledges that they are aware that this is a (partially) Federally Funded Project and Bidder has familiarized themselves with the requirements governing this Agreement. Federal Regulations governing this Agreement are found, in depth, in the Supplemental Conditions of the Agreement draft found in Section D, Article II but are summarized as follows:
   a. ACCESS TO RECORDS AND REPORTS
   b. AFFIRMATIVE ACTION PLAN
   c. BUY AMERICAN PREFERENCES
   d. CIVIL RIGHTS - GENERAL
   e. CIVIL RIGHTS - TITLE VI
   f. CLEAN AIR AND WATER POLLUTION CONTROL
   g. CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS
   h. DEBARMENT AND SUSPENSION (NON-PROCUREMENT)
   i. ENERGY CONSERVATION REQUIREMENTS
   j. FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)
   k. LOBBYING AND INFLUENCING FEDERAL EMPLOYEES
   l. OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970
   m. RIGHTS TO INVENTIONS
   n. TRADE RESTRICTION CLAUSE
   o. VETERAN’S PREFERENCE
   p. TERMINATION OF CONTRACT
   q. TRADE RESTRICTION CLAUSE
   r. DAVIS BACON ACT
   s. COPELAND ANTI-KICKBACK
   t. EQUAL EMPLOYMENT OPPORTUNITY
   u. NON SEGREGATED FACILITIES
   v. BREACH OF CONTRACT
   w. TEXTING WHEN DRIVING CLAUSE

NOTE: One or more of the above referenced Federal Contract Provision require certification by the Bidder. Where no separate certification form is provided in this Request for Bid package, the Bidder’s signature below certifies that they have met the requirements contained in all of the above reference Federal Contract Provisions.
3. Acknowledgment is hereby made of the following Addenda (identified by number) received since issuance of the Contract Documents, Plans and Specifications:

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**CONTRACTOR’S BID**

For all Work required in accordance with the applicable Plans, Specifications and other Contract Documents, the undersigned submits the Total Bid Amount shown below accompanied by the Respondents Bid Price Breakdown shown in the following section.

**TOTAL BID AMOUNT:**

$ ____________________________ DOLLARS

($ ____________________________ )

By: ___________________________  Respondent Firm Name

Name: __________________________

Title: __________________________
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**Division 2 - Site Work/Demolition**

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**Division 3 - Roads**

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<td>0501</td>
<td>Utilities</td>
<td>Concreteeno</td>
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</tr>
<tr>
<td>0502</td>
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<tr>
<td>0504</td>
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**Division 6 - Landscaping**

<table>
<thead>
<tr>
<th>ID EXH NO.</th>
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<tbody>
<tr>
<td>0601</td>
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</table>

Page 14 of 81
<table>
<thead>
<tr>
<th>BID ITEM NO.</th>
<th>SPEC SECTION</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>TOTAL QUANTITY</th>
<th>UNIT COST</th>
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<tr>
<td>4 100</td>
<td>15-4031</td>
<td>Compressor Reconditioning (follicles)</td>
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<td>LS</td>
<td>1</td>
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<td>LS</td>
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**Division 12 - Specialty Construction**

<table>
<thead>
<tr>
<th>BID ITEM NO.</th>
<th>SPEC SECTION</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>TOTAL QUANTITY</th>
<th>UNIT COST</th>
<th>TOTAL COST</th>
</tr>
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<tr>
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<td>13-34 17</td>
<td>Cables Support Tools</td>
<td>EA</td>
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<tr>
<td>5 101</td>
<td>13-34 17</td>
<td>Conveyors Overhead Structure and Deck</td>
<td>SF</td>
<td>2,292</td>
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<tr>
<td>5 102</td>
<td>13-34 17</td>
<td>Conveyor Bldg.</td>
<td>EA</td>
<td>14</td>
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<tr>
<td>5 103</td>
<td>13-34 17</td>
<td>Aluminum Metal Conduit Pipes</td>
<td>SP</td>
<td>479</td>
<td></td>
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<td>5 104</td>
<td>13-34 17</td>
<td>Outfit</td>
<td>LF</td>
<td>1,905</td>
<td></td>
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<td>5 105</td>
<td>13-34 17</td>
<td>1/2&quot; PVC Pipe</td>
<td>LF</td>
<td>120</td>
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<td>5 106</td>
<td>13-34 17</td>
<td>Conduit for CHU Storage Tanks</td>
<td>LS</td>
<td>1</td>
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<tr>
<td>ALL</td>
<td></td>
<td>Maintenance Agreement</td>
<td>LS</td>
<td>1</td>
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<td></td>
</tr>
</tbody>
</table>

**Vendor Name:**  

**Name of Authorized Agent:**  

**Date:**  

**Signature of Authorized Agent:**  

**BID TOTAL:**
**BID SECURITY**

Each Bid shall be accompanied by a Bid Bond, submitted in the form equivalent, in content and coverage, to that of AIA Form A310-2010 Bid Bond, a copy of which is included below for informational purposes only. Respondents are required to provide original bonds. No reproducible copies of this document will be accepted. The Bid Bond shall be duly executed by the Bidder as Principal having as Surety thereon a Surety company fulfilling the qualifications described below.

The Bid Bond shall be written through a licensed Alabama agency on behalf of a Surety company licensed to do business in the State of Alabama and shall be in an amount equal to five percent (5%) of the amount of the Total Bid Price payable to the Birmingham Airport Authority. The Bid Bond shall be submitted with the understanding of the following:

1. that the Bid Bond shall guarantee that the Bidder will submit a responsive Bid;
2. that the Bidder will not withdraw the Bid for a period of One Hundred Twenty (120) days following the opening of Bids;
3. that, if the Bidder is provided with a Notice of Intent to Award the Contract, the Bidder will enter into a formal Contract with the Owner in the form contained in the Contract Documents;
4. that the Bidder will supply evidence of the authority of the person executing the Contract Documents and bonds to do so;
5. that the required Contract Bonds, Certificates of Insurance, Equal Opportunity and Disadvantaged Business Enterprise data, certifications and submissions will be given;
6. that all other Contract Documents will be executed as required therein.

If any of the foregoing requirements are not met, the Owner shall be entitled to the full amount of the Bid Bond as damages to the Owner resulting from the Bidder’s failure to meet those requirements.

Bid Bonds will be returned to all except the three (3) apparent low, qualified, responsible, responsive Bidders within ten (10) Days after the awarding of Bid, and the remaining Bid Bonds will be returned within three (3) Days after the Owner and the successful Bidder have executed the Contract Documents required by the Owner for the Work. No cash, checks, cashier’s checks or money orders will be accepted and will constitute a non-responsive bid which will be returned to the Bidder without consideration.
DRAFT AIA Document A310™ – 2010

Bid Bond

CONTRACTOR:  

SURETY:  

OWNER:  

BOND AMOUNT:  

PROJECT:  

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety’s consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor’s bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.
When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, 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.

Signed and sealed this __________ day of ______________________

(Contractor as Principal)  (Seal)

(Witness)

(Title)

(Surety)  (Seal)

(Witness)

(Title)
DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM

DBE Policy

It is the policy of the Birmingham Airport Authority that DBEs as defined in 49 CFR Part 26 will have maximum opportunity to participate in the performance of all Authority projects and the Respondent will take all necessary and reasonable steps to ensure that DBEs have the maximum opportunity to compete for and perform subcontracts. Respondents will demonstrate that they will subcontract with certified DBEs, or clearly demonstrate in a manner acceptable to the Authority its good faith efforts to obtain DBE subcontractors.

Respondents are encouraged to refer to the Authority’s DBE Program and Policy which is obtained by contacting the BAA Properties and DBE Manager, Diane Gillam, at dgillam@flybirmingham.com. Respondents should refer to the directory of DBE companies certified by the Alabama Unified Certification Program (ALUCP). To ensure the eligibility of DBEs proposed to participate on the contract, all DBEs must be certified by the ALUCP. Certification applications may be obtained by contacting the BAA Properties and DBE Manager, Diane Gillam, at dgillam@flybirmingham.com. DBEs must be certified with the ALUCP at the time SOQs are received. Any firm having questions regarding its eligibility as a DBE should contact the BAA Properties and DBE Manager, Diane Gillam, regarding certification requirements at (205) 599-0522 or via email at dgillam@flybirmingham.com.

DBE Terminology

Each contract the Authority executes with the Respondent and each subcontract the Respondent executes with a subcontractor, must include the following clause:

“No consultant or subconsultant will discriminate on the basis of race, creed, color, national origin, or sex in the performance of this contract or subsequent subcontracts. Failure of the consultant or subcontractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the Authority deems appropriate.”

DBE Goals

DBE Goals are established for each specific prime contract with subcontracting opportunities. Only DBEs certified with the ALUCP will count toward the contract Goal. In accordance with the Authority’s policy, “A recipient may count expenditures of materials and supplies obtained from a DBE Manufacturer at 100% of the cost of the materials or supplies toward DBE Goal.” In accordance with the Authority’s policy, “A recipient or contractor may count toward its DBE Goal 60% of its expenditures for materials and supplies required under a contract and obtained from a DBE regular dealer.”

In the event that the Respondent for this solicitation qualifies as an eligible DBE, the contract Goal will be deemed to have been met, if the Respondent performs at least the prescribed DBE contract Goal percentage of the work with its own forces. The Respondent will be required to submit information concerning those DBEs that will participate in this contract at the time the SOQ is submitted to the Authority. The information will include the names and addresses of each DBE, description of the work to be performed by each named DBE firm. If the Respondent fails to achieve the Goal stated herein, the Respondent will be required to provide documentation demonstrating that the Respondent made “Good Faith Efforts” in attempting to do so. The BAA’s DBE Goal for this Project is 20%.

Respondent Efforts to Meet DBE Goals

1. In all contracts, the successful Respondent will satisfy to the Authority that it has made “Good Faith Efforts” to utilize DBEs in meeting the established DBE Goal. “Good Faith Efforts” are those efforts...
that could reasonably be expected to result in DBE Goal attainment by a Respondent who aggressively and actively seeks to obtain DBE participation. Efforts that are merely “Pro Forma” are not “Good Faith Efforts” to meet DBE Goals. Efforts to attain DBE participation are not “Good Faith Efforts” to meet the Goals even if they are sincerely motivated, if, given all reasonable circumstances, the efforts could not reasonably be expected to produce a level of DBE participation sufficient to meet such Goals. In determining whether or not the apparent successful Respondent has made such “Good Faith Efforts” to meet the Goal, some of the factors the Authority will consider are the following:

   a. Whether the Respondent attended any pre submittal meetings that were scheduled by the Authority to inform DBEs of contracting and subcontracting opportunities;

   b. Whether the Respondent advertised in general circulation, trade association, and minority-focus media concerning the subcontracting opportunities at least ten calendar days prior to SOQ submission;

   c. Whether the Respondent provided written notice by certified mail to a reasonable number of specific DBEs that their interest in the Contract was being solicited at least ten calendar days prior to SOQ submission;

   d. Whether the Respondent followed up initial solicitations of interest by contacting DBEs to determine with certainty whether the DBEs were interested;

   e. Whether the Respondent selected portions of the work to be performed by DBEs in order to increase the likelihood of meeting the DBE Goals “Good Faith Efforts” and, in the case of federally-funded projects, the DBE Goals (including, where appropriate, breaking down contracts into economically feasible units to facilitate DBE participation);

   f. Whether the Respondent provided interested DBEs with adequate information about the requirements of the Contract;

   g. Whether the Respondent negotiated in good faith with interested DBEs, not rejecting DBEs as unqualified without sound reasons based on a thorough investigation of their capabilities;

   h. Whether the Respondent made efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance required by the Authority or Consultant;

   i. Whether the Respondent effectively used the services of available minority community organizations; minority contractors' groups; local, state and federal minority business assistance offices; and other organizations that provide assistance in the recruitment and placement of DBEs;

   j. Whether the Scope of Work submitted by the Respondent to any DBE contractor, DBE subcontractor, DBE sub-subcontractor, DBE supplier, DBE sub-supplier or DBE sub-sub-supplier, and so on, either directly or in-directly, was intended to achieve, in whole or in part, the specified DBE participation;

   k. Whether the Respondent has met some portion of the stated DBE Goal;

   l. Whether the replies from DBEs in response to Scopes of Work submitted to them by contractors, either directly or indirectly, were fair and responsive;

   m. Whether the Respondent contacted the Authority's DBE Liaison Officer for assistance in meeting the Authority's DBE Goals.

   n. Respondents who do not meet DBE contract Goals may alternately satisfy the good faith efforts requirement by documenting their efforts to do so, and on a finding by the Authority that the Respondent did not meet the good faith effort, are entitled, at their option, to the administrative reconsideration process as outlined in the Authority’s DBE policy. The bidder must show that it took all necessary and reasonable steps to achieve a DBE Goal which, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to obtain sufficient DBE participation, even if not fully successful.
2. Respondents who do not meet DBE contract Goals may alternately satisfy the good faith efforts requirement by documenting their efforts to do so, and on a finding by the Authority that the Respondent did not meet the good faith effort, are entitled, at their option, to the administrative reconsideration process as outlined in the Authority’s DBE policy.

3. Respondents who meet the DBE Goal will be deemed to have made the necessary “Good Faith Efforts” without the need for further proof. Failure to meet the Goal may be grounds for refusing to award the contract, if, upon investigation by the Authority, such investigation shows that the Respondent refused to make a “Good Faith Effort” to meet the Goal, or that the failure was due to discrimination. In that event, the Authority may refuse to award the contract to that Respondent.

4. The Authority will require Respondents to make a statement on how they plan to provide meaningful work for DBEs. Respondents should include the names and contact information of proposed DBEs, their scope of work and, where possible for this RFB, the extent of responsibility in each area. Certification status for all planned DBEs shall be submitted in with the response to this RFQ. Failure to provide such information may render the RFB incomplete. The Authority reserves the right to require such additional and supplemental information solely for the purpose of clarifying the DBE information submitted by the Respondent. The BAA Properties and DBE Manager will be responsible for making initial good faith determinations for the Authority.

Each Bidder shall complete, sign, and submit together with its Bid, the DBE Letter of Intent form concerning DBE participation. A Bid may be considered unresponsive and may be rejected, in the Owner’s sole discretion, if the Bidder fails to provide the fully executed Statement or fails to furnish the required data. The apparent low, qualified, responsible, responsive Bidder who receives a Notice of Intent to Award the Contract shall, within ten (10) Calendar Days after the date of Intent to Award, submit all additional information, required by this Disadvantaged Business Enterprise Program, to the Owner. The Bidder, in meeting the guidelines of the Disadvantaged Business Enterprise Program, is not relieved of its Equal Employment Opportunity obligations under state and federal laws and regulations.

**Disadvantaged Business Enterprise Data**

The Bidder will complete the following statement by checking the appropriate box (check one only).

- The Bidder assures that it will meet the requirements of the FAA’s DBE Provisions and the Birmingham Airport Authority’s DBE Policy and Program, and will utilize not less than the prescribed goal of **20%** DBE participation. The DBE assurance stated above is the minimum prescribed goal, however, additional DBE participation is encouraged and the actual DBE contractual commitment will be the percentage of the dollar amounts of participation shown on the validated Letter(s) of Intent submitted by the Contractor. It is understood that the dollar amounts shown on the Letter(s) of Intent are estimates and that actual amounts paid to DBE subcontractors may vary depending on the final adjustments of the estimated quantities; however, the total DBE Commitment may only be modified by Change Order.

- The Bidder is unable to assure DBE participation of the prescribed Goal of 25% in this Contract, but will provide for a minimum of ________ % participation. (If this box is checked, Bidder may fill in the percentage blanks and document on a separate attachment to this Assurance, Bidder’s efforts in attempting to meet the Goal.)

On all contracts for which a Contract Goal has been established, the Authority will inform all competitors that they will be required to submit DBE participation information to the Authority as part of their Bid. All DBEs must be certified by the Alabama Unified Certification Program (ALUCP) at the time the bids are submitted. Failure of a Bidder to submit a Letter of Intent with the following DBE...
information stated below in their Bid may render the Bid nonresponsive:

1. The names and addresses of DBE firms that participate in the Contract;
2. A description of the Work each named DBE firm will perform; and
3. The dollar amount of participation by each named DBE firm.
4. Written documentation of the Bidder’s commitment to use a DBE subcontractor whose participation it submits to meet the contract goal.
5. Written confirmation from the DBE subcontractor that it will be participating in the contract as provided in the Bid.
6. A copy of each named DBE’s certification letter from the ALUCP.

A SEPARATE LETTER OF INTENT MUST BE COMPLETED FOR EACH DBE FIRM.
LETTER OF INTENT

Name of Prime Bidder’s firm: ____________________________________________________________

Address: __________________________________________________________________________

City: ______________________________________________________________________________

Telephone: _______________ FAX _______________ E-mail ________________________________

Prime Bidder’s Contract Amount $ _______________________________________________________

Percentage of Contract Amount performed by Prime Bidder _____________________________%

Name of DBE firm: __________________________________________________________________

Address: __________________________________________________________________________

City: ______________________________________________________________________________

Telephone: _______________ FAX _______________ E-mail ________________________________

Identity of DBE (e.g. Hispanic, American Indian, Black, Female, etc.): ______________________

Check the appropriate box if the DBE is a material supplier:

☐ Materials and supplies obtained from a DBE Manufacturer (counts as 100% towards goal)

☐ Materials or supplies obtained from a DBE regular dealer (counts as 60% towards goal)

Description of work to be performed by DBE firm: ______________________________________

Amount of Subcontract $ __________________

Subcontract Percent of Prime Bidder’s Contract Amount __________________ %

Commitment

The Prime Bidder is committed to utilizing the above-named DBE firm for the work described above.

By: ___________________________ Date: ____________________________

(Signature of Authorized Representative) (Title) (Name of Prime Bidder Firm)

Affirmation

The above-named DBE firm affirms that it will perform the portion of the contract for the estimated dollar value as stated above.

By: ___________________________ Date: ____________________________

(Signature of DBE Authorized Representative) (Title) (Name of DBE Firm)

If the Prime Bidder does not receive award of the prime contract, any and all representations in this Letter of Intent and Affirmation will be null and void.

EACH CONTRACT THE AUTHORITY EXECUTES WITH THE CONTRACTOR (AND EACH SUBCONTRACT THE CONTRACTOR EXECUTES WITH A SUBCONTRACTOR) MUST INCLUDE THE FOLLOWING CLAUSE:

Contractor’s DBE Assurance: The Contractor or Subcontractor will not discriminate on the basis...
of race, color, national origin, or sex in the performance of this Contract. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the recipient deems appropriate.

The word “Contractor”, as used in this Assurance, will mean the same as “Bidder”.

________________________________________
Name of Bidder)

By: ____________________________________
(Signature*)

Title: ________________________________

Date: ________________________________

* Must be same signature on Bid Form.
LIST OF NON-DISADVANTAGED BUSINESS ENTERPRISE SUBCONTRACTORS / SUPPLIERS

LETTER OF INTENT: NON-DBE

Name of Prime Bidder’s firm: ____________________________________________
Address: _____________________________________________________________
City: ________________________________________________________________
Telephone: ______________ FAX ______________ E-mail ______________________

Prime Bidder’s Contract Amount $ __________________________
Percentage of Contract Amount performed by Prime Bidder ______________ %

Name of firm: _________________________________________________________
Address: _____________________________________________________________
City: ________________________________________________________________
Telephone: ______________ FAX ______________ E-mail ______________________

Description of work to be performed by firm: ______________________________
________________________________________________________
________________________________________________________
Amount of Subcontract $ __________________________
Subcontract Percent of Prime Bidder’s Contract Amount ______________ %

Name of firm: _________________________________________________________
Address: _____________________________________________________________
City: ________________________________________________________________
Telephone: ______________ FAX ______________ E-mail ______________________

Description of work to be performed by firm: ______________________________
________________________________________________________
________________________________________________________
Amount of Subcontract $ __________________________
Subcontract Percent of Prime Bidder’s Contract Amount ______________ %

Name of firm: _________________________________________________________
Address: _____________________________________________________________
City: ________________________________________________________________
Telephone: ______________ FAX ______________ E-mail ______________________

Description of work to be performed by firm: ______________________________
________________________________________________________
________________________________________________________
Amount of Subcontract $ __________________________
Subcontract Percent of Prime Bidder’s Contract Amount ______________ %

Bidder: _____________________________________________________________
**DISADVANTAGED BUSINESS UNAVAILABILITY CERTIFICATION**  
(Must be completed for each unavailable DBE contacted)

I, ___________________________________ (Name), the ____________________________ (Title), of the Bidder, certify that on _________ (date), I contacted the following DBE Contractor to obtain a Bid for the following Work to be performed on:

<table>
<thead>
<tr>
<th>Forms of Bid Sought</th>
<th>Disadvantaged Contractor</th>
<th>Type of Work</th>
<th>(Unit Prices, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

To the best of my knowledge and belief, said disadvantaged Contractor was unavailable (exclusive of unavailability due to lack of agreement on price) for Work on this Project, or unable to prepare a Bid for the following reason(s):

__________________________________________________________

Signature: _______________  Date: _______________
Title: ________________________________

I, ___________________________ (Name), the ____________________________ (Title), of ___________________________ (Disadvantaged Company Name) was offered an opportunity to Bid on the above-identified Work on _________________ (Date) by _________________.

The above statement is a true and accurate account of why I did not submit a Bid on the Project.

Signature: ___________________________  Date: _______________
Title: ________________________________
INFORMATION FOR DETERMINING JOINT VENTURE ELIGIBILITY

Bidder: ________________________________

INFORMATION FOR DETERMINING JOINT VENTURE ELIGIBILITY
(This form need not be filled in if all joint venture firms are disadvantaged owned.)

1. Name of joint venture: ________________________________
2. Address of joint venture: ________________________________
3. Phone number of joint venture: ________________________________
4. Identify the firms which comprise the joint venture.
   (The DBE partner must complete the Equal Opportunity Report Statement attached to the Bid.)

   (a) Describe the role of the DBE firm in the joint venture.
   (b) Describe very briefly the experience and business qualifications of each non-DBE joint venture.

5. Nature of joint venture’s business: ________________________________
6. Provide a copy of the joint venture agreement.
7. What is the Claimed percentage of the DBE Ownership? ________________________________
8. Ownership of joint venture: (This need not be filled in if described in the joint venture agreement, provided in question 6.)
   (a) Profit and loss sharing
   (b) Capital contributions, including equipment
   (c) Other applicable Ownership interests

9. Control of and participation in this Contract: identify (by name, race, sex and firm) those individuals (and their titles) who are responsible for Day-to-Day management and policy decision-making, including, but not limited to, those with prime responsibility for:
   (a) Financial decisions ________________________________
   (b) Management decisions, such as: ________________________________
      (1) Estimating:
      (2) Marketing and sales:
      (3) Hiring and firing of management personnel:
      (4) Purchasing of major items or supplies:
      (c) Supervision of field operations: ________________________________

NOTE: If, after filing this disclosure and before the completion of the joint venture's Work on the Contract covered by this regulation, there is any significant change in the information submitted, the joint venture must inform the Owner, either directly or through the Bidder if the joint venture is a Subcontractor.
WITHDRAWAL OF BIDS

No Bid may be withdrawn for a period of **(180) One-Hundred and Eighty Days** after the time and date fixed for the opening of Bids after it is submitted, unless the Bidder can present clear and convincing documentary evidence of a Bid mistake. The Bidder must make its request by letter and such request must be received prior to the time and date fixed for the receipt of Bids. Should its Bid be withdrawn, the Bidder shall be excluded from any participation in the Project or Bidding on the same Project if it is re-advertised.

DISQUALIFICATION OF BIDDER

Any of the following causes may be considered sufficient for the disqualification of a Bidder and the rejection of its Bid:

- **A.** Submission of more than one Bid for the same Work by a firm, partnership or corporation under the same or different names;
- **B.** Evidence of collusion between or among Bidders;
- **C.** Work for which the Bidder is committed by Contract, which, in the Owner's judgment and sole discretion, might hinder or prevent the prompt completion of the Work under this Contract if awarded to the Bidder;
- **D.** Being behind on the approved completion schedule for any existing Contracts with the Owner, in litigation with the Owner or having defaulted on a previous Contract with the Owner;
- **E.** Poor, negligent or defective performance of Work for Owner or any other party on prior Projects, which, in the Owner's judgment and sole discretion, raises doubts as to the Bidder's ability to properly perform the Work;
- **F.** The Bidder is presently debarred or suspended by any Federal department or agency;
- **G.** The Bidder fails to submit all of the items required under Section C, Article I, Paragraph 7 (above);
- **H.** Appearance of the Bidder on the Department of General Services' Convicted Vendors List; and
- **I.** Any other cause which, in the Owner's judgment and sole discretion, is sufficient to justify disqualification of a Bidder or the rejection of its Bid

REJECTION OF IRREGULAR BIDS

Bids will be considered irregular and may be rejected if they show omissions, alterations of form, additions not called for, conditions, limitations, unauthorized alternate Bids or other irregularities of any kind. The Owner shall have the right to waive any informalities or irregularities of Bids or to reject any or all Bids.

BASIS OF AWARD

A Bid Evaluation Committee will review all technically compliant Bids submitted. The Authority may retain external experts to provide advice and support in the review of the submissions. Each bid will be evaluated evenly based on the following criteria:

1. Commitment to Federal Provisions and RFB Requirements
2. Proposed Cost of Construction
3. DBE Program commitment

In determining the apparent low Bid, the Owner reserves the right to correct, in all Bids, obvious
mathematical errors within the Total Bid Price, the unit price extensions, page totals or any combination thereof, if applicable.

This Contract is contingent upon receipt of committed federal funding from the FAA.

**NOTICE OF INTENT TO AWARD CONTRACT**

Unless all Bids are rejected, a Notice of Intent to Award the Contract will be issued to the qualified, responsible Bidder whose Bid is responsive to the Invitation to Bid and is most advantageous to the Owner, price and other factors considered. The Owner reserves the right to take into consideration the Bidder’s past performance with the Owner or any other entity in determining if the Bidder and its Bid are responsible, qualified, and most advantageous to the Owner.

**PERFORMANCE AND PAYMENT BONDS**

A Performance Bond and a Payment Bond, in accordance with these General Conditions and each in an initial amount of not less than the Total Contract Price, will be required of the successful Bidder for, among other, the following purposes:

A. To guarantee faithful performance of the requirements of the Contract Documents, including all applicable warranties;

B. To guarantee the payment for all labor, materials, or supplies used directly or indirectly in the prosecution of the Work provided for in the Contract.

The penal sum of the Performance Bond and the Payment Bond shall be increased or decreased during the course of the Work in the event that modifications, Change Orders or Addenda increase or decrease the Total Contract Price so that the penal sum of each bond shall be in an amount equal to the completed Contract Price at the completion of the Work.

The Bonds shall be similar, in content and requirement, to standard AIA forms [A312-2010 Payment Bond](https://www.aia.org/) and [A312-2010 Performance Bond](https://www.aia.org/), and written through a licensed Alabama agency on behalf of a Surety company licensed to do business in the State of Alabama, meeting the following requirements:

A. **Qualification - Management and Strength:** The Surety must be rated no less than “A” as to management and no less than “XII” as to strength, by the latest edition of Best's Insurance Guide, published by A.M. Best Company, PO Box 1107, Summit, New Jersey 07901.

B. **Bonding Limit - Any One Risk:** The bonding limit of the Surety shall not exceed five percent (5%) of the policyholder surplus (capital and surplus) as listed by the aforementioned Best's Insurance Guide.

C. **Qualification Federal Project Approval:** The Surety’s company executing the Bonds shall be on the current list of the U.S. Treasury Department as being approved by and writing bonds for the Federal Projects in the amount not less than the penal sum of the Bonds provided by the Owner.

The completed Bonds shall be delivered to the Owner with the executed Contract as required hereinafter in these General Requirements.
INSURANCE REQUIREMENTS

The Selected Bidder/Contractor shall procure, at its expense, and keep in full force and effect at all times during the term of this Agreement, the types and amounts of insurance specified herein, under the “BAA Contractor Insurance Requirements”, which is attached hereto and incorporated by reference herein.

The specified insurance shall include and insure Birmingham Airport Authority, City of Birmingham, Alabama and their respective directors, council members, agents and employees, including, with limits, the OAR and the Engineer and the other named consultants, their officers, agents and employees as additional insured’s (with the exception of Worker’s Compensation and Professional Liability), against the areas of risk associated with the Services as described in this RFP with respect to Contractor’s operations, acts or omissions in the performance of this Agreement, its operations, use and occupancy of the Airport, and other related functions performed by or on behalf of Contractor in, on or about Airport, which the Contractor may be legally liable, whether such operations be by the Contractor, or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose act any of them may be liable.

A copy of the Contractor’s current insurance certificate, verifying the Contractor’s insurance coverage, must be submitted upon execution of the Agreement and prior to commencement of the Work. The minimum required insurance coverage is not intended to, and shall not in any manner, limit or reduce liabilities and obligations assumed by the Contractor, its agents, employees, or any subcontractor. Contractor shall furnish the insurance coverages outlined in Exhibit A: “BAA Contractor Insurance Requirements” either through existing policies or by virtue of a specific project policy, with deductible limits acceptable to the Authority.

Certificates of Insurance shall be filed with the Owner prior to commencement of the Work on a Certificate of Insurance form, or Certificates, policies, or endorsements acceptable to the Owner. If such insurance coverages are required to remain in force after Final Payment, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment by the Contractor. Information concerning reduction or cancellation of coverage shall be immediately furnished by the Contractor to the Owner.

All such insurance shall be primary and non-contributing with any other insurance held by Authority where liability arises out of or results from the acts or omissions of Contractor, its agents, employees, officers, assigns or any person or entity acting for or on behalf of Contractor. Such policies shall also include a Waiver of Subrogation and provide the Owner at least thirty (30) days prior written notice of any cancellation or non-renewal thereof. Such policies may provide for reasonable deductibles and/or retentions acceptable to the Authority based upon the nature of Contractor’s operations and the type of insurance involved.

Coverages, whether written on an occurrence or claims made basis, shall be maintained without interruption from date of commencement of the Work until date of Final Payment and termination of any coverage required to be maintained after Final Payment. If such insurance coverages are required to remain in force after Final Payment, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment by the Contractor. If the Contractor’s coverage is written on a claims-made basis, the Contractor shall also provide tail coverage to include claims made after the completion of the Work for the Completed Operations coverage for the required statute of repose.

Each specified insurance policy (other than Worker's Compensation and Employers' Liability and fire and extended coverage's) shall contain a Severability of Interest (Cross Liability) clause which states, “It is agreed that the insurance afforded by this policy shall apply separately to each insured against
whom a claim is made or suit is brought except with respect to the limits of the company's liability,"
and a Contractual Endorsement which shall state, "Such insurance as is afforded by this policy shall
also apply to liability assumed by the insured under insured's Agreement with the Authority."

At least ten (10) days prior to the expiration date of the above policies, documentation showing that
the insurance coverage has been renewed or extended shall be filed with Authority. If such
coverage is canceled or reduced, Contractor shall, within fifteen (15) days of such cancellation or
reduction of coverage, file with Authority evidence that the required insurance has been reinstated
or provided through another insurance company or companies. In the event Contractor fails to
furnish Authority with evidence of insurance and maintain the insurance as required, Authority upon
ten (10) days prior written notice to comply, may, but shall not be required to, procure such
insurance at the cost and expense of Contractor, and Contractor agrees to promptly reimburse
Authority for the cost thereof. Payment shall be made within thirty (30) days of invoice date.

Contractor shall provide proof of all required insurance and related requirements to Authority either
by production of: the actual insurance policy(ies); or a Certificate of Insurance in a form acceptable
to the Authority. The documents evidencing all required coverage's shall be filed with Authority prior
to Contractor performing Services or occupying the Airport. The documents shall contain (i) the
applicable policy number, (ii) the inclusive dates of policy coverage's, (iii) the insurance carrier's
name, address and telephone number, (iv) shall bear an original signature of an authorized
representative of said carrier, and (v) shall provide that such insurance shall not be subject to
cancellation, reduction in coverage, or nonrenewal except after written notice by certified mail,
return receipt requested, to the Authority at least thirty (30) days prior to the effective date thereof.
Information concerning reduction or cancellation of coverage shall be immediately furnished by the
Contractor to Owner. Owner reserves the right to have submitted to it, upon request, all pertinent
information about the agent, broker, and carrier providing such insurance.

Authority and Contractor agree that the insurance policy limits specified herein shall be reviewed for
adequacy annually throughout the term of this Agreement by the Authority who may, thereafter,
require Contractor, on thirty (30) days prior written notice, to adjust the amounts of insurance
coverage to whatever reasonable amount said Authority deems to be adequate.

All insurance policies shall be written in a company or companies lawfully authorized to do business in
Alabama and are required to have minimum A.M. Best financial rating of A minus, 8 (A-, VIII).

If Contractor has Subcontractor performing any work, the Subcontractor is subject to the same
insurance requirements outlined in this section and on Exhibit A: BAA Contractor's Insurance
Requirements.

Contractor is also advised of the statutory immunity of negligence applicable to the owner and its
directors, which is contained in Article 2, Chapter 3 of Title 4 Section 4-30-50 of the Code of Alabama,
1975.

INDEMNIFICATION

The Contractor hereby agrees to indemnify, defend and hold Owner, its agents, employees and
designees ("Indemnities") harmless from all losses, claims, liabilities, injuries, damages and expenses,
including attorney's fees, that the Indemnities may incur by reason of any injury or damage sustained
to any person or property (including, but not limited to, any one or more of the Indemnities) arising out
of or resulting from, in whole or part, the negligent performance, or lack of performance, by
Contractor of its duties and obligations under or pursuant to this Agreement and Amendments.

ADDITIONAL INSURANCE REQUIREMENTS

It is highly recommended that each Bidder request that its current insurance broker/agent review the
insurance requirements in this Contract before completing and submitting a Bid, so each Bidder will be aware of any additional cost that may be incurred to meet the Owner’s insurance requirements for this Contract. No such additional costs shall be part of the Bid price, and the Contractor shall be responsible for paying the same.

All such insurance policies shall provide that coverage is primary and non-contributory, includes waiver of subrogation and provides the Owner at least thirty (30) days prior written notice of any cancellations or modification thereof. The Owner shall be named as an additional insured on all policies except Workers’ Compensation and the Professional Liability/E&O policies.

Additional Insureds shall read: Birmingham Airport Authority, City of Birmingham, Alabama and their respective directors, council members, agents and employees.

Please note that separate limits may be required if RFP requires work be performed “Airside” vs “Non Airside” as outlined on the attached Exhibit A and Sample Certificates.

Contractor shall at all times during the term of this Agreement maintain, at its own expense, the following minimum levels and types of insurance (see next page):
## BAA Contractor Insurance Requirements

### Contractor Provided Insurance for Non-Airside Project Coverage

<table>
<thead>
<tr>
<th>Type of Coverage</th>
<th>Minimum Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Worker's Compensation</strong></td>
<td>Statutory</td>
</tr>
<tr>
<td><strong>Employee's Liability</strong></td>
<td>$1,000,000 Each Accident</td>
</tr>
<tr>
<td></td>
<td>$1,000,000 Disease – Policy Limit</td>
</tr>
<tr>
<td></td>
<td>$1,000,000 per Employee</td>
</tr>
</tbody>
</table>

**Requirements:**
1. Voluntary Compensation Endorsement
2. Waiver of Subrogation

<table>
<thead>
<tr>
<th>General Liability</th>
<th>$1,000,000 each occurrence</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$2,000,000 General Aggregate</td>
</tr>
<tr>
<td></td>
<td>$2,000,000 Completed Operations/Products Aggregate</td>
</tr>
<tr>
<td></td>
<td>$2,000,000 Personal Injury</td>
</tr>
<tr>
<td></td>
<td>$5,000 Medical Payments</td>
</tr>
</tbody>
</table>

**Requirements:**
1. XCU Perils Coverage
2. Completed Operations Extended 3 Years
3. Broad Form Property Damage
4. Fellow Employee Coverage
5. Primary & Non-Contributory
6. Waiver of Subrogation
7. 30-day notice of Cancellation to Certificate Holder
8. CG2010 and CG2037 Endorsements
9. Contractual Liability applicable to Contractor's indemnification obligations

<table>
<thead>
<tr>
<th>Business Automobile</th>
<th>$2,000,000 per occurrence combined limit for bodily injury liability and property damage</th>
</tr>
</thead>
</table>

**Requirements:**
1. Covers owned, non-owned and hired autos
2. Primary & Non-Contributory
3. Waiver of Subrogation
4. 30 Day- Notice of Cancellation to Certificate Holder

<table>
<thead>
<tr>
<th>Umbrella</th>
<th>$5,000,000</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Builder's Risk Policy</th>
<th>Amount of Project</th>
</tr>
</thead>
</table>

**Requirements:** Contractor provide coverage for Contractor's equipment on the job site and all construction material and equipment which is schedule for the Work but has not been delivered to the Job Site.

1. Coverage shall insure interest of Owner and Contractor
2. Provide Replacement Cost
3. Event of Loss, proceeds of any claim shall be paid to the Owner who shall apportion the proceeds between the Owner and the Contractor as their interest may appear
4. Coverage includes flood and earth movement
5. Per Project Aggregate

<table>
<thead>
<tr>
<th>Pollution Policy</th>
<th>$1,000,000 (Depending on project)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional Liability</td>
<td>$1,000,000 (Depending on project)</td>
</tr>
</tbody>
</table>
BAA CONTRACTOR INSURANCE REQUIREMENTS
CONTRACTOR PROVIDED INSURANCE FOR AIR-SIDE PROJECT COVERAGE

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<th>Type of Coverage</th>
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</tr>
</tbody>
</table>

Requirements:
1. Voluntary Compensation Endorsement
2. Waiver of Subrogation

General Liability
$1,000,000 each occurrence
$10,000,000 General Aggregate
$10,000,000 Completed Operations/Products Aggregate
$1,000,000 Personal Injury
$5,000 Medical Payments

Requirements:
1. XCU Perils Coverage
2. Completed Operations Extended 3 Years
3. Broad Form Property Damage
4. Fellow Employee Coverage
5. Primary & Non-Contributory
6. Waiver of Subrogation
7. 30 Day Notice of Cancellation to Certificate Holder
8. CG2010 and CG2037 Endorsements
9. Contractual Liability applicable to Contractor’s indemnification obligations

Business Automobile
$2,000,000 per occurrence combined limit for bodily injury liability and property damage

Requirements:
1. Covers owned, non-owned and hired autos
2. Primary & Non-Contributory
3. Waiver of Subrogation
4. 30 Day Notice of Cancellation to Certificate Holder

Umbrella
$10,000,000

Builder’s Risk Policy
Amount of Project

Requirements:
Contractor provide coverage for Contractor’s equipment on the job site and all construction material and equipment which is schedule for the Work but has not been delivered to the Job Site.
Coverage shall insure interest of Owner and Contractor.
Provide Replacement Cost.
Event of Loss, proceeds of any claim shall be paid to the Owner who shall apportion the proceeds between the Owner and the Contractor as their interest may appear.
Coverage includes flood and earth movement.
Per Project Aggregate

Pollution Policy
$5,000,000 (Depending on project)

Professional Liability
$1,000,000 (Depending on project)
EXECUTION OF AGREEMENT

The Bidder who receives a Notice of Intent to Award the Contract shall, within ten (10) Calendar Days after the date of Notice of Intent to Award, execute and deliver to the Owner the Contract Agreement, the completed Bonds listed above, satisfactory evidence of compliance with the Bid conditions pertaining to the Disadvantage Business Enterprise Program, satisfactory evidence of all required insurance coverage, proof satisfactory to the Owner of the authority of the person or persons executing the Contract Agreement and the Performance Bond and the Payment Bond on behalf of the Bidder and evidence of obtaining licenses and permits needed to perform. The above documents must be furnished, executed and delivered before the Contract Documents will be executed by the Owner. The Contract shall not be deemed awarded and shall not be binding upon the Owner until it has been approved and executed by the Owner and approved by the FAA, and a copy of the fully executed Contract Documents is delivered to the Contractor. Further, award of this Contract is contingent upon Owner's receipt of grant funding from State agencies or the FAA, if applicable. The Owner shall have the right to rescind its Notice of Intent to Award without liability, except for the return of the Bid Guaranty to the Bidder, at any time before the Contract Documents have been fully executed by all parties and delivered to the Contractor.

FAILURE TO EXECUTE AGREEMENT - BID GUARANTY FORFEITED

If the Bidder, receiving a Notice of Intent to Award the Contract, fails to execute and deliver to the Owner the Contract Agreement, the completed Payment Bonds and Performance Bonds, the required evidences of insurance coverage, compliance with Bid conditions pertaining to the DBE Program and the evidence of authority to execute this Agreement, and evidence of obtaining licenses and permits needed to perform, within ten (10) Calendar Days after the date of the Notice of Intent to Award, the Owner may elect to rescind the Notice of Intent to Award and shall be entitled to the full amount of the Bid Guaranty, not as a penalty, but in liquidation of and compensation for damages sustained. A Notice of Intent to Award may then be provided to the next most, qualified, responsible Bidder whose Bid is responsive to the Invitation to Bid and is most advantageous to the Owner, price and other factors considered. In addition, the Owner reserves the right to reject all Bids at any time prior to full execution of Contract and delivery to the Contractor.

BIRMINGHAM AIRPORT AUTHORITY PROPOSED AGREEMENT (DRAFT)

Included under these General Requirements Exhibits section is a draft of the proposed agreement to be executed between the Owner and the Contractor for the construction phase of this project. This draft is intended to provide the Bidders with the Owner’s intent regarding the terms of the final Agreement to be executed. The Owner reserves the right to modify this document prior to final draft and will provide the successful Contractor with a summary of any major modifications made between the original issuance and final draft.

All bidders are responsible for reviewing the entire contents of this Agreement draft prior to submitting a Bid for the Work and shall include, with the submittal of their Bid, notification to the Owner of any objections to the language contained in this Agreement draft. Bidders shall note the specific Agreement references (Articles, paragraphs and page numbers) when noting any exceptions to this Agreement draft.
SALES AND USE TAXES

The Owner is exempt from all taxation in the State of Alabama, including sales and use taxes under Ala. Code §40-3-59 (1075). In addition, the Bidder is hereby notified that the Bidder will be required to apply for and obtain from the Alabama Department of Revenue, pursuant to Ala. Code §40-9-33, a certification allowing the Bidder to purchase personal property to be incorporated into realty in connection with the Work for the Owner on a tax exempt basis. With regard to property that will not be incorporated into the realty hereunder, the Bidder will be required to comply with the Owner’s tax exempt procedures set forth in Section G of these General Conditions. The Bidder shall not include in the Total Contract Price bid by the Bidder any such taxes.

TIME OF COMPLETION

The time of completion is of the essence of this Contract and, each Bidder, if delivered an executed Contract, shall proceed with the Work in accordance with the approved schedule and within the Contract Time specified herein. In the event of failure to complete the Work within the time specified, the Owner may assess damages as provided by law or the Contract Documents, including Liquidated Damages, unless an appropriate extension of time has been granted. The time of completion or Contract Time for this Contract shall be PENDING calendar days from the Contractor’s Notice to Proceed, inclusive of the base bid and any or all Alternates as awarded.

AWARD AND EXECUTION OF CONTRACT

Consideration of Bids

After the Bids are publicly opened and read, they will be compared on the basis of the summation of the products obtained by multiplying the estimated quantities shown in the Proposal by the unit Bid Prices. If a Bidder’s Proposal contains a discrepancy between unit prices written in words and unit prices written in numbers, the unit price written in words shall govern.

Until the award of a Contract is made, the Owner reserves the right to reject a Bidder’s Proposal for any of the following reasons:

- If the Proposal is irregular as specified in the Subsection titled Irregular Proposals
- If the Bidder is disqualified for any of the reasons specified in the Subsection titled Disqualification of Bidders

In addition, until the award of a Contract is made, the Owner reserves the right to reject any or all Proposals, waive technicalities, if such waiver is in the best interest of the Owner and is in conformance with applicable federal, state and local laws or regulations pertaining to the letting of construction Contracts; advertise for new Proposals, or proceed with the Work otherwise. All such actions shall promote the Owners best interests.

Award of Contract

The award of a Contract, if it is to be awarded, shall be made within 30 Calendar Days after the date specified for publicly opening Proposals, unless otherwise specified herein.

Award of the Contract shall be made by the Owner to the lowest, qualified Bidder whose Proposal conforms to the cited requirements of the Owner.

No award shall be made until the FAA has concurred with the Owners recommendation to make such Award and has approved the Owner proposed Contract to the extent that such concurrence and approval are required by 49 CFR Part 18.
Cancellation of Award

The Owner reserves the right to cancel the award without liability to the Bidder, except return of Proposal Guaranty, at any time before a Contract has been fully executed by all parties and is approved by the Owner in accordance with the Subsection titled Approval of Contract of this Section.

Return of Bid Bond

All Bid Bonds, except those of the three lowest Bidders, will be returned immediately after the Owner has made a comparison of Bids as hereinbefore specified in the Subsection titled Consideration of Bids. Bid Bonds of the three lowest Bidders will be retained by the Owner until such time as an Award is made, at which time, the unsuccessful Bidder’s Bid Bond will be returned. The successful Bidder’s Bid Bond will be returned as soon as the Owner receives the Contracts Bonds as specified in the Subsection titled Requirements of Contract Bonds.

Execution of Contract

The successful Bidder shall sign (execute) the necessary agreements for entering into the Contract and return such signed Contract to the Owner, along with the fully executed Surety Bond or Bonds specified in the Subsection titled Requirements of Contract Bonds of this Section, within (10) Calendar Days from the date mailed or otherwise delivered to the successful Bidder. If the Contract is mailed, special handling is recommended.
SECTION E - FEDERAL CONTRACT PROVISIONS

This project is being partially funded with Airport Improvement Program (AIP) funds from the Federal Aviation Administration (FAA). As is required with federal projects, the Respondent must meet the following federal provisions. A copy of the language required by each of these provisions is included in the section following this outline. The required provisions for this Project are outlined below:

A. ACCESS TO RECORDS AND REPORTS
B. AFFIRMATIVE ACTION PLAN
C. BUY AMERICAN PREFERENCE
D. CIVIL RIGHTS - GENERAL
E. CIVIL RIGHTS - TITLE VI ASSURANCES
F. CLEAN AIR AND WATER POLLUTION CONTROL
G. CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS
H. DEBARTMENT AND SUSPENSION (NON-PROCUREMENT)
I. ENERGY CONSERVATION REQUIREMENTS
J. FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)
K. LOBBYING AND INFLUENCING FEDERAL EMPLOYEES
L. OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970
M. RIGHTS TO INVENTIONS
N. TRADE RESTRICTION CLAUSE
O. VETERAN’S PREFERENCE
P. TERMINATION OF CONTRACT
Q. TRADE RESTRICTION CLAUSE
R. DAVIS BACON ACT
S. COPELAND ANTI-KICKBACK
T. EQUAL EMPLOYMENT OPPORTUNITY
U. CERTIFICATION OF NON-SEGREGATED FACILITIES
V. BREACH OF CONTRACT
W. TEXTING WHEN DRIVING CLAUSE
X. DISADVANTAGED BUSINESS ENTERPRISE (SEE OWNER’S PROGRAM REQUIREMENTS)
A. ACCESS TO RECORDS AND REPORTS

The Contractor shall provide all information and reports required by the Regulations or directives issued pursuant thereto, and shall permit access to its books, records, accounts, other sources of information and its facilities as may be determined by Owner or the FAA to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of the Contractor is in the exclusive possession of another who fails or refuses to furnish this information the Contractor shall so certify to Owner or the FAA as appropriate, and shall set forth what efforts it has made to obtain the information.

B. AFFIRMATIVE ACTION PLAN

Notice of Requirement For Affirmative Action


2. The goals and timetables for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

   A. Timetables
   B. Goals for minority participation for each trade (Vol. 45 Federal Register pg. 65984 10/3
   C. Goals for female participation in each trade (6.9%)

These goals are applicable to all of the contractor's construction work (whether or not it is Federal or federally-assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor is also subject to the goals for both federally funded and non-federally funded construction regardless of the percentage of federal participation in funding.

The contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training shall be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor or from project to project, for the sole purpose of meeting the contractor's goals, shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Director, Office of Federal Contract Compliance Programs (OFCCP), within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this notice and in the contract resulting from this solicitation, the "covered area" is Jefferson County, Birmingham, Alabama.

C. BUY AMERICAN PREFERENCE
The Contractor shall agree to the following: The following language, applicable to goods manufactured under this Scope of Work, shall be incorporated into any Agreement issued by the Contractor:

The Contractor agrees to comply with 49 USC § 50101, which provides that Federal funds may not be obligated unless all steel and manufactured goods used in AIP-funded projects are produced in the United States, unless the FAA has issued a waiver for the product; the product is listed as an Exempted Article, Material Or Supply in Federal Acquisition Regulation subpart 25.108; or is included in the FAA Nationwide Buy American Waivers Issued list.

A bidder or Contractor must submit the appropriate Buy America certification (below) with all bids or offers on AIP funded projects. Bids or offers that are not accompanied by a completed Buy America certification must be rejected as nonresponsive.

**Type of Certification is based on Type of Project:**

There are two types of Buy American certifications:

- For projects for a facility, the Certificate of Compliance Based on Total Facility (Terminal or Building Project) must be submitted.
- For all other projects, the Certificate of Compliance Based on Equipment and Materials Used on the Project (Non-building construction projects such as runway or roadway construction; or equipment acquisition projects) must be submitted.
Certificate of Buy American Compliance for Total Facility

(Buildings such as Terminal, SRE, ARFF, etc.)

As a matter of bid responsiveness, the bidder or Contractor must complete, sign, date, and submit this certification statement with their proposal. The bidder or Contractor must indicate how they intend to comply with 49 USC § 50101 by selecting one of the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (i.e. not both) by inserting a checkmark (✓) or the letter “X”.

☐ Bidder or Contractor hereby certifies that it will comply with 49 USC § 50101 by:
   a) Only installing steel and manufactured products produced in the United States; or
   b) Installing manufactured products for which the FAA has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing; or
   c) Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or Contractor agrees:

1. To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
2. To faithfully comply with providing US domestic products
3. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

☐ The bidder or Contractor hereby certifies it cannot comply with the 100% Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or Contractor with the apparent low bid agrees:

1. To submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that support the type of waiver being requested.
2. That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination may result in rejection of the proposal.
3. To faithfully comply with providing US domestic products at or above the approved US domestic content percentage as approved by the FAA.
4. To furnish US domestic product for any waiver request that the FAA rejects.
5. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 3 Waiver - The cost of components and subcomponents produced in the United States is more that 60% of the cost of all components and subcomponents of the “facility”. The required documentation for a type 3 waiver is:

1. Listing of all manufactured products that are not comprised of 100% US domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and
products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety)

2. Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly and installation at project location.

3. Percentage of non-domestic component and subcomponent cost as compared to total “facility” component and subcomponent costs, excluding labor costs associated with final assembly and installation at project location.

**Type 4 Waiver** - Total cost of project using US domestic source product exceeds the total project cost using non-domestic product by 25%. The required documentation for a type 4 of waiver is:

   a) Detailed cost information for total project using US domestic product

   b) Detailed cost information for total project using non-domestic product

**False Statements**: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

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DATE

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SIGNATURE

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COMPANY NAME

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TITLE
Certificate of Buy American Compliance for Manufactured Products
(Non-building construction projects, equipment acquisition projects)

As a matter of bid responsiveness, the bidder or Contractor must complete, sign, date, and submit this certification statement with their proposal. The bidder or Contractor must indicate how they intend to comply with 49 USC § 50101 by selecting one on the following certification statements. These statements are mutually exclusive. Bidder must select one or the other (not both) by inserting a checkmark (✓) or the letter “X”.

☐ Bidder or Contractor hereby certifies that it will comply with 49 USC § 50101 by:

1. Only installing steel and manufactured products produced in the United States, or;
2. Installing manufactured products for which the FAA has issued a waiver as indicated by inclusion on the current FAA Nationwide Buy American Waivers Issued listing, or;
3. Installing products listed as an Excepted Article, Material or Supply in Federal Acquisition Regulation Subpart 25.108.

By selecting this certification statement, the bidder or Contractor agrees:

1. To provide to the Owner evidence that documents the source and origin of the steel and manufactured product.
2. To faithfully comply with providing US domestic product.
3. To furnish US domestic product for any waiver request that the FAA rejects.
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

☐ The bidder or Contractor hereby certifies it cannot comply with the 100% Buy American Preferences of 49 USC § 50101(a) but may qualify for either a Type 3 or Type 4 waiver under 49 USC § 50101(b). By selecting this certification statement, the apparent bidder or Contractor with the apparent low bid agrees:

1. To submit to the Owner within 15 calendar days of the bid opening, a formal waiver request and required documentation that support the type of waiver being requested.
2. That failure to submit the required documentation within the specified timeframe is cause for a non-responsive determination may result in rejection of the proposal.
3. To faithfully comply with providing US domestic products at or above the approved US domestic content percentage as approved by the FAA.
4. To refrain from seeking a waiver request after establishment of the contract, unless extenuating circumstances emerge that the FAA determines justified.

Required Documentation

Type 3 Waiver - The cost of the item components and subcomponents produced in the United States is more that 60% of the cost of all components and subcomponents of the “item”. The required documentation for a type 3 waiver is:

1. Listing of all product components and subcomponents that are not comprised of 100% US domestic content (Excludes products listed on the FAA Nationwide Buy American Waivers Issued listing and products excluded by Federal Acquisition Regulation Subpart 25.108; products of unknown origin must be considered as non-domestic products in their entirety)
2. Cost of non-domestic components and subcomponents, excluding labor costs associated with final assembly at place of manufacture.
3. Percentage of non-domestic component and subcomponent cost as compared to total “item” component and subcomponent costs, excluding labor costs associated with final assembly at place of manufacture.
Type 4 Waiver – Total cost of project using US domestic source product exceeds the total project cost using non-domestic product by 25%. The required documentation for a type 4 of waiver is:

1. Detailed cost information for total project using US domestic product
2. Detailed cost information for total project using non-domestic product

False Statements: Per 49 USC § 47126, this certification concerns a matter within the jurisdiction of the Federal Aviation Administration and the making of a false, fictitious or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code.

_________________________    _______________________
DATE                        SIG NATURE

_________________________    _______________________
COMPANY NAME                 TITLE
D. CIVIL RIGHTS – GENERAL

The Contractor agrees that it will comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or handicap be excluded from participating in any activity conducted with or benefiting from Federal assistance. This provision binds the Contractors from the bid solicitation period through the completion of the contract. This provision is in addition to that required of Title VI of the Civil Rights Act of 1964. This provision also obligates the tenant/concessionaire/lessee or its transferee for the period during which Federal assistance is extended to the airport through the Airport Improvement Program, except where Federal assistance is to provide, or is in the form of personal property; real property or interest therein; structures or improvements thereon. In these cases the provision obligates the party or any transferee for the longer of the following periods:

(a) the period during which the property is used by the airport sponsor or any transferee for a purpose for which Federal assistance is extended, or for another purpose involving the provision of similar services or benefits; or

(b) the period during which the airport sponsor or any transferee retains ownership or possession of the property.

E. CIVIL RIGHTS – TITLE VI ASSURANCES

During the performance of this Agreement, Contractor, for itself, its assignees and successors in interest (for this section only referred to as the Contractor) agrees as follows:

1. Compliance with Regulations: The Contractor shall comply with the regulations relative to nondiscrimination in federally-assisted programs of the Department of Transportation (hereinafter, DOT) Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, hereinafter referred to as the “Regulations”), which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination: The Contractor, with regard to the work performed by it during the Agreement, shall not discriminate on the grounds of race, color, or national origin, in the selection and retention of Sub-Contractors, including procurement of materials and leases of equipment. The Contractor shall not participate either directly or indirectly in the discrimination prohibited by Section 21.5 of the Regulations, including practices when the Agreement covers a program set forth in Appendix B of the Regulations.

Title VI Solicitation Notice

(Source: Appendix 4 of FAA Order 1400.11, Nondiscrimination in Federally-Assisted Programs at the Federal Aviation Administration)

Title VI Solicitation Notice:

The Birmingham Airport Authority, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

Title VI Clauses for Compliance with Nondiscrimination Requirements

(Source: Appendix A of Appendix 4 of FAA Order 1400.11, Nondiscrimination in Federally-Assisted Programs at the Federal Aviation Administration)
Compliance with Nondiscrimination Requirements

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”) agrees as follows:

1. **Compliance with Regulations:** The Contractor (hereinafter includes Contractors) will comply with the Title VI List of Pertinent Nondiscrimination Statutes and Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The Contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of Sub-Contractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential Sub-Contractor or supplier will be notified by the Contractor of the Contractor’s obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, or national origin.

4. **Information and Reports:** The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a Contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a Contractor’s noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:
   a. Withholding payments to the Contractor under the contract until the Contractor complies; and/or
   b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The Contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a Sub-Contractor, or supplier because of such direction, the Contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.
Title VI Clauses for Deeds Transferring United States Property

(Source: Appendix B of Appendix 4 of FAA Order 1400.11, Nondiscrimination in Federally-Assisted Programs at the Federal Aviation Administration)

CLAUSES FOR DEEDS TRANSFERRING UNITED STATES PROPERTY:

The following clauses will be included in deeds effecting or recording the transfer of real property, structures, or improvements thereon, or granting interest therein from the United States pursuant to the provisions of the Airport Improvement Program grant assurances.

NOW, THEREFORE, the Federal Aviation Administration as authorized by law and upon the condition that the Birmingham Airport Authority will accept title to the lands and maintain the project constructed thereon in accordance with the (Name of Appropriate Legislative Authority), for the (Airport Improvement Program or other program for which land is transferred), and the policies and procedures prescribed by the Federal Aviation Administration of the U.S. Department of Transportation in accordance and in compliance with all requirements imposed by Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation pertaining to and effectuating the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252; 42 U.S.C. § 2000d to 2000d-4), does hereby remise, release, quitclaim and convey unto the Birmingham Airport Authority all the right, title and interest of the U.S. Department of Transportation/Federal Aviation Administration in and to said lands described in (Exhibit A attached hereto or other exhibit describing the transferred property) and made a part hereof.

(HABENDUM CLAUSE)

TO HAVE AND TO HOLD said lands and interests therein unto the Birmingham Airport Authority and its successors forever, subject, however, to the covenants, conditions, restrictions and reservations herein contained as follows, which will remain in effect for the period during which the real property or structures are used for a purpose for which Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits and will be binding on the Birmingham Airport Authority, its successors and assigns.

The Birmingham Airport Authority, in consideration of the conveyance of said lands and interests in lands, does hereby covenant and agree as a covenant running with the land for itself, its successors and assigns, that (1) no person will on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination with regard to any facility located wholly or in part on, over, or under such lands hereby conveyed, and (2) that the Birmingham Airport Authority will use the lands and interests in lands so conveyed, in compliance with all requirements imposed by or pursuant to Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Effectuation of Title VI of the Civil Rights Act of 1964, and as said Regulations and Acts may be amended, and (3) that in the event of breach of any of the above-mentioned non-discrimination conditions, the Department will have a right to enter or re-enter said lands and facilities on said land, and that above described land and facilities will thereon revert to and vest in and become the absolute property of the Federal Aviation Administration and its assigns as such interest existed prior to this instruction.*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary in order to make clear the purpose of Title VI.)
CLAUSES FOR TRANSFER OF REAL PROPERTY ACQUIRED OR IMPROVED UNDER THE ACTIVITY, FACILITY, OR PROGRAM

The following clauses will be included in deeds, licenses, leases, permits, or similar instruments entered into by the Birmingham Airport Authority pursuant to the provisions of the Airport Improvement Program grant assurances.

A. The (grantee, lessee, permittee, etc. as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree [in the case of deeds and leases add “as a covenant running with the land”] that:

1. In the event facilities are constructed, maintained, or otherwise operated on the property described in this (deed, license, lease, permit, etc.) for a purpose for which a Federal Aviation Administration activity, facility, or program is extended or for another purpose involving the provision of similar services or benefits, the (grantee, licensee, lessee, permittee, etc.) will maintain and operate such facilities and services in compliance with all requirements imposed by the Nondiscrimination Acts and Regulations listed in the Pertinent List of Nondiscrimination Authorities (as may be amended) such that no person on the grounds of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities.

2. With respect to licenses, leases, permits, etc., in the event of breach of any of the above Nondiscrimination covenants, Birmingham Airport Authority will have the right to terminate the (lease, license, permit, etc.) and to enter, re-enter, and repossess said lands and facilities thereon, and hold the same as if the (lease, license, permit, etc.) had never been made or issued.*

3. With respect to a deed, in the event of breach of any of the above Nondiscrimination covenants, the Birmingham Airport Authority will have the right to enter or re-enter the lands and facilities thereon, and the above described lands and facilities will thereupon revert to and vest in and become the absolute property of the Birmingham Airport Authority and its assigns.*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)
Title VI Clauses for Construction/Use/Access to Real Property

Acquired Under the Activity, Facility or Program
(Source: Appendix D of Appendix 4 of FAA Order 1400.11, Nondiscrimination in Federally-Assisted Programs at the Federal Aviation Administration)

CLAUSES FOR CONSTRUCTION/USE/ACCESS TO REAL PROPERTY
ACQUIRED UNDER THE ACTIVITY, FACILITY OR PROGRAM

The following clauses will be included in deeds, licenses, permits, or similar instruments/agreements entered into by Birmingham Airport Authority pursuant to the provisions of the Airport Improvement Program grant assurances.

A. The (grantee, licensee, permittee, etc., as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree (in the case of deeds and leases add, “as a covenant running with the land” that (1) no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities, (2) that in the construction of any improvements on, over, or under such land, and the furnishing of services thereon, no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination, (3) that the (grantee, licensee, lessee, permittee, etc.) will use the premises in compliance with all other requirements imposed by or pursuant to the List of Pertinent Nondiscrimination Authorities.

B. With respect to (licenses, leases, permits, etc.), in the event of breach of any of the above nondiscrimination covenants, Birmingham Airport Authority will have the right to terminate the (license, permit, etc., as appropriate) and to enter or re-enter and repossess said land and the facilities thereon, and hold the same as if said (license, permit, etc., as appropriate) had never been made or issued.*

C. With respect to deeds, in the event of breach of any of the above nondiscrimination covenants, Birmingham Airport Authority will thereupon revert to and vest in and become the absolute property of Birmingham Airport Authority and its assigns.*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)
Title VI List of Pertinent Nondiscrimination Authorities
(Source: Appendix E of Appendix 4 of FAA Order 1400.11, Nondiscrimination in Federally-Assisted Programs at the Federal Aviation Administration)

During the performance of this contract, the Contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the “Contractor”) agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

• Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin);

• 49 CFR part 21 (Non-discrimination in Federally-Assisted Programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964);

• The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);

• Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR part 27;

• The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);

• Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);

• The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms “programs or activities” to include all of the programs or activities of the Federal-aid recipients, sub-recipients and Contractors, whether such programs or activities are Federally funded or not);

• Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38;

• The Federal Aviation Administration’s Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);

• Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;

• Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);

• Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq)
F. CLEAN AIR AND WATER POLLUTION CONTROL

The Contractor shall agree to the following:

1. That any facility to be used in the performance of the contract or subcontract or to benefit from the contract is not listed on the Environmental Protection Agency (EPA) List of Violating Facilities;

2. To comply with all the requirements of Section 114 of the Clean Air Act, as amended, 42 U.S.C. 1857 et seq. and Section 308 of the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq. relating to inspection, monitoring, entry, reports, and information, as well as all other requirements specified in Section 114 and Section 308 of the Acts, respectively, and all other regulations and guidelines issued thereunder;

3. That, as a condition for the award of this contract, the contractor or subcontractor will notify the awarding official of the receipt of any communication from the EPA indicating that a facility to be used for the performance of or benefit from the contract is under consideration to be listed on the EPA List of Violating Facilities;

4. To include or cause to be included in any construction contract or subcontract which exceeds $100,000 the aforementioned criteria and requirements.

G. CONTRACT WORKHOURS AND SAFETY STANDARDS ACT REQUIREMENTS

1. Overtime Requirements - No Contractor or Sub-Contractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic, including watchmen and guards, in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; Liability for Unpaid Wages; Liquidated Damages: In the event of any violation of the clause set forth in paragraph (1) above, the Contractor and any Sub-Contractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and Sub-Contractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph 1 above, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph 1 above.

3. Withholding for Unpaid Wages and Liquidated Damages: The Federal Aviation Administration or the Sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the Contractor or Sub-Contractor under any such contract or any other Federal contract with the same prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or Sub-Contractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph 2 above.

4. Sub-Contractors: the Contractor or Sub-Contractor shall insert in any subcontracts the clauses set forth in paragraphs 1 through 4 and also a clause requiring the Sub-Contractor to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any Sub-Contractor or lower tier Sub-Contractor with the clauses set forth in paragraphs 1 through 4 of this section.
H. DEBARMENT AND SUSPENSION (NON-PROCUREMENT)

By submitting a bid/proposal under this solicitation, the bidder or Contractor certifies that at the time the bidder or Contractor submits its proposal that neither it nor its principals are presently debarred or suspended by any Federal department or agency from participation in this transaction.

CERTIFICATION REGARDING DEBARMENT AND SUSPENSION
(SUCCESSFUL BIDDER REGARDING LOWER TIER PARTICIPANTS)

The successful bidder, by administering each lower tier subcontract that exceeds $25,000 as a “covered transaction”, must verify each lower tier participant of a “covered transaction” under the project is not presently debarred or otherwise disqualified from participation in this federally assisted project. The successful bidder will accomplish this by:

I. Checking the System for Award Management at website: http://www.sam.gov

II. Collecting a certification statement similar to the Certificate Regarding Debarment and Suspension (Bidder or Contractor), above.

III. Inserting a clause or condition in the covered transaction with the lower tier contract

If the FAA later determines that a lower tier participant failed to tell a higher tier that it was excluded or disqualified at the time it entered the covered transaction, the FAA may pursue any available remedy, including suspension and debarment.

I. ENERGY CONSERVATION REQUIREMENTS

The contractor agrees to comply with mandatory standards and policies relating to energy efficiency that are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Public Law 94-163).

J. FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

All contracts and subcontracts that result from this solicitation incorporate the following provisions by reference, with the same force and effect as if given in full text. The contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that pertain to a referenced requirement directly with the Federal Agency with enforcement responsibilities.

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<td>(29 USC 201)</td>
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K. LOBBYING AND INFLUENCING FEDERAL EMPLOYEES

The Contractor certifies by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the bidder or Contractor, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

L. OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

All contracts and subcontracts that result from this solicitation incorporate the following provisions by reference, with the same force and effect as if given in full text. The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that pertain to a referenced requirement directly with the Federal Agency with enforcement responsibilities.

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M. RIGHTS TO INVENTIONS

All rights to inventions and materials generated under this contract are subject to requirements and regulations issued by the FAA and the Sponsor of the Federal grant under which this contract is executed.

N. TRADE RESTRICTION CLAUSE

The Contractor or Sub-Contractor, by submission of an offer and/or execution of a contract, certifies that it:

i. is not owned or controlled by one or more citizens of a foreign country included in the list of countries that discriminate against U.S. firms published by the Office of the United States Trade Representative (USTR);

ii. has not knowingly entered into any contract or subcontract for this project with a person that is a citizen or national of a foreign country on said list, or is owned or controlled directly or indirectly by one or more citizens or nationals of a foreign country on said list;

iii. has not procured any product nor subcontracted for the supply of any product for use on the project that is produced in a foreign country on said list.

Unless the restrictions of this clause are waived by the Secretary of Transportation in accordance with 49 CFR 30.17, no contract shall be awarded to a Contractor or Sub-Contractor who is unable to certify to the above. If the Contractor knowingly procures or subcontracts for the supply of any product or service of a foreign country on said list for use on the project, the Federal Aviation Administration may
direct through the Sponsor cancellation of the contract at no cost to the Government.

Further, the Contractor agrees that, if awarded a contract resulting from this solicitation, it will incorporate this provision for certification without modification in each contract and in all lower tier subcontracts. The Contractor may rely on the certification of a prospective Sub-Contractor unless it has knowledge that the certification is erroneous.

The Contractor shall provide immediate written notice to the sponsor if the Contractor learns that its certification or that of a Sub-Contractor was erroneous when submitted or has become erroneous by reason of changed circumstances. The Sub-Contractor agrees to provide written notice to the Contractor if at any time it learns that its certification was erroneous by reason of changed circumstances.

This certification is a material representation of fact upon which reliance was placed when making the award. If it is later determined that the Contractor or Sub-Contractor knowingly rendered an erroneous certification, the Federal Aviation Administration may direct through the Sponsor cancellation of the contract or subcontract for default at no cost to the Government.

Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by this provision. The knowledge and information of a Contractor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

This certification concerns a matter within the jurisdiction of an agency of the United States of America and the making of a false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code, Section 1001.

O. VETERAN’S PREFERENCE

In the employment of labor (except in executive, administrative, and supervisory positions), preference must be given to Vietnam era veterans, Persian Gulf veterans, Afghanistan-Iraq war veterans, disabled veterans, and small business concerns owned and controlled by disabled veterans as defined in Title 49 United States Code, Section 47112. However, this preference shall apply only where the individuals are available and qualified to perform the work to which the employment relates.

P. TERMINATION OF CONTRACT

1. The Sponsor may, by written notice, terminate this contract in whole or in part at any time, either for the Sponsor’s convenience or because of failure to fulfill the contract obligations. Upon receipt of such notice services must be immediately discontinued (unless the notice directs otherwise) and all materials as may have been accumulated in performing this contract, whether completed or in progress, delivered to the Sponsor.

2. If the termination is for the convenience of the Sponsor, an equitable adjustment in the contract price will be made, but no amount will be allowed for anticipated profit on unperformed services.

3. If the termination is due to failure to fulfill the Contractor's obligations, the Sponsor may take over the work and prosecute the same to completion by contract or otherwise. In such case, the Contractor is liable to the Sponsor for any additional cost occasioned to the Sponsor thereby.

4. If, after notice of termination for failure to fulfill contract obligations, it is determined that the Contractor had not so failed, the termination will be deemed to have been effected for the convenience of the Sponsor. In such event, adjustment in the contract price will be made as provided in paragraph 2 of this clause.
5. The rights and remedies of the sponsor provided in this clause are in addition to any other rights and remedies provided by law or under this contract.

Q. DAVIS BACON ACT

Contractor shall agree to the following:

1. Minimum Wages

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalent thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under (1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can easily be seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken
shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii) (B) or (C) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding.

The Federal Aviation Administration or the Sponsor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of work, all or part of the wages required by the contract, the Federal Aviation Administration may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security
number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual costs incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the Federal Aviation Administration. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH–347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Federal Aviation Administration if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the Federal Aviation Administration, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance,” signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR § 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR § 5.5 (a)(3)(i) and that such information is correct and complete;

(2) That each laborer and mechanic (including each helper, apprentice and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe
benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (3)(i) of this section available for inspection, copying or transcription by authorized representatives of the Sponsor, the Federal Aviation Administration or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeymen's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the contractor
will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeymen wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall not be paid at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal Employment Opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act Requirements.

The contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this contract.


The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR Part 5.5(a)(1) through (10) and such other clauses as the Federal Aviation Administration may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.


A breach of the contract clauses in paragraph 1 through 10 of this section may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance With Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and
5 are herein incorporated by reference in this contract.


Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6 and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).


R. COPELAND ANTI-KICKBACK

The United States Department of Labor Wage and Hours Division oversees the Copeland "Anti-Kickback" Act requirements. All contracts and subcontracts must meet comply with the Occupational Safety and Health Act of 1970.

United States Department of Labor Wage and Hours Division can provide information regarding any specific clauses or assurances pertaining to the Copeland "Anti-Kickback" Act requirements required to be inserted in solicitations, contracts or subcontracts.

S. EQUAL EMPLOYMENT OPPORTUNITY

During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

3. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this
section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

5. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

6. In the event of the contractor’s noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY CONSTRUCTION CONTRACT SPECIFICATIONS

As used in these specifications:

1. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

2. "Director" means Director, Office of Federal Contract Compliance Programs (OFCCP), U.S. Department of Labor, or any person to whom the Director delegates authority;

3. "Employer identification number" means the Federal social security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941;

4. "Minority" includes:

5. Black (all) persons having origins in any of the Black African racial groups not of Hispanic origin);

6. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);

7. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

8. American Indian or Alaskan native (all persons having origins in any of the original peoples
of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

I. Whenever the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

II. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors shall be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved plan is individually required to comply with its obligations under the EEO clause and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractors or subcontractors toward a goal in an approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

III. The contractor shall implement the specific affirmative action standards provided in paragraphs 18.7a through 18.7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in a geographical area where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

IV. Neither the provisions of any collective bargaining agreement nor the failure by a union with whom the contractor has a collective bargaining agreement to refer either minorities or women shall excuse the contractor's obligations under these specifications, Executive Order 11246 or the regulations promulgated pursuant thereto.

V. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees shall be employed by the contractor during the training period and the contractor shall have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees shall be trained pursuant to training programs approved by the U.S. Department of Labor.

VI. The contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The contractor shall document these efforts fully and shall implement affirmative action steps at least as extensive as the following:

1. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign two or more women to each construction
project. The contractor shall specifically ensure that all foremen, superintendents, and other onsite supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

2. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

3. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefore along with whatever additional actions the contractor may have taken.

4. Provide immediate written notification to the Director when the union or unions with which the contractor has a collective bargaining agreement has not referred to the contractor a minority person or female sent by the contractor, or when the contractor has other information that the union referral process has impeded the contractor's efforts to meet its obligations.

5. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources compiled under 7b above.

6. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

7. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions including specific review of these items with onsite supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

8. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.

9. Direct its recruitment efforts, both oral and written, to minority, female, and community organizations, to schools with minority and female students; and to minority and female
recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations, such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

10. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.

11. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

12. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel, for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

13. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the contractor's obligations under these specifications are being carried out.

14. Ensure that all facilities and company activities are non-segregated except that separate or single user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

15. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

16. Conduct a review, at least annually, of all supervisors' adherence to and performance under the contractor's EEO policies and affirmative action obligations.

17. Contractors are encouraged to participate in voluntary associations, which assist in fulfilling one or more of their affirmative action obligations (18.7a through 18.7p). The efforts of a contractor association, joint contractor union, contractor community, or other similar groups of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 18.7a through 18.7p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's and failure of such a group to fulfill an obligation shall not be a defense for the contractor's noncompliance.

18. A single goal for minorities and a separate single goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, if the particular group is employed in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally,) the contractor may be in violation of the Executive Order if a
specific minority group of women is underutilized.

19. The contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

20. The contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

21. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

22. The contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 18.7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

23. The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee, the name, address, telephone number, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

24. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).
EQUAL OPPORTUNITY REPORT STATEMENT

Bidder: ________________________________

Project: ______________________________

Equal Opportunity Report Statement
(as Required in 41 C.F.R. 60-1.7(b))

The Bidder shall complete the following statements by checking the appropriate blanks. Failure to complete these blanks may be grounds for rejection of Bid:

1. The Bidder has [ ] has not [ ] developed and has on file at each established affirmative action programs pursuant to 41 C.F.R. 60-1.40 and 41 C.F.R. 60-2.

2. The Bidder has [ ] has not [ ] participated in any previous Contract or Subcontract subject to the equal opportunity clause prescribed by Executive Order 11246, as amended.

3. The Bidder has [ ] has not [ ] filed with the Joint Reporting Committee the annual compliance report on Standard Form 100 (EEO)-1 Report.

4. The Bidder does [ ] does not [ ] employ fifty or more employees.

_______________________________
(Name of Bidder)

Dated: ____________

By: ________________________________

Name: ______________________________

Title: ______________________________
T. CERTIFICATION OF NON-SEGREGATED FACILITIES

The Contractor shall agree to the following:

1. A Certification of Non-segregated Facilities shall be submitted prior to the award of a subcontract exceeding $10,000, which is not exempt from the provisions of the Equal Opportunity Clause.

2. Contractors receiving subcontract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide for the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity Clause.


CERTIFICATION OF NONSEGREGATED FACILITIES

The federally-assisted construction contractor certifies that she or he does not maintain or provide, for his employees, any segregated facilities at any of his establishments and that she or he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally-assisted construction contractor certifies that she or he will not maintain or provide, for his employees, segregated facilities at any of his establishments and that she or he will not permit his employees to perform their services at any location under his control where segregated facilities are maintained. The federally-assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this contract.

As used in this certification, the term “segregated facilities” means any waiting rooms, work areas, restrooms, and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directives or are, in fact, segregated on the basis of race, color, religion, or national origin because of habit, local custom, or any other reason. The federally-assisted construction contractor agrees that (except where she or he has obtained identical certifications from proposed subcontractors for specific time periods) she or he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause and that she or he will retain such certifications in his files.

Each Bidder shall complete, sign, and submit together with its Bid, the Certification of Non-Segregated Facilities. A Bid may be considered unresponsive and may be rejected, in the Owner's sole discretion, if the Bidder fails to provide the fully executed Statement, or fails to furnish the required data.
Certification of Non-Segregated Facilities

The Bidder certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments and that it does not permit its employees to perform their services on any location under its control, where segregated facilities are maintained. The Bidder certifies further it will not maintain or provide for its employees segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location under its control, where segregated facilities are maintained. The Bidder agrees that a breach of this certification is a violation of the equal opportunity clause in this Contract. As used in this certification, the term “segregated facilities” means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion or national origin, because of habit, local custom or any other reason. The Bidder agrees that (except where it has obtained identical certification from proposed Subcontractors for specific time periods) it will obtain identical certifications from proposed Subcontractors prior to the award of Subcontracts exceeding $100,000 which are not exempt from the provisions of the equal opportunity clause, and that it will retain such certification in its files.

(Name of Bidder)

Dated: __________________________  By: __________________________

Name: __________________________

Title: __________________________
U. BREACH OF CONTRACT

Any violation or breach of terms of this contract on the part of the Contractor or its Sub-Contractors may result in the suspension or termination of this contract or such other action that may be necessary to enforce the rights of the parties of this agreement. The duties and obligations imposed by the Contract Documents and the rights and remedies available thereunder are in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

V. TEXTING WHEN DRIVING CLAUSE

In accordance with Executive Order 13513, "Federal Leadership on Reducing Text Messaging While Driving" (10/1/2009) and DOT Order 3902.10 “Text Messaging While Driving” (12/30/2009), FAA encourages recipients of Federal grant funds to adopt and enforce safety policies that decrease crashes by distracted drivers, including policies to ban text messaging while driving when performing work related to a grant or sub-grant.

The Contractor must promote policies and initiatives for employees and other work personnel that decrease crashes by distracted drivers, including policies to ban text messaging while driving. The Contractor must include these policies in each third party subcontract involved on this project.

W. DISADVANTAGED BUSINESS ENTERPRISE (DBE) REQUIREMENTS: the Contractor shall agree to the following:

Contract Assurance (§ 26.13) - The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the recipient deems appropriate.

Prompt Payment (§26.29) - The prime contractor agrees to pay each subcontractor under this prime contract for satisfactory performance of its contract no later than {specify number} days from the receipt of each payment the prime contractor receives from {Name of recipient}. The prime contractor agrees further to return retainage payments to each subcontractor within {specify the same number as above} days after the subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval of the {Name of Recipient}. This clause applies to both DBE and non-DBE subcontractors.
DISADVANTAGED BUSINESS ENTERPRISE DATA

The Respondent will complete the following statement by checking the appropriate box (check one only).

☐ The Respondent assures that it will meet the requirements of the FAA’s DBE Provisions and also the Birmingham Airport Authority's DBE Program and will utilize not less than the prescribed goal of **20%** DBE participation. The DBE assurance stated above is the minimum prescribed goal, however, additional DBE participation is encouraged and the actual DBE contractual commitment will be the percentage of the dollar amounts of participation shown on the validated Letter(s) of Intent submitted by the Contractor. It is understood that the dollar amounts shown on the Letter(s) of Intent are estimates and that actual amounts paid to DBE subcontractors may vary depending on the final adjustments of the estimated quantities; however, the total DBE Commitment may only be modified by Change Order.

☐ The Respondent is unable to assure DBE participation of the prescribed Goal of **20%** in this Contract, but will provide for a minimum of ____ % participation.

(If this box is checked, Respondent may fill in the percentage blanks and document, on a separate attachment to this Assurance, Respondent’s efforts in attempting to meet the Goal as instructed in the section titled “DISADVANTAGED BUSINESS UNAVAILABILITY CERTIFICATION”, and the Birmingham Airport Authority's DBE Policy and Program.)

On all contracts for which a Contract Goal has been established, the Authority will inform all competitors that they will be required to submit DBE participation information to the Authority as part of their Bid. All DBEs must be certified by the Alabama Unified Certification Program (ALUCP) at the time the bids are submitted. Failure of a Respondent to submit a Letter of Intent with the following DBE information stated below in their Bid may render the Bid nonresponsive:

1. The names and addresses of DBE firms that participate in the (Proposed) Contract;
2. A description of the Scope of Work each named DBE firm will perform; and
3. The dollar amount of participation by each named DBE firm.
4. Written documentation of the Respondent’s commitment to use a DBE subcontractor whose participation it submits to meet the contract goal.
5. Written confirmation from the DBE subcontractor that it will be participating in the contract as provided in the Bid.
6. A copy of each named DBE’s certification letter from the ALUCP.

A SEPARATE LETTER OF INTENT FOR EACH DBE FIRM MUST BE COMPLETED AND SUBMITTED WITH THE RESPONDENT’S BID.
LETTER OF INTENT

Name of Respondent’s firm:_______________________________________________________

Address:_____________________________________________________________________

City:_________________________ State:_________ Zip:__________________________

Telephone:_________________ FAX ___________________ E-mail____________________

Respondent’s (Proposed) Contract Amount $ _________________________________

Percentage of (Proposed) Contract Amount performed by Prime Respondent __________%

Name of DBE firm:_____________________________________________________________

Address:_____________________________________________________________________

City:_________________________ State:_________ Zip:__________________________

Telephone:_________________ FAX ___________________ Website:__________________

Identity of DBE (e.g. Hispanic, American Indian, Black, Female, etc.): _________________

Check the appropriate box if the DBE is a material supplier:

☐ Materials and supplies obtained from a DBE Manufacturer (counts as 100% towards goal)

☐ Materials or supplies obtained from a DBE regular dealer (counts as 60% towards goal)

Description of work to be performed by DBE firm:__________________________________________

________________________________________________________________________

Amount of (Proposed) Subcontract $______________

Subcontract Percent of Respondent’s (Proposed) Contract Amount _______ %

COMMITMENT

If awarded this Project, the undersigned Respondent is committed to utilizing the above-named DBE firm for the associated work described.

________________________________________ Date: __________________________

(Signature of Authorized Representative) (Title) (Name of Respondent Firm)

AFFIRMATION

The above-named DBE firm affirms that it will perform the portion of the contract for the scope of work at the estimated dollar value as stated above.

By:________________________________________ Date: _________________________

(Signature of DBE Authorized Representative) (Title) (Name of DBE Firm)

If the Respondent does not receive award of the prime contract, any and all representations in this Letter of Intent and Affirmation will be null and void.

Each contract the authority executes with the respondent (and each subcontract the respondent executes with a subcontractor) must include the following clause:
Contractor's DBE Assurance:

The Contractor or Subcontractor will not discriminate on the basis of race, color, national origin, or sex in the performance of this Contract. Failure by the Contractor to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the recipient deems appropriate.

The word “Contractor”, as used in this Assurance, will mean the same as “Respondent”.

(Name of Respondent)

_________________________________________(Sig)

Signature*

Title: _________________________________

Date: _________________________________

* Must be same signature on Bid Form
LIST OF NON-DISADVANTAGED BUSINESS ENTERPRISE SUBCONTRACTORS / SUPPLIERS

Letter of Intent Non-DBE

LETTER OF INTENT: NON-DBE

Name of Respondent’s firm: ______________________________________________________________________
Address: _______________________________________________________________________________________
City: ___________________________ State: ___________ Zip: ___________
Telephone: ________________ FAX ___________________ E-mail ____________________________
Prime Respondent’s (Proposed) Contract Amount $ ____________________________
Percentage of (Proposed) Contract Amount performed by Prime Respondent _____________%
Name of firm: ______________________________________________________________________
Address: _______________________________________________________________________________________
City: ___________________________ State: ___________ Zip: ___________
Telephone: ________________ FAX ___________________ E-mail ____________________________
Description of work to be performed by firm: _____________________________________________________________________________

_____________________________________________________________________________________________

Amount of (Proposed) Subcontract $ ____________________________________________________________
Subcontract Percent of Respondent’s (Proposed) Contract Amount __________________________% 
Name of firm: ______________________________________________________________________
Address: _______________________________________________________________________________________
City: ___________________________ State: ___________ Zip: ___________
Telephone: ________________ FAX ___________________ E-mail ____________________________
Description of work to be performed by firm: _____________________________________________________________________________

_____________________________________________________________________________________________

Amount of (Proposed) Subcontract $ ____________________________________________________________
Respondent’s (Proposed) Contract Amount _________%
Name of firm: ______________________________________________________________________
Address: _______________________________________________________________________________________
City: ___________________________ State: ___________ Zip: ___________
Telephone: ________________ FAX ___________________ E-mail ____________________________
Description of work to be performed by firm: _____________________________________________________________________________

_____________________________________________________________________________________________

Amount of (Proposed) Subcontract $ ____________________________________________________________
Subcontract Percent of Prime Respondent’s Contract Amount _____________ %
DISADVANTAGED BUSINESS UNAVAILABILITY CERTIFICATION

Respondent: ________________________________

<table>
<thead>
<tr>
<th>Forms of Bid Sought</th>
<th>Disadvantaged Contractor</th>
<th>Type of Work</th>
<th>(Unit Prices, etc.)</th>
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To the best of my knowledge and belief, said disadvantaged Contractor was unavailable (exclusive of unavailability due to lack of agreement on price) for Work on this Project, or unable to prepare a Bid for the following reason(s):

_______________________________

Signature: ___________________________ Date: __________________
Title: _________________________________

I, __________________________________the ___________________ of the
(Disadvantaged Company Name)

(Respondent)

was offered an opportunity to Bid

on the above identified Work on _______________ by _________________________

(Date) (Respondent)

The above statement is a true and accurate account of why I did not submit a Bid on the Project.

Signature: ___________________________ Date: __________________
Title: _________________________________
INFORMATION FOR DETERMINING JOINT VENTURE ELIGIBILITY

Respondent: ____________________________________________________________

INFORMATION FOR DETERMINING JOINT VENTURE ELIGIBILITY
(This form need not be filled in if all joint venture firms are disadvantaged owned.)

1. Name of joint venture: _______________________________________________

2. Address of joint venture: _____________________________________________

   Phone number of joint venture: _________________________________________

4. Identify the firms, which comprise the joint venture.
   (The DBE partner must complete the Equal Opportunity Report Statement attached to the Bid.)

       Describe the role of the DBE firm in the joint venture)

       (Describe very briefly the experience and business qualifications of each non-DBE joint venture.)

5. Nature of joint venture’s business: _____________________________________

   Provide a copy of the joint venture agreement.

7. What is the Claimed percentage of the DBE Ownership? ___________________

8. Ownership of joint venture: (This need not be filled in if described in the joint venture agreement, provided in question 6.)
   (a) Profit and loss sharing ____________________________________________
   (b) Capital contributions, including equipment ____________________________
   (d) Other applicable Ownership interests ________________________________

9. Control of and participation in this Contract: identify (by name, race, sex and firm) those individuals (and their titles) who are responsible for day-to-day management and policy decision-making, including, but not limited to, those with prime responsibility for:
   (a) Financial decisions ______________________________________________
   (b) Management decisions, such as:____________________________________
       (1) Estimating:____________________________________________________
       (2) Marketing and sales:__________________________________________
       (3) Hiring and firing of management personnel:_______________________
       (4) Purchasing of major items or supplies:__________________________
           (c) Supervision of field operations:______________________________

NOTE: If, after filing this disclosure and before the completion of the joint venture’s Work on the Contract covered by this regulation, there is any significant change in the information submitted, the joint venture must inform the Owner, either directly or through the Respondent if the joint venture is a Subcontractor.
NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

Bidder: ____________________________

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

State of: ____________________________
County of: ____________________________

being first duly sworn, deposes and says:

(1) He/She is the ____________________________ (Title) of the Bidder that has submitted the attached Bid;
(2) Such Bid is genuine and is not a collusive or sham Bid;
(3) Neither the said Bidder nor any of its officers, partners, Owners, agents, representatives, employees or parties in interest, including this affidavit, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm or present to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or the refrain from Bidding in connection with such Contract, or has communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or any other Bidder, or to fix any overhead, profit or cost element of the Bid Price or the Bid Price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Owner or any person interested in the proposed Contract;
(4) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, Owners, employees, or parties in interest, including this affidavit; and
(5) The undersigned is duly authorized to give this Affidavit on behalf of the Bidder.

Date: ____________________________ Signature: ____________________________
Name: ____________________________ Title: ____________________________

I, the undersigned, a Notary Public in and for said County in said State, do hereby certify that ____________________________ (Name) whose name as ____________________________ (Title) of ____________________________ (Bidder), a Corporation/Partnership/LLC as ____________________________ (Corporation/Partnership/LLC) is signed to the foregoing instrument and who is known to me, acknowledged before me on this date that being informed of the contents of said instrument, he, as such officer and with full authority, executed the same voluntarily for and as the act of said ____________________________ (Bidder), a Corporation/Partnership/LLC (Corporation/Partnership/LLC) on the Day the same bears date.

Given under my official hand and seal this __________ day of ____________________________ 20 ___.

[NOTARIAL SEAL] Notary Public
My commission expires ____________________________
SECTION F - SAFETY AND SECURITY PROGRAM REQUIREMENTS

See General Requirements Exhibit A for all Safety & Security provisions for this project.

SECTION G - GENERAL REQUIREMENTS EXHIBITS

EXHIBIT 1 - SAFETY AND SECURITY REQUIREMENTS
EXHIBIT 2 - PROPOSED AGREEMENT DRAFT (TO BE ISSUED VIA ADDENDUM)
AIRPORT CONSTRUCTION SAFETY & SECURITY PROGRAM

ARTICLE I:  BAA CONTRACTOR SAFETY AND SECURITY PROGRAM (14 pages)
ARTICLE II: SPECIAL FAA PROVISIONS (12 pages)
ARTICLE III: SAFETY PLAN FOR THE AOA (59 pages)
INTRODUCTION

Purpose Statement:
To provide Contractors with a clear and concise understanding of the safety requirements and responsibilities while working at the Birmingham-Shuttlesworth International Airport as well as to reduce exposures that cause personal injury, property damage, and liability losses due to construction, renovation and demolition of Birmingham Airport Authority (BAA) owned buildings and facilities.

Objectives
The major objectives of the Contractor Safety Program are to:
- Inform Contractors of their responsibilities when working on BAA property.
- Protect employees, tenants, passengers, property, and the environment from potential hazards.
- Comply with all federal and local safety and environmental regulations.

Contractor Responsibilities
- Contractors are expected to implement their own environmental health and safety programs.
- If contracted by a tenant of the Birmingham Airport Authority, the Contractor shall ensure that the BAA Tenant Alteration Form has been completed and approved.
- Prior to starting a project, each Contractor is required to review the work site with a BAA representative and identify hazards that may occur while performing the job.
- The Contractor shall maintain on-site and make accessible an approved copy of the BAA Tenant Alteration Form for the duration of the project.
- Prior to the start of the project, the Contractor shall contact their BAA Project Manager to ensure that all pertinent information for the project including permits, floor plans, utility information and forms have been approved.
- The Contractor shall ensure proper environmental health and safety precautions are followed in accordance with the Occupational Safety and Health Administrations (OSHA) and the Environmental Protection Agency’s (EPA) Code of Federal Regulations (CFR).
- The Contractor shall ensure individuals working at the site are trained and are aware of potential hazards. Contractors shall also ensure that these individuals are provided with proper safety equipment to prevent accidental injury in accordance with OSHA’s CFR.
- The Contractor shall ensure all personnel follow the guidelines of OSHA, EPA, and all BAA policies, in addition to any guidelines of the jurisdiction(s) in which the operations will be performed.
- The Contractor is required to attend a Pre-Construction meeting as arranged by the BAA Project Manager.
- The Contractor shall ensure that any changes to the approved scope of work is submitted in writing to the BAA Project Manager and that written approval is received before the work is performed.
- The Contractor shall ensure that any additional charges, beyond those defined either through contract or agreed upon proposal, are approved in writing by the BAA Project Manager. Failure to obtain pre-approval for additional charges may result in non-payment.

Inspection Authority
Birmingham Airport Authority Staff reserves the right to inspect any worksite at any time to ensure compliance with all rules and regulations as set forth in this document. Failure to adhere to any of the rules and regulations in this document could result in the stoppage of the project until the violations are corrected. Any violations resulting in fines from any agency will be directed to the General Contractor.

Insurance Requirements
Prior to start of work and for the duration of the project the Contractor and any Subcontractors shall maintain the minimum insurance coverage as required by the Birmingham Airport Authority. Minimum Insurance requirements will determined by the project scope.

The Authority shall be notified two (2) weeks prior to cancellation of insurance. The Authority cannot protect the structure against fire, vandalism, theft, or hazards, which may affect the salvage value and makes no warranty in this regard.
The BAA withholds the right to increase coverage requirements based on project specifications, duration, and potential loss.

SECURITY REQUIREMENTS
In accordance with Birmingham Airport Authority policies and Transportation Security Administration (TSA) regulations (49 CFR 1542) all Airport workers (employees, tenants, Contractors, etc.) must obtain and display an identification badge when working on airport property. The Birmingham-Shuttlesworth International Airport is a controlled access facility. NO PERSON may be within a defined Restricted Area or the Airport Operations Area (AOA) without proper Security Identification Display Area (SIDA) badge. Identification media is issued through the BAA Badging Office.

Personnel intrusions or incidents may result in detention of personnel, fines per violation, or arrest of the person(s) under applicable local, state or federal statutes. Any incidents which cause the BAA to be in violation of federal security regulations may subject the BAA to fines from the TSA. Any fines levied against the BAA due to the actions of a Contractor will be passed along to the Contractor.

PERSONNEL ID REQUIREMENTS
All persons working on the AOA or in the Restricted Areas of the Airport are required to have an airport issued SIDA badge displayed at all times above waist level on their outermost garment of clothing. The badge is the property of the BAA and must be surrendered to the badge holder's employer or Airport Operations Department within 24 hours of termination of employment or completion of contract.

General Contractor Requirements:
- Ensuring that all persons within the construction area possess the proper Airport issued ID badge.
- Ensuring a minimum of one person on the job site that has undergone AOA Security training and has been issued an Airport Security SIDA badge with escort privileges.

SIDA Badge
- Badge applicants must complete a Criminal History Records Check (CHRC) / Badge Request Form. The Form must be signed by an approved and authorized sponsor.
- Two (2) forms of acceptable identification must accompany the completed CHRC/ Badge Request Form. A listing of acceptable forms of identification is available at the BAA Badging Office.
- The SIDA badge fee is $60 per badge and must be paid at the time of service and is non-refundable.
- Each badge applicant will be fingerprinted and subjected to a Security Threat Assessment (STA) by the Transportation Security Clearinghouse (TSC).
- The STA and CHRC may take up to two (2) weeks to complete.
- Upon approval of the STA and CHRC, each applicant must successfully complete SIDA training held in the BAA Badging Office. The SIDA training will take approximately 1 to 2 hours to complete.

No Access ID Card
- No Access ID Badge applicants must complete a No Access ID Card Request Form. The Form must be signed by an approved and authorized sponsor.
- Two (2) forms of acceptable identification must accompany the completed No Access ID Card Request Form. A listing of acceptable forms of identification is available at the BAA Badging Office.
- The No Access ID badge fee is $25 per badge and must be paid at the time of service and is non-refundable.
- Each No Access ID badge applicant will be subjected to a Security Threat Assessment (STA) by the Transportation Security Clearinghouse (TSC).
- The STA may take up to two (2) weeks to complete.
- Upon approval of the STA, each applicant must successfully complete No Access ID Card training held in the BAA Badging Office. The No Access ID Card training will take approximately 30 minutes to complete.

Failure to ensure proper ID on all employees while on the AOA or in Restricted Areas of the Airport could result in fines of up to $10,000.
Birmingham Airport Authority Operations Staff will conduct routine patrols of the construction site to ensure compliance with the personnel ID regulations. Any violations resulting in fines from any agency will be directed to the General Contractor.

**VEHICLE ID REQUIREMENTS**

**Absolutely no private vehicles are allowed in the Secured Areas or in the AOA construction areas.** Commercially registered company vehicles only are allowed in the AOA construction areas and must meet the following conditions:

- A company logo affixed to the side of the vehicle. Logos should be visible with characters of contrasting color and easy to read.
- The vehicle must be listed on the insured vehicle listing and covered by the insurance limits as required by the contract.
- All persons within the vehicle must comply with the Personnel ID requirements.
- All vehicles must either be lighted with a flashing amber beacon or flagged during daylight hours and lighted during hours of darkness or reduced visibility in accordance with AC 150/5210-5.
- Flags should be 3 foot square and have a checkered pattern of International Orange and White square at least 1 foot on each side.
- Vehicle lighting should be an amber-flashing beacon visible from any direction including the air.
- Vehicle lighting should be low-intensity with a minimum effective intensity range in the horizontal range of 40 candelas but not more than 400 candelas.
- All persons operating equipment or driving a vehicle inside an AOA construction area must undergo BAA Airfield driver training. Airfield driver training must be scheduled through the BAA Operations Department.
- Unescorted driving privileges outside of the construction areas will be granted to only those persons possessing an Airport Security ID badge and having successfully completed the BAA driver-training program.
- The BAA driver-training program is an interactive training program that utilizes a touch screen monitor and video segments that require the user to correctly answer a series of questions before moving onto the next segment.
- Drivers must remain clear of the Movement Areas of the AOA at all times.
- Penalties for non-compliance with BAA and FAA driver requirements:

**Non-movement area violations:**

1st offense - The violator will receive a written warning and must re-visit the BAA driver training program.

2nd offense - The violator’s driving privileges will be suspended for 30 days along with the completion of the BAA driver training program.

3rd offense - The violator’s driving privileges will be permanently revoked.

**Movement area violations:**

1st offense - The violator’s driving privileges will be permanently revoked along with a possible fine of up to $10,000.

**WORK AREA SECURITY (PUBLIC PROTECTION)**

All Contractors are responsible for the security of their tools, equipment, storage, etc. The Authority provides no protection for loss.

**Contractor Responsibility**

- Each Contractor and/or sub-Contractor is responsible for open gates and doors, fallen fences, etc. Work area and AOA security must be maintained.
- The Contractor is responsible for limiting access through the “Contractors” gates to only those individuals displaying the proper airport issued ID badge and have an official need to be there.
- The person responsible for the security of any open AOA doors or gates must possess an Airport issued Security ID badge.
• All construction work areas outside the airport security fencing should provide protection to the public in the form of work area fencing. This fencing should be a minimum of 6 feet high supported as required to provide adequate public protection. All fencing shall be installed as directed by the BAA Engineer.

**TERMINAL DELIVERIES**
The roadways, both upper and lower levels, at the curb of the terminal building are restricted. No vehicle may be left unattended at these locations for any purpose unless prior approval is gained from the Airport Security Coordinator.

When a Contractor has a need to take delivery of materials, supplies, etc. at the airport, the following procedures should be followed:

- Contact the Airport Operations supervisor at 205-599-0518 at least 48 hours prior to the delivery to make arrangements.
- Deliveries should be made to the ramp via field gate #44 at the end of Airline Drive.
- BAA Operations will meet delivery vehicle and escort same to a pre-determined delivery point.
- Contractor must have a badged representative meet the delivery at the delivery point and assume the SIDA escort of the delivery personnel.
- Once delivery has been completed, Contractor should contact BAA Operations at 205-599-0519 to request an escort for the delivery vehicle to exit the field.
- All vehicles and persons entering the Secured Area are subject to search.
- No firearms, weapons or other prohibited items are allowed in the Secured Area. Violators are subject to fines.

Deliveries will only be allowed on the curb in front of the Terminal if the item delivered is too large to fit on the service elevator. In that case:

- Contractor must contact the Airport Operations supervisor at 205-599-0518 at least 48 hours prior to the delivery to make arrangements.
- Delivery must be made at night after all flight activity has ceased. Typically between the hours of midnight and 4:30 am.
- Contractor must arrange for an attendant to remain with the delivery vehicle for the duration of the time it is located on the curb.
- Vehicle may remain on the curb only for the duration of the unloading process. Once the unloading is completed, the vehicle must leave the curb area.
- All vehicles approaching the curb are subject to search.

**AIR OPERATIONS AREA - AOA**
The Air Operations Area (AOA) for this context is defined as the area of the Airport used or intended to be used for the taxiing, landing, taking off, or surface maneuvering of aircraft and any contiguous area within the perimeter fence of the Airport. Construction activities within the AOA require extra ordinary precautions and must be accomplished in accordance with the most current version of AC 150/5370 Operational Safety on Airports During Construction. All work within the AOA must be coordinated with the BAA Operations Department.

Limitations on Construction

- Open flames are prohibited unless adequate fire and safety precautions have been taken. Contractor shall comply with NFPA regulations.
- Stockpiling of materials shall be constrained in a manner to prevent movement resulting from jet blast or wind conditions in excess of 10 knots.
- Contractor’s storage and staging area: The Contractor shall store all materials and equipment (when not in use) in the designated areas. Material will be stored on blocking clear of contact with the ground.
- Open trenches, excavations and stockpiled material at the construction site shall be prominently marked with barricades marked with diagonal orange and white stripes with flashing red light units (acceptable and approved by the FAA and BAA) during hours of darkness and or restricted visibility.
• The Contractor shall not use any access or haul roads other than those approved by the Airport. Special attention should be paid to ensure that all Emergency Response vehicles have the right of way and that access is not impeded at any time.
• The Contractor shall be responsible for the removal and/or disposal of hazardous waste generated from the project. Hazardous waste generated from the project must be removed and disposed of in accordance with federal and local regulations.
• All Contractors performing inspections, construction, and repairs at the Birmingham-Shuttlesworth International Airport are to comply with the requirements of this manual. Failure to adhere to these requirements may result in an immediate shutdown of the work site and a breach of contract with the Birmingham Airport Authority.

ESCORT REQUIREMENTS
Vehicles not authorized to operate on the movement areas of the AOA must be escorted. The coordination of escorts is accomplished through the BAA Project Manager and Airport Operations Department. The following restrictions shall apply to Vehicle escorts:
• No vehicles will be escorted onto the movement areas during times of peak aircraft traffic.
• No more than 2 vehicles shall be escorted at one time unless there is an escort vehicle in lead and in trail with the convoy.

Unauthorized entry or crossing of active taxiways or runways could result fines to the Contractor of up to $10,000.

DRESS CODE
An employee’s uniform and/or company identifying clothing aid in the identification of outside Contractors enhance Airport security and promote the professional image of the Airport.

The Contractor shall ensure that:
• All Employee shirts/blouses/ vests/ jackets/ coveralls have their employer’s company identifying logo or company name on the garment.
• Clothing shall be neat and clean at the start of each shift and worn in the normal manner.
• Shirts will normally be buttoned and shirttails tucked in.
• Pants will be worn at the waist.
• Clothing must not have statements, pictures, or language that is racial, obscene, or promotes negative connotations.
• Footwear must be appropriate for the task being performed.

BARRICADING AND FENCING
The Contractor is responsible for maintaining a safe and accessible path-of-travel for all pedestrians, including those with disabilities, around and/or through construction sites. Barricades act as warning devices, alerting others of the hazards created by construction activities, and should be used to control traffic, both vehicular and pedestrian, safely through or around the work site.

Barricades and signage shall be used wherever necessary for the physical protection of people or property.

The Contractor shall:
• Erect and maintain for the duration of the Contract proper barricades including fencing material, traffic cones, A-frames, caution tape and temporary curb ramps complying with all access codes and regulations at all closed crosswalks and existing closed curb ramps.
• Obtain all applicable permits required by the regulations.
• Furnish, erect, and maintain all necessary signs, barricades, lighting, fencing, bridging, and flaggers that conform to the requirements set forth by the BAA Project Manager.
• Ensure that no construction materials be stored and/or placed on the path-of-travel.
• Maintain the construction barriers in a sound, neat, and clean condition.
• Not occupy public sidewalks except where pedestrian protection is provided.
• The Contractor shall not obstruct free and convenient approach to any fire hydrant, alarm box, or utility box.
• Remove barriers and enclosures upon completion of the work in accordance with applicable regulatory requirements and to the satisfaction of the owner.
• Provide protection for pedestrians consistent with all local and federal codes, including the Americans with Disabilities Act.

CONFINED SPACE ENTRY
It is the responsibility of the Contractor performing confined space entry activities at the Birmingham-Shuttlesworth International Airport to protect workers from toxic, explosive, or asphyxiating atmospheres, and from engulfment when working in and around confined spaces. Types of confined space entries include, but are not limited to: Manholes, HVAC systems, crawlspaces, pits, and tanks.

The Contractor shall:
• Identify permit-required confined spaces.
• Evaluate each confined space for potential hazards.

Control potential hazards with the following measures:
• Mechanical - Use proper lockout/tagout procedures when needed to prevent hazards within the confined space.
• Ventilation - If exposed to harmful vapors or an oxygen deficient atmosphere exists; a ventilation fan shall be used for the duration of the job.
• To prevent an explosion, do not use equipment that may cause flame or sparks in an oxygen-enriched atmosphere.
• Personal protective equipment (goggles, gloves, dust mask, respirator) shall be worn when a potential hazard exists.
• Coordinate entry operations with the BAA Project Manager when employees are working in or near the area.
• Inform the BAA Project Manager of entry procedures that will be followed and of any hazards identified or created.
• Provide documentation of their company’s entry procedures to the BAA Project Manager and the BAA Operations Department before work begins.

In the event of an emergency requiring entry rescue services, the attendant shall immediately CALL 911. In the event of an emergency that requires non-entry rescue services the attendant shall immediately call the BAA Operations Center at (205) 599-0519.

INDOOR ENVIRONMENTAL QUALITY
It is the Contractor's responsibility to minimize the impact construction-related activities have on indoor environmental quality at the Birmingham-Shuttlesworth International Airport.

Prior to performing construction-related activities including repair projects, Contractors shall eliminate or minimize any potential contaminant/physical agent exposures by implementing the following procedures:
• Maintain good housekeeping habits to contain dust and construction debris. Use a dust collector or filtered vacuum to minimize re-circulation of contaminants.
• Implement engineering controls; such as dilution or local exhaust ventilation and isolation of mechanical systems.
• Install critical barriers made of polyethylene sheeting on doors, windows, vents, etc. in order to isolate the specific work area.
• To minimize dust, use wet methods when appropriate.
• Use the least toxic material suitable for the application (for example, latex paint rather than oil-based).
• Communicate with BAA Project Manager to implement effective strategies (for example, working off hours) to minimize occupant exposure.
• Relocate sources of contamination (for example, a generator or tar kettle) away from the building air intake.
LOCKOUT / TAGOUT
It is the Contractor’s responsibility when performing lockout/tagout activities at the Birmingham-Shuttlesworth International Airport to ensure all persons potentially affected by de-energizing or re-energizing of building systems are properly protected and notified.

Hazardous energy must be isolated or locked and tagged out before servicing and/or maintenance activities are performed. The following types of hazardous energies are typically found at the Birmingham-Shuttlesworth International Airport:

- Electrical
- Pneumatic
- Mechanical
- Thermal
- Hydraulic
- Chemical

The Contractor is responsible for the following:

- Having a lockout/tagout program prior to performing work.
- Communicating their lockout/tagout program with the BAA Maintenance Department.
- Coordinating with BAA representatives prior to performing lockout/tagout activities.
- Providing their own lockout/tagout equipment that meet OSHA standards.
- Performing lockout/tagout activities in accordance with OSHA standards and the BAA Lock-Out/Tag-Out program.
- Following special procedures for jobs requiring multiple lockout devices and those involving shift or personnel changes.

FALL PROTECTION
Contractors working at elevated locations must provide their employees with fall protection. Potential activities requiring fall protection may include working on:

- Portable and fixed ladders
- Aerial lifts
- Scaffolds
- Roofs
- Elevated work locations and platforms

Contractors have the responsibility to:

- Reduce the hazards associated with falls.
- Control fall hazards first through engineering controls.
- Institute personal fall arrest systems, administrative controls and training when engineering controls are not feasible.
- Have a formal fall protection program in accordance with OSHA requirements.
- Have the necessary fall protection equipment to safely perform the job.
- Have workers properly trained in the use of fall protection equipment.

HOT WORK PERMIT
It is the Contractor’s responsibility to obtain a hot work permit when performing hot work activities at the Birmingham-Shuttlesworth International Airport. The hot work permit is designed to reduce the potential of an uncontrolled ignition of materials in a hot work area.

Hot work is any activity that creates heat, flame, sparks, or smoke. Examples of hot work include but are not limited to:

- Brazing
- Cutting
- Grinding
- Soldering
- Gas or Arc welding
- Torch-applied roofing
Hot work permits are not required during the construction of new facilities or renovations of unoccupied existing facilities.

The Contractor is responsible for the following:

- Understanding and complying with the BAA hot work permit program.
- Having trained employees and approved fire prevention equipment on site prior to performing work.
- Obtaining a hot work permit from the BAA Director of Facilities prior to the commencement of any hot work activity. To obtain a hot work permit contact the BAA Director of Facilities at (205) 599-0545 at least (24) hours before beginning any hot work activities.
- Acquiring a hot work permit prior to performing hot work within: Occupied existing facilities, 35 feet of a building, combustible materials or potential hazard such as a fuel storage tank, and confined spaces regardless of location.
- Coordinating with the BAA Project Manager and the BAA Operations Department the temporary shutdown of localized fire systems to prevent possible fire alarm activation and disruption of normal business operations.
- Posting the hot work permit at the job site in an accessible and conspicuous location.
- Submitting the hot work permit to the BAA Project Manager or Director of Facilities at the completion of the activity.
- Conducting their hot work activities in a sound fire safe manner and following the precautions outlined on the hot work permit.
- Assuring that a firewatcher remains on the job for 60 minutes after the completion of the hot work activity.

SCAFFOLDING / LADDERS

Before undertaking any projects of repair, renovation or construction, that may require the use of scaffolding or ladders, Contractors shall:

- Understand and comply with the BAA Contractor Safety Program.
- Ensure all employees have received training in compliance with federal and local regulations.
- Contact the BAA Project Manager with questions regarding scaffolding or ladder safety and required precautions.

The Contractor shall ensure that scaffolding be:

- Erected and dismantled by competent workers, under the supervision of knowledgeable and experienced supervisors.
- Erected on sound and rigid footing, capable of carrying the maximum intended load without settling or displacement.
- Securely fastened with all braces, pins, screw jacks, base plates and other fittings installed as required by the manufacturer.
- Limited to authorized personnel only, especially after working hours.
- Equipped with standard guardrails and toe boards on all open sides and ends of platforms.
- Provided with a screen between the toe board and the guardrail, where persons are required to work or pass under the scaffold.
- Replaced or repaired immediately if scaffolding and accessories have any defective parts.
- Provided with an access ladder or equivalent safe access.

The Contractor shall ensure that the planking be:

- Scaffold grade or equivalent.
- Overlapped a minimum of 12 inches or secured from movement.
- Extended over their end supports not less than 6 inches or more than 12 inches.

The Contractor shall ensure:

- Barricades are erected whenever scaffolding or ladders are in use to prevent public access and for public protection.

PERSONAL PROTECTIVE EQUIPMENT

Contractors shall provide their employees with personal protective equipment including:
• Protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices,
  and protective shields and barriers, shall be used wherever it is necessary by reason of hazards of
  processes or environment, chemical hazards, radiological hazards, or mechanical irritants
  encountered in a manner capable of causing injury or impairment in the function of any part of the
  body through absorption, inhalation or physical contact.
• Provide training to each employee who is required to use PPE.

HAZARD COMMUNICATION
The Contractor shall:
• Maintain and have accessible copies of Material Safety Data Sheets (MSDSs) for hazardous
  chemicals brought onto BAA property.
• Before use, forward MSDSs of hazardous materials to the BAA Project Manager for review.
• Maintain an effective hazard communication program.
• Use and store all hazardous or flammable chemicals, liquids, or gases brought onto the project site
  in approved containers conforming to applicable federal and local codes.
• Secure permits, if applicable, for the temporary storage of hazardous materials on the project site.
• Ensure that spills of hazardous materials are contained and cleaned-up immediately and that all
  necessary means and materials are maintained at the work site to accomplish this task.
• Notify the BAA Operations Department at (205) 599-0519 and the Project Manager immediately of
  a hazardous material spill.
• In the event the Contractor encounters a hazardous material on the project site (i.e., asbestos,
  lead, PCBs), which has not been rendered harmless, the Contractor shall report the condition to the
  Project Manager.

RED TAG PERMIT FOR FIRE SUPPRESSION SYSTEMS
Projects of repair, renovation or construction often require the disabling or alteration of automatic sprinkler
and other fire safety systems. The Red Tag Permit Program is a system approved by the BAA and designed as
a method of managing life safety (i.e. sprinkler system) impairments in BAA owned buildings in the event the
systems must be temporarily taken out of service for repairs or replacement.

Before undertaking any projects of repair, renovation or construction, that may require the disabling or
alteration of a sprinkler system in a BAA owned building, Contractors shall:
• Plan to utilize temporary protection (i.e. fire extinguishers or charged lines).
• Schedule any work that involves the disabling or alteration of sprinkler systems to be done during
  non-peak times.
• Restrict all Hot Work in the affected area.
• To obtain a Red Tag Permit contact the BAA Director of Facilities at 205-599-0545.
• Fill out the approved Red Tag Permit, following all instructions, and forward a copy to the BAA Project
  Manager, Director of Facilities and Operations Center.
• Place a FIRE PROTECTION OUT OF SERVICE tag on the isolated system.
• Promptly restore fire protection equipment to automatic service following completion of work.
• Conduct any tests to ensure the system has been fully recharged.
• Lock the system back open.
• Reset any notification systems (i.e. alarm systems).
• Complete the Red Tag and immediately notify the Project Manager and the Operations Center of
  the project completion.

HAND AND POWER TOOL SAFETY
Each Contractor shall be responsible for the safe working conditions of tools and equipment used by its
employees which may include but are not limited to hand and portable power tools and other hand-held
equipment. Prior to performing activities related to repair, renovation, or construction projects, Contractors
shall eliminate or minimize any potential unsafe tools or equipment by implementing the following
procedures:
• Each employer shall be responsible for the safe condition of tools and equipment used by its
  employees.
• Tools shall be inspected at regular intervals and shall be repaired in accordance with the manufacturers' specification.
• Power tools shall be maintained in accordance with the manufacturers’ specifications.
• Appropriate personal protective equipment should be worn due to hazards that may be encountered while using portable power tools and hand tools.
• Tools should only be used for their intended purposes.
• All employees should receive instruction on regulations and the safe use of each power tool.
• Owner’s manuals including manufacturers’ specifications and suggested work practices should be kept on-file and made available upon request to all employees required to use the equipment.

ELECTRICAL SAFETY
Construction activities frequently impact electrical systems as part of the planned work activity. Such activities include, but are not limited to:

• Installation of electrical systems, components, machinery, and equipment
• Alterations of electrical systems, components, machinery, and equipment
• Maintenance of existing systems and equipment
• Demolition of existing systems
• Temporary planned outages
• Tests and diagnostics

Prior to performing activities related to repair, renovation, or construction projects potentially impacting electrical system components and energized or non-energized machinery, equipment, parts, or systems, Contractors shall:

• Identify any potential sources of electrical energy likely to cause death, injury, or serious physical harm.
• Notify the BAA Project Manager of impact activities prior to the start of work.
• Coordinate planned outages with the BAA Project Manager.
• Ensure all employees performing impact activities have received sufficient training in compliance with federal and local regulations.
• Ensure all employees are provided adequate personal protective equipment as required by regulations.
• Ensure all work is performed in accordance with the guidelines of federal and local regulations and the BAA Lock-Out / Tag-Out Program.
• Ensure all affected employees, Contractors, and tenants are notified through the BAA Project Manager prior to impacting building electrical systems.
• Follow Lock-Out/Tag-Out procedures for the Control of Hazardous Energy as specified in the OSHA 29 CFR 1910.147 Standard, and in the BAA Contractor Safety Manual (Section 5).

POWERED INDUSTRIAL LIFT TRUCKS
Powered Industrial Lift Trucks include but are not limited to: fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines.

Prior to allowing employees access to job sites where industrial lift trucks are used, Contractors shall ensure:

• Vehicles are inspected daily.
• Employees obey all safe operating procedures.
• Any power-operated industrial truck not in safe operating condition shall be removed from service.
• All repairs shall be made by authorized personnel.
• No person shall be allowed to stand or pass under the elevated portion of any truck, whether loaded or empty.
• Unauthorized personnel shall not be permitted to ride on powered industrial trucks.
• Operators will sound the horn and use extreme caution when meeting pedestrians, making turns, and traveling through doors.
• When loading trailers, dock plates will be used. Operators will assure dock plates are in good condition and will store on edge when not in use.
• Operators are instructed to report all accidents, regardless of fault and severity.
• All employees are trained in the operation and handling in accordance with federal and local regulations.

HAZARDOUS WASTE
To inform Contractors of their responsibilities when handling, storing, transporting, and disposing of hazardous wastes generated at the Birmingham – Shuttlesworth International Airport it is the responsibility of the Contractor to perform these activities in accordance with the Birmingham Airport Authority’s Hazardous Waste Management Program (HWMP).

With the enactment in 1976 of the Resource Conservation and Recovery Act (RCRA), the transportation, handling, storage, and disposal of hazardous wastes became regulated under federal, state and local laws. The Environmental Protection Agency (EPA) and the local jurisdictions have developed regulations for compliance with RCRA. Responsibility for compliance with hazardous waste regulations begins with the person generating the waste material and follows through to disposal.

RCRA defines a hazardous waste as a solid waste that because of its quantity, concentration, physical, chemical, or infectious characteristics may cause or significantly contribute to an increase in serious, irreversible, or incapacitating reversible illnesses or pose a substantial, present or potential hazard to human health, safety, or welfare to the environment when improperly treated, stored, transported, used, disposed of or otherwise managed. Examples of hazardous wastes associated with the construction industry include, but are not limited to: adhesives, cements, lubricants, spill residues, used oil, cleaning supplies, solvents, paints, paint thinners, and empty cylinders.

Prior to performing activities related to repair, renovation, or construction projects potentially impacting or generating hazardous waste, Contractors shall:
• Identify any potential hazardous wastes associated with the planned work activity.
• Implement their own Hazardous Waste Program.
• Implement their own employee-training program for the specific materials identified in compliance with local and federal regulations.
• Contact the BAA Project Manager regarding the transportation, handling, storage, and disposal of all solid and hazardous wastes potentially generated as part of the proposed work activities.
• Ensure no wastes are abandoned in place.
• Notify the BAA Project Manager prior to the transportation, handling, storage and disposal of all solid and hazardous wastes potentially generated as part of the proposed work activities.
• Comply with all local and federal regulations and the BAA HWMP.
• Forward copies of all transportation, handling, storage, and disposal records including but not limited to Hazardous Waste Manifests, DOT Permits, and Disposal or Recycling certificates to the BAA Project Manager.

SPILL PREVENTION CONTROL AND COUNTERMEASURE (SPCC)
Management of all fuel or oil in containers 55 gallons or greater in size shall by conducted in accordance with the Spill Prevention Control and Countermeasure (SPCC) requirements of Code of Federal Regulations, Title 40, Part 112 (40 CFR 112).

Some general requirements are as follows:
• All containers shall be in good condition without significant rusting, pitting, or other evidence of deterioration or damage.
• Berms and/or other barriers shall be used to protect stored fuel and oil containers from damage due to construction activities.
• Adequate secondary containment shall be provided for all containers.
• Containers of fuel and oil shall be located on level and stable ground and not in close proximity to storm sewer drains or inlets.
• Area lighting shall be sufficient to discover discharges occurring during the hours of darkness and to prevent discharges from occurring through acts of vandalism.
• All containers shall be properly labeled with Contents, NFPA Hazmat Diamond signs, and “No Smoking” signs.
• All tanks shall be double walled and at least 110% secondary containment of the primary tank.
• Tank openings shall be securely capped and/or locked when not in use.
• Motor control of fuel dispensing shall be locked in the off position, except when fueling is being conducted and will be inaccessible to unauthorized personnel.
• A spill kit with sufficient sorbent, booms, and other clean up material shall be located in close proximity to each fuel tank or drum. The spill kit shall be sized to prevent all potential discharges related to the fuel tank or fuel loading activities from reaching storm inlets.
• Regular bi-weekly inspections shall be conducted to inspect containers of fuel and oil that are 55 gallons or greater in size for signs of damage, deterioration, and oil discharges. Deficiencies shall be promptly remedied.

EROSION AND SEDIMENT CONTROL
Each Contractor shall be responsible for minimizing erosion and sediment transport on all excavation type projects to ensure compliance with the City of Birmingham’s rules as well as the permit requirements administered by the Alabama Department of Environmental Management (ADEM). Prior to any excavation project on any BAA owned properties with a planned disturbance of greater than 1 acre or sites that are less than 1 acre, but have the potential to have an adverse impact on downstream water quality Contractors shall ensure:
• An Erosion and Control Best Management Practices (BMP) plan is submitted to the BAA Project Manager.
• All necessary local state and federal permits are obtained and maintained.
• Conduct an initial on-site walkthrough inspection of site BMPs with the BAA Project Manager to ensure that all BMPs are installed in accordance with the approved Erosion and Sediment Control BMP plan.
• Conduct site inspections after each significant rainfall event or a minimum of once per week.
• Document failures / deficiencies in BMPs on site and communicate those deficiencies to the BAA Project Manager.

USE OF FIRE HYDRANTS
Unless directed otherwise by authorized BAA personnel, fire hydrants are ONLY to be used for fire service and are NOT to be used for construction activities including, but not limited to watering of sod, filling of barricades, water blasting, drilling, core borings, etc.
In order to use a hydrant for construction activities, the Contractor must obtain a meter and permit from Birmingham Water Works Board (BWWB). Per the BWWB, the steps to obtaining a meter and permit are as follows:
1. Obtain permit from City Hall ($25.00 – 3 month interval)
2. Carry a copy of the permit to the call center
3. Pay $1,200 deposit
4. Carry permit to meter shop and receive a 3” meter with backflow device
5. Turn meter back in when finished or at the end of the three month interval (account can be pro-rated)

Please contact BWWB for additional information or clarifications.

ACCOUNTABILITY
Contractors will be responsible for complying with the above guidelines and for communicating the information to their employees and Subcontractors. This includes the implementation of policies and procedures. All work shall be performed in accordance with all applicable laws and regulations.
SECTION F - ARTICLE II: SPECIAL FAA PROVISIONS

SPECIAL FAA PROVISIONS:
CONSTRUCTION SAFETY AND SECURITY REQUIREMENTS
FOR AIRSIDE & NON-AIRSIDE PROJECTS

NOTE: This section also applies to non-airside projects that may impact aircraft traffic at
the Birmingham-Shuttlesworth International Airport

NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

Prior to the start of construction, the Contractor shall be required to notify the FAA of construction at the
Airport for the Project. Within ten (10) days after the receipt of the written Notice of Intent to Award from the
Owner, the Contractor shall coordinate with the Engineer and Owner to complete and submit FAA form
7460-1, Notice of Proposed Construction or Alteration. The notification process is required forty-five (45) days
before construction begins. No construction equipment or machinery shall be permitted on the Airport
property without prior approval from the FAA and the Owner. Once the FAA completes their study, they shall
submit to the Contractor a letter of determination. The Contractor must oblige by all requirements stated in
the FAA letter of determination.

RESTRICTIONS REGARDING AIR OPERATIONS AREA

The Contractor shall control its operations and the operations of its Subcontractors and Suppliers so as to
provide for the free and unobstructed movement of aircraft in the Air Operations Area (AOA) of the Airport.
When the Work requires the Contractor to conduct its operations within the AOA, the Work shall be
coordinated with the Owner's Operations Department (through the Engineer and OAR) at least seventy-two
(72) hours prior to commencement. The Contractor shall not close an AOA until authorized by the OAR and
until the necessary temporary markings and Lighting are in place as provided in Subsection 4 of this Section
00220, AOA CLOSURES.

CONTRACTOR OPERATIONS ON THE AOA

Aircraft traffic will continue to use existing Runways, aprons, and Taxiways of the Airport during the time that
Work under the Contract is being performed. The Contractor shall at all times conduct its Work so as to
create no hindrance, hazard or obstacle to aircraft using the Airport and must, at all times, conduct the
Work in conformance with requirements of the Owner and the FAA Chief Control Tower Operator or
authorized representatives.

The Contractor shall identify each motorized vehicle or piece of construction equipment in conformance to

All Runways, Taxiways, and aprons which have been used by the Contractor's vehicles or equipment shall
be returned to the condition existing prior to any closing or crossing and prior to the reopening of these
areas to aircraft traffic. All existing wooded or grassed areas beyond the limit of Work damaged by the
Contractor's operations shall be restored to its original condition by the Contractor.

If the Contractor is given approval to perform Work at night, the Contractor shall provide lights at the Work
site and along the access route. Type, direction, number and location of lights shall be subject to the
approval of the Owner and FAA Chief Control Tower Operator.

Open flame type lighting is prohibited on the AOA.

AOA CLOSURES

If absolutely essential, in order to permit construction, Runways or Taxiways may be closed to aircraft
operations during periods when weather or other conditions do not require its use by aircraft, upon advance
written application by the Contractor to the Owner and Engineer on a form to be provided by the Owner.
The Contractor will schedule and organize its Work so that a minimum of closings or crossing of Runways and
Taxiways will be required during the performance of the Work.
When the Work requires closing an AOA of the Airport or portion of such area, the Contractor shall furnish, erect and maintain temporary markings and associated lighting conforming to the requirements of the current edition FAA Advisory Circular 150/5340-1, Marking of Paved Areas on Airports.

NAVAIDS AND OTHER SIGNALS

There are installed on the Airport FAA NAVAIDs or Owner NAVAIDs and other electronic and visual signals (hereinafter collectively NAVAIDS) which may include but not be limited to, ASR, UHF, NDB and VHF Receivers and Transmitters, National Weather Service Facilities, Lighting, electric cables and controls relating to such NAVAIDs and facilities and other electric power cables serving other facilities. Such NAVAIDs, National Weather Service and other facilities and electric cables must be fully protected during the entire construction time. Work under this Contract can be accomplished in the vicinity of these facilities and cables only at approved periods of time, which approval is subject to withdrawal at any time because of changes in the weather, emergency conditions on the existing airfield areas, anticipation of emergency condition and for any other reason as determined by the Engineer and OAR acting under the orders and instructions of the Owner or the designated FAA representative. Any instructions to the Contractor to clear any given area, at any time by the OAR, Engineer, the Owner’s Director of Operations or the Air Traffic Control Tower (by radio or other means) shall be immediately executed. Construction Work will be commenced in the cleared area only when additional instructions to this effect are issued.

To the extent that they are known, the approximate locations of NAVAIDs, National Weather Service and other facilities have been indicated on the Contract Drawings. The Owner does not warrant or guaranty the accuracy or completeness of the location information relating to NAVAIDs, National Weather Service and other facilities appearing on the Contract Drawings. Any inaccuracy or omission shall not relieve the Contractor of its responsibility to protect such existing facilities from damage or unscheduled interruption of service.

Power and control cables leading to and from any NAVAIDs, National Weather Service and other facilities will be marked in the field by the Contractor, before any Work in its general vicinity is started. Thereafter, through the entire time of this construction, they shall be protected from any possible damage.

These special provisions intend to make perfectly clear the need for protection of FAA NAVAIDs, National Weather Service and other facilities and cables by this Contractor at all times.

The Contractor shall immediately repair at its expense, with identical material by skilled Workers, any underground cables serving FAA NAVAIDs, National Weather Service and other Airport facilities, which are damaged by its Workers, equipment or Work. Prior approval of the FAA must be obtained for the materials, Workers, time of Day or night, method of repairs, or for any temporary or permanent repairs the Contractor proposes to make to any FAA NAVAIDs, National Weather Service facilities or other cables and controls serving such NAVAIDs and facilities which are damaged by the Contractor. Prior approval by the Owner must be obtained for the materials, Workers, time of Day or night, method of repairs for any temporary or permanent repairs the Contractor proposes to make to any of the Airport facilities and cables damaged by the Contractor.

FAA REQUIRED PROVISIONS

- The Contractor will not erect or permit the erection on the Airport property of any permanent or temporary structure or facility which would interfere materially with the use, operation or future development of the Airport, or permit the generation of electronic emissions that would interfere with communications and navigation by aircraft using the Airport.

- This Contract confers no right upon the Contractor to use any landing area or air navigation facility at the Airport, and hence, nothing contained in this Contract shall be construed to grant, or to authorize the granting of, an exclusive right for the use of any such landing area or air navigation facility in violation of Section 00308 of the Federal Aviation Act of 1958.
• The Contractor will not erect or permit the erection on the Airport property of any permanent or temporary structure or facility which would interfere materially with the use, operation or future development of the Airport, or permit the generation of electronic emissions that would interfere with communications and navigation by aircraft using the Airport.

• This Contract confers no right upon the Contractor to use any landing area or air navigation facility at the Airport, and hence, nothing contained in this Contract shall be construed to grant, or to authorize the granting of, an exclusive right for the use of any such landing area or air navigation facility in violation of Section 00308 of the Federal Aviation Act of 1958.

• The Contractor shall comply with all applicable FAA regulations concerning Airport security.

• The Contractor expressly agrees for itself, its successors and assigns, to provide the Owner with background checks to the extent allowable by law, for any employee of the Contractor or any of its Subcontractors, who have unescorted access to any area of the Airport controlled for security reasons. Said background checks shall include, but not be limited to, references and prior employment histories, to the extent necessary to verify representations made by the Contractor and its employees concerning all such employees, relating to employment in the preceding ten (10) years.

• The Contractor shall not, in its operations hereunder, generate any odors, fumes, smoke, noise, glare, vibration, electronic emissions, soot, dust or atmospheric pollution, sewage, industrial or other wastes, in violation of any applicable law, regulation or procedure of any Federal, state, county or city authority having jurisdiction with respect to such matters.

• The Contractor expressly agrees for itself, its successors and assigns, to restrict the height of structures, objects of natural growth and other obstructions on the Airport to such a height so as to comply with Federal Aviation Regulations, Part 77.

• The Contractor agrees for itself and its Subcontractors to require any lights on the Airport to be constructed, focused or arranged in a manner that will prevent the lights from casting beams in an upward direction so as to interfere with the vision of pilots in aircraft.

• If the FAA determines that any right or Claim of right in or to the property herein creates an undue risk or interference with the operation of the Airport or the performance of or compliance with any covenants and conditions to which the use of the Airport is subject, said right or Claim shall be extinguished or modified in a manner acceptable to the FAA.

• The Contractor shall allow any authorized representative of the FAA to inspect and review any Work or materials used in the performance of this Contract.

**INSPECTION BY OTHERS**

Jefferson County Environmental Services shall be notified before work commences on their right-of-way. All excavation, blasting and sanitary sewer encasement will be subject to inspection by Jefferson County Environmental Services. Such inspections shall not be construed so as to make Jefferson County Environmental Services a party to this Contract and shall not interfere with the performance of the obligations of any party to this Contract.

**USE OF SITE**

Personal vehicles of employees and vehicles operated by vendors of goods or services will not be permitted beyond the Contractor’s parking area.

No signs shall be placed on the site, nor shall any photographs be taken without the Owner’s prior written consent. No visitors other than persons engaged in the Work shall be permitted on the construction site without the Owner’s prior written consent.

**BARRICADES, WARNING SIGNS AND HAZARD MARKINGS**

For Work on the AOA, the following requirements are in addition to those prescribed in
Section “Safety Plan for the Air Operations Area”.

The Contractor shall furnish, erect and maintain markings and associated lighting of open trenches, excavations, temporary stock piles and parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the Airport in reasonable conformance to the latest edition of FAA Advisory Circular 150/5370-2, Safety on Airports During Construction included as section 00202 of the specifications.

The Contractor shall furnish and erect all barricades, warning signs, and marking for hazards prior to commencing Work which requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their dismantling is approved in writing by the Owner.

All cranes used on the site shall be marked in the following manner:

During **Daylight** hours, a flag shall be installed at the highest point of the equipment. The flag shall be aviation surface orange and be a minimum of five (5) feet square. During **non-Daylight** hours, at least one steady burning light should be installed at the highest point of equipment on a horizontal plane in a manner to insure unobstructed visibility of aircraft at any normal angle of approach. The obstruction light shall be enclosed in aviation red obstruction light globe of at least 116 watts (when used in multiple circuits) with an intensity of not less than 32.5 foot-candles. If the crane boom is lowered to the ground at night, obstruction lights will not be required.

**CONTRACTOR’S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS**

For Work on the AOA, the following requirements are in addition to those prescribed in the Safety Plan for the Air Operations Area.

The Contractor shall cooperate with the Owner of any public or private utility service, FAA or NOAA, or a utility service of another governmental agency that may be authorized by the Owner to construct, reconstruct or maintain such utility services or facilities during the progress of the Work. In addition, the Contractor shall control its operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA or National Oceanic and Atmospheric Administration (NOAA) facilities, or utility services of other governmental agency are known by the Owner to exist within the limits of the Contract Work, the approximate locations have been indicated on the Contract Drawings.

It is understood and agreed that the Owner does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of its responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the owners of all utility services or other facilities of its plan of operations. Such notification shall be in writing addressed to THE PERSON TO CONTACT as provided hereinbefore in this subsection and the subsection titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the Engineer.

In addition to the general written notification hereinbefore provided, it shall be the responsibility of the Contractor to keep such individual owners advised of changes in its plan of operations that would affect such owners.

Prior to commencing the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such owner of his/her plan of operation. If, in the Contractor’s opinion, the owner's assistance is needed to locate the utility service or facility or the presence of a representative of the owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's PERSON TO CONTACT no later than two normal business days prior to the Contractor’s commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the Engineer.
The Contractor’s failure to give (48) hours’ notice hereinabove provided shall be cause for the Owner to suspend the Contractor’s operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use excavation methods acceptable to the Engineer within 3 feet (90 cm) of such outside limits at such points as may be required to ensure protection from damage due to the Contractor’s operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the Engineer and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the Engineer continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to his/her operations whether or not due to negligence or accident. The Owner reserves the right to deduct such costs from any monies due or which may become due the Contractor, or its surety.

FACILITIES AND CABLE RUNS

The Contractor is hereby advised that the construction limits of the project include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the prosecution of the project work, shall comply with the following:

1. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

2. The Contractor shall notify the above named FAA Airway Facilities Point-of-Contact seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

3. If prosecution of the project work requires a facility outage, the Contractor shall contact the above named FAA Point-of-Contact a minimum of 48 hours prior to the time of the required outage.

4. If prosecution of the project work results in damages to existing FAA equipment or cables, the Contractor shall repair the damaged item in conformance with FAA Airway Facilities’ standards to the satisfaction of the above named FAA Point-of-Contact.

5. If the project work requires the cutting or splicing of FAA owned cables, the above named FAA Point-of-Contact shall be contacted a minimum of 48 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA Airway Facilities representative on site to observe the splicing of the cables as a condition of acceptance. All cable splices are to be accomplished in accordance with FAA Airway Facilities’ specifications and require approval by the above named FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA Airway Facilities restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA Airway Facilities, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

PROTECTION OF PERSONS AND PROPERTY

SAFETY PLAN

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and implementing and monitoring a safety program in connection with the performance of the Contract including but not limited to those requirements in this Section 00200 and the Construction Safety and Phasing Plan (CSPP) for the project. The Contractor shall submit to the Owner a copy of its Safety Plan Compliance Document (SPCD) within ten (10) Days of issuance of the Notice to Proceed. The Contractor’s SPCD must, at a minimum, incorporate the provisions set forth in Section 00201 (Safety Plan for the Air Operations Area); Section 00202 (Operational Safety on Airports During Construction); and Section 00203 (Birmingham Airport Authority Contractors Airport Security and Operational Regulations). The Contractor is responsible for
enforcing the observance of and compliance with the CSPP and SPCD by the Contractor, its Subcontractors, and their respective employees, agents and contractors.

In the event the Contractor fails to initiate, maintain, suspend and monitor the safety of its operations during the performance of the Work, including the operations of its Subcontractors, Suppliers and any others for whom the Contractor is responsible, then the Owner may, without reservation, pursue any rights or remedies against the Contractor that are available, under this Contract or by law, including withholding of payment.

**CONTRACTOR'S RESPONSIBILITY FOR SAFETY**

The Contractor shall take all reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

1. Employees and other persons who may be affected thereby;
2. The Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors; and
3. Other property at the Work site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with applicable laws, ordinances, codes, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying Owners and users of adjacent sites and utilities.

When use or storage of hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

In the event the Contractor encounters on the site material reasonably believed to be hazardous material, such as asbestos or polychlorinated biphenyl (PCB), the Contractor shall immediately stop Work in the area affected and verbally report the condition to the Owner and Engineer followed by notification in writing. The Work in the affected area shall not thereafter be resumed except by written agreement between the Owner and Contractor if in fact the material is hazardous and has not been rendered harmless. The Work in the affected area shall be resumed if the material is not hazardous or if it has been rendered harmless, by written agreement of the Owner and Contractor, or in accordance with final determination by the Engineer.

The Contractor shall not be required to perform, without its consent, any Work relating to hazardous materials.

To the fullest extent permitted by law, and on the condition that Contractor shall have followed the procedures set forth in this section, the Owner shall indemnify and hold harmless the Contractor, OAR, Engineer, Engineer's consultant's and agents and employees of any of them from and against Claims, damages, losses and expenses, including but not limited to Attorney's fees and expenses, arising out of or resulting from performance of the Work in the affected area if in fact materials encountered are hazardous, such as asbestos or polychlorinated biphenyl (PCB), and have not been rendered harmless, provided that such Claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefore, but only to the extent caused solely by negligent acts or omissions of the Owner, anyone directly or indirectly employed by the Owner or anyone for whose acts the Owner may be liable. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described above.

The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property for which it is responsible under the Contract Documents caused in whole or in part by the Contractor, a Subcontractor or anyone directly or indirectly
employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible, except damage or loss attributable to acts or omissions of the Owner, OAR or Engineer or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

The Contractor shall designate a responsible member of the Contractor's organization on the Work site whose duty shall be the safety of persons and property as provided herein. This person shall be the Contractor's Superintendent unless otherwise designated by the Contractor in writing to the Owner, OAR and Engineer.

The Contractor shall not load (for example, by delivery of materials, structural or physical loads) or permit any part of the Work, construction or site to be loaded so as to endanger the safety of the Owner, OAR, Engineer, Contractor or their agents, representatives or employees.

The Contractor shall protect adjoining private or municipal property and shall provide barricades, temporary fences, and covered walkways required to protect the safety of passers-by, as required by prudent construction practices, local building codes, ordinances or other laws, or the Contract Documents.

The Contractor shall take all reasonable precautions to protect and keep the Work, materials and equipment free from injury or damage from rain, wind, storms, frost or heat. If extreme adverse weather conditions prevent the Contractor from continuing operations safely in spite of having implemented weather precautions, the Contractor shall cease Work and notify the Owner and the Engineer of such cessation. The Contractor shall not permit open fires on the Project site.

The Contractor shall, at its sole cost and expense, promptly repair any damage or disturbance to walls, utilities, sidewalks, curbs and the property of third parties (including municipalities) resulting from the performance of the Work, whether by Contractor or by its Subcontractors at any tier. The Contractor shall maintain streets affected by the Work in good repair and traversable condition.

The Contractor shall, at all times, act in a manner to preserve life and property, and prevent pollution of the environment by proper use of the facility's prevention and containment systems to prevent hydrocarbon and hazardous material spills. No pollutant, regardless of the volume, shall be disposed of onto the ground or water, or allowed to drain into the ground or water. Federal regulations impose substantial fines and/or imprisonment for willful pollution of navigable waters. Failure to report accidental pollution at this facility, or elsewhere, can be cause for equally severe penalties to be imposed by federal regulations.

In the event of a spill or discharge of potentially hazardous material, the Contractor shall immediately stop Work in the area affected and verbally report the spill or discharge to the OAR and the BAA Operations Center, 205-599-0519. The Contractor shall notify the Owner and Engineer in writing of the spill or discharge within one (1) Day of the spill or discharge. The Work in the affected area shall not thereafter be resumed except by approval of the Owner.

In the event of a spill or discharge of potentially hazardous material, the Contractor shall fully comply and follow all directions of the spill response personnel.

The cost of cleaning, controlling or remediating spills or discharges caused in whole or in part by the Contractor, a Subcontractor or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible, shall be paid for by the Contractor.

The Contractor shall maintain his equipment in good working order to prevent spills or discharges.

**CLEANING UP**

The Contractor, on a daily basis, shall keep the premises and surrounding area free from the accumulation of waste materials or rubbish caused by operations under the Contract. At the completion of the Work, the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials caused by operations under the Contract. The Contractor shall not dispose of debris or waste material on the Owner's property or in waste containers (dumpsters) leased by the Owner without prior approval of the Owner. If the Contractor fails to keep the site
clean as provided in the Contract Documents, then, following the Owner’s written notice to the Contractor the Owner may take appropriate action to clean the site and charge such costs to the Contractor.

**EMERGENCIES**

In an emergency affecting the safety of persons or property, the Contractor shall act, at the Contractor’s discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time Claimed by the Contractor on account of an emergency shall be allowed pursuant to the Terms in the Agreement.

**BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS**

The Contractor shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to protect the public and the Work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated. Unless otherwise specified, barricades, warning signs, and markings for hazards that are in the air operations area shall be a maximum of 18 in high.

For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual of Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office).

When the Work requires closing an Air Operations Area of the Airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of AC 150/5340-1, latest edition, Marking of Paved Areas on Airports and as set forth in this Section.

The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and Contractor’s parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the Airport in reasonable conformance to AC 150/5370-2, latest edition, Operational Safety on Airports During Construction Activity.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2, latest edition.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing Work which requires such erection and shall maintain the barricades, warning signs, and markings for hazards until dismantling thereof is directed by the Engineer.

Open-flame type lights shall not be permitted within the Air Operations Areas of the Airport.

**USE OF EXPLOSIVES**

When the use of explosives is necessary for the prosecution of the Work, the Contractor shall exercise the utmost care not to endanger life or property, including the Work. The Contractor shall be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner in compliance with all applicable laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and, in general, not closer than 1,000 feet from the Work or from any building, road, or other place of human occupancy.

The Contractor shall notify each property Owner and public utility company having structures or facilities in proximity to the site of the Work of its intention to use explosives. Such notice shall be given sufficiently in advance to enable such parties to take such steps as they may deem necessary to protect their property from injury. The Contractor shall supply seismic monitoring in accordance with the requirements of Division II, Section 152-2.2, Excavation.

The use of electrical blasting caps shall not be permitted on or within 1,000 feet of the Airport property.

**PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE**
The Contractor shall be responsible for the preservation of all public and private property affected by the Work, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer has witnessed or otherwise referenced their location. The Contractor shall not move any such monuments or markers until directed to do so by the Engineer.

The Contractor shall be responsible for all damage or injury to property of any character, during the prosecution of the Work, resulting from any act, omission, neglect, or misconduct in its or its Subcontractors' or Suppliers' manner or method of executing the Work, or at any time due to defective Work or materials, and the Contractor shall not be released from such responsibility until the Work shall have been completed and Finally Accepted by the Owner, unless expressly set forth herein to the contrary.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work, or in consequence of the non-execution thereof by the Contractor or its Subcontractors or Suppliers, the Contractor shall restore, at its own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in a manner acceptable to the Owner of such property.

SANITARY, HEALTH, AND SAFETY PROVISIONS
The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of its employees as may be necessary to comply with the requirements of the state and local Board of Health, or of other bodies or tribunals having jurisdiction over sanitary, health and safety in connection with the Work and the Project.

Attention is directed to Federal, state, and local laws, rules and regulations concerning construction safety and health standards. The Contractor shall not require any worker to Work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to his/her health or safety.

PUBLIC CONVENIENCE AND SAFETY
The Contractor shall control its operations and those of its Subcontractors and all Suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall not interfere with the free and unobstructed movement of aircraft and vehicular traffic with respect to its own operations and those of its Subcontractors and all Suppliers in accordance with the provisions of this section and shall limit such operations for the convenience and safety of the traveling public as specified in the section titled Limitation of Operations.
SECTION F - ARTICLE III: SAFETY PLAN FOR THE AOA

SAFETY PLAN FOR THE AIR OPERATIONS AREA

PURPOSE
The purpose of this section is to describe METHODS, PROCEDURES, RULES AND AUTHORITIES TO BE FOLLOWED DURING THE CONSTRUCTION OF THIS Project. The Contractor's attention is directed to the DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION ADVISORY CIRCULAR 150/5370-2F and its references as included in Section 00202 of this document. Nothing contained in this section supersedes or alters any content of ADVISORY CIRCULAR 150/5370-2F and its references, neither of the contents of this section waive the duty of the Contractor to adhere to all safety regulations of the ADVISORY CIRCULAR and its references and to all and any other advisory material pertaining to OPERATIONAL SAFETY ON AIRPORTS WITH EMPHASIS ON SAFETY DURING CONSTRUCTION.

OBJECTIVES
General objectives that must be attained in order to minimize time and economic loss to the aviation community, airline passengers, and the construction Contractor are as follows:

1) Maintain safety of aircraft operations.
2) Maintain safety of construction activities.
3) Minimize aircraft operations and construction activity conflicts.
4) Minimize flight operations delays.
5) Minimize delays to Contractor activities.
6) Keep the Airport operational for all user aircraft.

WORK SCHEDULE
A minimum of one week prior to the pre-construction conference, the Contractor will be required to submit, in writing, its proposed construction schedule and submittal schedule for review and approval by the Engineer. The construction schedule shall include number of personnel, type of equipment, date construction will commence, estimated date, and/or number of Days to complete each phase of the Work. The submittal schedule shall contain data as described in Section 00030 of this document.

The Contractor's construction schedule shall be prepared considering the various conditions outlined herein, but it will be subjected to modifications during construction if necessary to keep interference with the Airport operations to the minimum possible.

The Contractor shall make its own estimate of the inherent difficulties involved in completing the construction under the conditions described herein and shall not make any Claims or additional compensation for delays, increased cost, or any reason, due to completing the required Work in the manner described below or as directed.

NOTAMS
The Owner's Operations Department must issue “Notices to Airmen” (NOTAM) or other appropriate advisories to Airport services and/or tenants prior to the commencement of all construction activities or changes to Airport operations. The Contractor must give the Engineer or OAR a minimum of (72) hours' notice to allow coordination of the Contractor's request with the Operations Department. The Contractor shall also advise the Engineer and OAR when NOTAM's can be canceled. The Engineer or OAR shall then notify the Owner's Operations Department.

BARRICADES
Closed Taxiways will be marked by low profile barricades as detailed in the Contract Plans. Barricades shall be constructed of a high-impact polyethylene. Each barricade unit shall include two (2) standard 2-way 6
volt LED barricade lights with red lenses. Barricade lights shall be battery operated and secured to the barricade. Batteries for the lights shall be checked on a daily basis.

Barricades shall alternate between orange and white and shall be eight (8) feet in length. Barricades shall be spaced no less than five (5) feet and interconnected where shown on the plans. They shall extend to ten (10) feet beyond the edge of pavement to be closed.

A 42 inch length of high reflective grade orange and white tape shall be visible at the center of each barricade.

Barricades shall be easily collapsible upon contact with an aircraft or any of its components and shall be weighted to prevent displacement from prop wash, jet blast, wing vortex or other surface wind currents. Each barricade must be secured for impending weather conditions. If the barricades are not properly secured, the Owner's Operations Department will request that the Contractor return to the site to secure the barricades immediately. The Contractor will be responsible for any damage caused by barricades which are not properly secured.

**Navigational Aids**

All navigational aids (NAVAIDs) must be protected during the construction Work. Should unplanned, accidental shutdown of any NAVAID occur, the Engineer or its representative and the Contractor will immediately notify the Airport Operations Department at (205) 599-0519.

Should the Contractor damage the NAVAIDs, the Contractor shall reimburse the Owner for all costs associated with repairing the damaged items, and the Contractor shall be fined $10,000 for every day the NAVAIDs are out of service.

**Trenches and/or Open Excavation**

No trenches or excavations will remain open during aircraft operation within clearance zones shown in the Safety Plan of the Contract Drawings.

Trenches left open outside the safety zones must be properly barricaded and lighted. The Contractor must notify the Operations Department so that a NOTAM regarding open trenches or excavations can be issued.

**Debris**

Waste and loose materials capable of causing damage to aircraft landing gears, propellers or being ingested in jet engines will not be left on active aircraft movement areas. Material tracked on these areas should be removed continuously during the construction of the Work. The Contractor shall also make provisions for dust control and removal of mud from these areas if the Contractor, Engineer or Owner determines it may become a problem.

A regular inspection program will be performed by the Contractor and the Engineer prior to commencement of aircraft operations in an area of Work.

Any open storage containers and/or dumpsters must be covered when not being filled for debris and bird control purposes.

**Equipment Marking**

All vehicles authorized to operate in the AOA shall have the Contractor's logo affixed to the sides and shall display in full view above the vehicle a 3' x 3', or larger, orange and white checkerboard flag. Each checkerboard color shall be (1) foot square. The vehicle shall be equipped with a flashing amber (yellow) dome type light, mounted on top of the vehicle and of such intensity to conform to local codes for maintenance and emergency vehicles. The vehicle shall be escorted and under the control of one Contractor two-way radio operator at all times. The Owner's Operations Department will assign call signs for the Contractor's use. If the Contractor's employees are driver trained and given call signs, the call sign
numbers must be of the size and displayed in the manner defined in the Owner’s Driver Training Handbook.

**STORAGE OF EQUIPMENT, MATERIAL OR EXCAVATION**

The Contractor shall not store materials or park equipment in aircraft operational areas when the equipment or material is not in use or about to be installed. Material or equipment in use in operational areas must be stored or parked in a manner that they may be quickly removed to accommodate aircraft operations.

Vehicles, equipment and materials will be stored or parked at least 500 feet from the centerline of active Runways and only in areas designated for this purpose.

**EXISTING RUNWAY AND TAXIWAY LIGHTING**

The existing Runway and Taxiway lights shall remain operational during all portions of the Work. The Contractor shall protect all existing lights as necessary to prevent accidental destruction of or unnecessary shutdown of those lights during non-working hours.

**DAILY INSPECTION**

At the end of each Day’s construction activities, an inspection will be made to insure the safety of the airfield in the areas affected by the Work. The Contractor shall coordinate the inspections with the Airport Operations Department. Items to be checked include:

1) Runways and Taxiways clear of debris and accumulation of dust and/or mud.
2) Equipment, material, and vehicles parked or stored shall be at least 500 feet from centerline of active Runways and only in designated areas.
3) No open trenches or excavations in excess of 3-inches deep and no rough grades within the aircraft safety zones.
4) Temporary barricades removed and stored at a safe location.
5) Airport Manager, Program Manager, Engineer and Control Tower informed of the next Day’s Work that Contractor has planned.

**COMMUNICATION REQUIREMENTS**

A positive communication system between the following will be required:

- Birmingham Airport Authority
- The FAA (The BHM Tower)
- BAA Project Manager from Project Management & Development
- Engineer/RPR
- Contractor

BAA Operations will maintain two-way Radio Communication with the Control Tower at all times that Contractor is working within the AOA. The ground control frequency is 121.70.

**NOTE:**

There will be no direct payment to the Contractor for the time, materials, equipment, or labor necessary to meet the requirements of this section. All costs required to implement these procedures shall be the responsibility of the Contractor.
SECTION G, ARTICLE IV: AC-150/5370-2F - Operational Safety on Airports during Construction

Advisory Circular

Subject: Operational Safety on Airports During Construction
Date: 9/28/11
AC No: 150/5370-2F
Initiated by: AAS-100

1. Purpose. This AC sets forth guidelines for operational safety on airports during construction.


3. Whom This AC Affects. This AC assists airport operators in complying with Title 14 Code of Federal Regulations (CFR) Part 139, Certification of Airports (Part 139). For those certificated airports, this AC provides one way, but not the only way, of meeting those requirements. The use of this AC is mandatory for those airport construction projects receiving funds under the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) Program. See Grant Assurance No. 34, “Policies, Standards, and Specifications,” and PFC Assurance No. 9, “Standard and Specifications.” While we do not require non-certificated airports without grant agreements to adhere to these guidelines, we recommend that they do so to help these airports maintain operational safety during construction.

4. Principal Changes.
   a. Construction activities are prohibited in safety areas while the associated runway or taxiway is open to aircraft.
   b. Guidance is provided in incorporating Safety Risk Management.
   c. Recommended checklists are provided for writing Construction Safety and Phasing Plans and for daily inspections.

5. Reading Material Related to this AC. Numerous ACs are referenced in the text of this AC. These references do not include a revision letter, as they are to be read as referring to the latest version. Appendix I contains a list of reading material on airport construction, design, and potential safety hazards during construction, as well as instructions for obtaining these documents.

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Chapter 1. Planning an Airfield Construction Project

101. Overview. Airports are complex environments, and procedures and conditions associated with construction activities often affect aircraft operations and can jeopardize operational safety. Safety considerations are paramount and may make operational impacts unavoidable. However, careful planning, scheduling, and coordination of construction activities can minimize disruption of normal aircraft operations and avoid situations that compromise the airport's operational safety. The airport operator must understand how construction activities and aircraft operations affect one another to be able to develop an effective plan to complete the project. While the guidance in this AC is primarily used for construction operations, some of the concepts, methods and procedures described may also enhance the day-to-day airport maintenance operations, such as lighting maintenance and snow removal operations.

102. Plan for Safety. Safety, maintaining aircraft operations, and construction costs are all interrelated. Since safety must not be compromised, the airport operator must strike a balance between maintaining aircraft operations and construction costs. This balance will vary widely depending on the operational needs and resources of the airport and will require early coordination with airport users and the FAA. As the project design progresses, the necessary construction locations, activities, and associated costs will be identified. As they are identified, their impact to airport operations must be assessed. Adjustments are made to the proposed construction activities, often by phasing the project, and/or to airport operations in order to maintain operational safety. This planning effort will ultimately result in a project Construction Safety and Phasing Plan (CSPP). The development of the CSPP takes place through the following five steps:

a. Identify Affected Areas. The airport operator must determine the geographic areas on the airport affected by the construction project. Some, such as a runway extension, will be defined by the project. Others may be variable, such as the location of haul routes and material stockpiles.

b. Describe Current Operations. Identify the normal airport operations in each affected area for each phase of the project. This becomes the baseline from which the impact on operations by construction activities can be measured. This should include a narrative of the typical users and aircraft operating within the affected areas. It should also include information related to airport operations: the Aircraft Reference Code (ACRC) for each runway; Airplane Design Group (ADG) and Taxiway Design Group (TDG) for each affected taxiway; designated approach visibility minimums; available approach and departure procedures; most demanding aircraft; declared distances; available air traffic control services; airport Surface Movement Guidance and Control System plan; and others. The applicable seasons, days and times for certain operations should also be identified as applicable.

c. Allow for Temporary Changes to Operations. To the extent practical, current airport operations should be maintained during the construction. In consultation with airport users, Aircraft Rescue and Fire Fighting (ARFF) personnel, and FAA Air Traffic Organization (ATO) personnel, the airport operator should identify and prioritize the airport's most important operations. The construction activities should be planned, through project phasing if necessary, to safely accommodate these operations. When the construction activities cannot be adjusted to safely maintain current operations, regardless of their importance, then the operations must be revised accordingly. Allowable changes include temporary revisions to approach procedures, restricting certain aircraft to specific runways and taxiways, suspension of certain operations, decreased weights for some aircraft due to shortened runways.

1 Taxiway Design Group will be introduced in AC 150/5300-13A.
and other changes. An example of a table showing temporary operations versus current operations is shown in Table 3-1 Sample Operations Effects.

d. **Take Required Measures to Revised Operations.** Once the level and type of aircraft operations to be maintained are identified, the airport operator must determine the measures required to safely conduct the planned operations during the construction. These measures will result in associated costs, which can be broadly interpreted to include not only direct construction costs, but also loss of revenue from impacted operations. Analysis of costs may indicate a need to reevaluate allowable changes to operations. As aircraft operations and allowable changes will vary so widely among airports, this AC presents general guidance on those subjects.

e. **Manage Safety Risk.** Certain airport projects may require the airport operator to provide a Project Proposal Summary to help the FAA to determine the appropriate level of Safety Risk Management (SRM) documentation. The airport operator must coordinate with the appropriate FAA Airports Regional or District Office early in the development of the CSPP to determine the need for SRM documentation. See FAA Order 5200.11, FAA Airports (ARP) Safety Management System (SMS), for more information. If the FAA requires SRM documentation, the airport operator must at a minimum:

1. Notify the appropriate FAA Airports Regional or District Office during the project "scope development" phase of any project requiring a CSPP.
2. Provide documents identified by the FAA as necessary to conduct SRM.
3. Participate in the SRM process for airport projects.
4. Provide a representative to participate on the SRM panel.
5. Ensure that all applicable SRM identified risks elements are recorded and mitigated within the CSPP.

103. **Develop a Construction Safety and Phasing Plan (CSPP).** Development of an effective CSPP will require familiarity with many other documents referenced throughout this AC. See Appendix 1, Related Reading Material for a list of related reading material.

a. **List Requirements.** A CSPP must be developed for each on-airfield construction project funded by the Airport Improvement Program (AIP) or the Passenger Facility Charge (PFC) program or located on an airport certified under Part 139. As per Order 5200.11, such projects do not include construction, rehabilitation, or change of any facility that is entirely outside the air operations area, does not involve any expansion of the facility envelope and does not involve construction equipment, haul routes or placement of material in locations that require access to the air operations area, increase the facility envelope, or impact line-of-sight. Such facilities may include passenger terminals and parking or other structures. However, extraordinary circumstances may trigger the need for a Safety Assessment and a CSPP. The CSPP is subject to subsequent review and approval under the FAA's Safety Risk Management procedures (see paragraph 102.e above). Additional information may be found in Order 5200.11.

b. **Prepare a Safety Plan Compliance Document.** The Safety Plan Compliance Document (SPCD) details how the contractor will comply with the CSPP. Also, it will not be possible to determine all safety plan details (for example specific hazard equipment and lighting, contractor's points of contact, construction equipment heights) during the development of the CSPP. The successful contractor must define such details by preparing an SPCD that the airport operator reviews for approval prior to issuance of a notice-to-proceed. The SPCD is a subset of the CSPP, similar to how a shop drawing review is a subset to the technical specifications.
c. Assume Responsibility for the CSPP. The airport operator is responsible for establishing and enforcing the CSPP. The airport operator may use the services of an engineering consultant to help develop the CSPP. However, writing the CSPP cannot be delegated to the construction contractor. Only those details the airport operator determines cannot be addressed before contract award are developed by the contractor and submitted for approval as the SPCD. The SPCD does not restate nor propose differences to provisions already addressed in the CSPP.

104. Who Is Responsible for Safety During Construction?

a. Establish a Safety Culture. Everyone has a role in operational safety on airports during construction: the airport operator, the airport’s consultants, the construction contractor and subcontractors, airport users, airport tenants, ARFF personnel, Air Traffic personnel, including Technical Operations personnel, FAA Airports Division personnel, and others. Close communication and coordination between all affected parties is the key to maintaining safe operations. Such communication and coordination should start at the project scoping meeting and continue through the completion of the project. The airport operator and contractor should conduct onsite safety inspections throughout the project and immediately remedy any deficiencies, whether caused by negligence, oversight, or project scope change.

b. Assess Airport Operator’s Responsibilities. An airport operator has overall responsibility for all activities on an airport, including construction. This includes the predesign, design, preconstruction, construction, and inspection phases. Additional information on the responsibilities listed below can be found throughout this AC. The airport operator must:

1. Develop a CSPP that complies with the safety guidelines of Chapter 2, Construction Safety and Phasing Plans, and Chapter 3, Guidelines for Writing a CSPP. The airport operator may develop the CSPP internally or have a consultant develop the CSPP for approval by the airport operator. For tenant sponsored projects, approve a CSPP developed by the tenant or its consultant.

2. Require, review and approve the SPCD by the contractor that indicates how it will comply with the CSPP and provides details that cannot be determined before contract award.

3. Convene a preconstruction meeting with the construction contractor, consultant, airport employees and, if appropriate, tenant sponsor and other tenants to review and discuss project safety before beginning construction activity. The appropriate FAA representatives should be invited to attend the meeting. See AC 150/5300-9, Pre-design, Prebid, and Preconstruction Conferences for Airport Grant Projects. (Note “FAA” refers to the Airports Regional or District Office, the Air Traffic Organization, Flight Standards Service, and other offices that support airport operations, flight regulations, and construction/environmental policies.)

4. Ensure contact information is accurate for each representative/point of contact identified in the CSPP and SPCD.

5. Hold weekly or, if necessary, daily safety meetings with all affected parties to coordinate activities.

6. Notify users, ARFF personnel, and FAA ATO personnel of construction and conditions that may adversely affect the operational safety of the airport via Notices to Airmen (NOTAM) and other methods, as appropriate. Convene a meeting for review and discussion if necessary.

7. Ensure construction personnel know of any applicable airport procedures and of changes to those procedures that may affect their work.

8. Ensure construction contractors and subcontractors undergo training required by the CSPP and SPCD.
(9) Ensure vehicle and pedestrian operations addressed in the CSPP and SPCD are coordinated with airport tenants, the airport traffic control tower (ATCT), and construction contractors.

(10) At certificated airports, ensure each CSPP and SPCD is consistent with Part 139.

(11) Conduct inspections sufficiently frequently to ensure construction contractors and tenants comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.

(12) Resolve safety deficiencies immediately. At airports subject to 49 CFR Part 1542, Airport Security, ensure construction access complies with the security requirements of that regulation.

(13) Notify appropriate parties when conditions exist that invoke provisions of the CSPP and SPCD (for example, implementation of low-visibility operations).

(14) Ensure prompt submittal of a Notice of Proposed Construction or Alteration (Form 7460-1) for conducting an aeronautical study of potential obstructions such as tall equipment (cranes, concrete pumps, etc.), stock piles, and haul routes. A separate form may be filed for each potential obstruction, or one form may be filed describing the entire construction area and maximum equipment height. In the latter case, a separate form must be filed for any object beyond or higher than the originally evaluated area/height. The FAA encourages online submittal of forms for expediency. The appropriate FAA Airports Regional or District Office can provide assistance in determining which objects require an aeronautical study.

(15) Promptly notify the FAA Airports Regional or District Office of any proposed changes to the CSPP prior to implementation of the change. Changes to the CSPP require review and approval by the airport operator and the FAA. Coordinate with appropriate local and other federal government agencies, such as EPA, OSHA, TSA, and the state environmental agency.

c. Define Construction Contractor’s Responsibilities. The contractor is responsible for complying with the CSPP and SPCD. The contractor must:

(1) Submit a Safety Plan Compliance Document (SPCD) to the airport operator describing how it will comply with the requirements of the CSPP and supplying any details that could not be determined before contract award. The SPCD must include a certification statement by the contractor that indicates it understands the operational safety requirements of the CSPP and it asserts it will not deviate from the approved CSPP and SPCD unless written approval is granted by the airport operator. Any construction practice proposed by the contractor that does not conform to the CSPP and SPCD may impact the airport’s operational safety and will require a revision to the CSPP and SPCD and re-coordination with the airport operator and the FAA in advance.

(2) Have available at all times copies of the CSPP and SPCD for reference by the airport operator and its representatives, and by subcontracts and contractor employees.

(3) Ensure that construction personnel are familiar with safety procedures and regulations on the airport. Provide a point of contact who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport. Many projects will require 24-hour coverage.

(4) Identify in the SPCD the contractor’s on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

(5) Conduct inspections sufficiently frequently to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.
Restrict movement of construction vehicles and personnel to permitted construction areas by flagging, barricading, erecting temporary fencing, or providing escorts, as appropriate and as specified in the CSPP and SPCD.

Ensure that no contractor employees, employees of subcontractors or suppliers, or other persons enter any part of the air operations area (AOA) from the construction site unless authorized.

Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other equipment), stock piles, and haul routes when different from cases previously filed by the airport operator. The FAA encourages online submittal of forms for expediency.

d. Define Tenant’s Responsibilities if planning construction activities on leased property. Airport tenants, such as airline operators, fixed base operators, and FAA ATO/Technical Operations sponsoring construction must:

Develop, or have a consultant develop, a project specific CSPP and submit it to the airport operator for certification and subsequent approval by the FAA. The approved CSPP must be made part of any contract awarded by the tenant for construction work.

In coordination with its contractor, develop an SPCD and submit it to the airport operator for approval to be issued prior to issuance of a Notice to Proceed.

Ensure that construction personnel are familiar with safety procedures and regulations on the airport.

Provide a point of contact of who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport.

In the SPCD the contractor’s on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.

Ensure that no tenant or contractor employees, employees of subcontractors or suppliers, or any other persons enter any part of the AOA from the construction site unless authorized.

Restrict movement of construction vehicles to construction areas by flagging and barricading, erecting temporary fencing, or providing escorts, as appropriate, and as specified in the CSPP and SPCD.

Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other), stock piles, and haul routes. The FAA encourages online submittal of forms for expediency.
Chapter 2. Construction Safety and Phasing Plans

Section 1. Basic Considerations

201. Overview. Aviation safety is the primary consideration at airports, especially during construction. The airport operator’s Construction Safety and Phasing Plan (CSPP) and the contractor’s Safety Plan Compliance Document (SPCD) are the primary tools to ensure safety compliance when coordinating construction activities with airport operations. These documents identify all aspects of the construction project that pose a potential safety hazard to airport operations and outline respective mitigation procedures for each hazard. They must provide all information necessary for the Airport Operations department to conduct airfield inspections and expeditiously identify and correct unsafe conditions during construction. All aviation safety provisions included within the project drawings, contract specifications, and other related documents must also be reflected in the CSPP and SPCD.

202. Assume Responsibility. Operational safety on the airport remains the airport operator’s responsibility at all times. The airport operator must develop, certify, and submit for FAA approval each CSPP. It is the airport operator’s responsibility to apply the requirements of the FAA approved CSPP. The airport operator must revise the CSPP when conditions warrant changes and must submit the revised CSPP to the FAA for approval. The airport operator must also require and approve a SPCD from the project contractor.

203. Submit the CSPP. Construction Safety and Phasing Plans should be developed concurrently with the project design. Milestone versions of the CSPP should be submitted for review and approval as follows. While these milestones are not mandatory, early submission will help to avoid delays. Submittals are preferred in 8.5 x 11 in or 11 x 17 in format for compatibility with the FAA’s Obstruction Evaluation/Airport Airspace Analysis (OE/AAA) process.

a. Submit an Outline/Draft. By the time approximately 25% to 30% of the project design is completed, the principal elements of the CSPP should be established. Airport operators are encouraged to submit an outline or draft, detailing all CSPP provisions developed to date, to the FAA for review at this stage of the project design.

b. Submit a Construction Safety and Phasing Plan (CSPP). The CSPP should be formally submitted for FAA approval when the project design is 80% to 90% complete. Since provisions in the CSPP will influence contract costs, it is important to obtain FAA approval in time to include all such provisions in the procurement contract.

c. Submit a Safety Plan Compliance Document (SPCD). The contractor should submit the SPCD to the airport operator for approval to be issued prior to the Notice to Proceed.

d. Submit CSPP Revisions. All revisions to the CSPP or SPCD should be submitted to the FAA for approval as soon as required changes are identified.

204. Meet CSPP Requirements.

a. To the extent possible, the CSPP should address the following as outlined in Section 2, Plan Requirements and Chapter 3, Guidelines for Writing a CSPP, as appropriate. Details that cannot be determined at this stage are to be included in the SPCD.

(1) Coordination.
(a) Contractor progress meetings.
(b) Scope or schedule changes.
(c) FAA ATO coordination.

(2) Phasing.
   (a) Phase elements.
   (b) Construction safety drawings.

(3) Areas and operations affected by the construction activity.
   (a) Identification of affected areas.
   (b) Mitigation of effects.

(4) Protection of navigation aids (NAVAIDs).

(5) Contractor access.
   (a) Location of stockpiled construction materials.
   (b) Vehicle and pedestrian operations.

(6) Wildlife management.
   (a) Trash.
   (b) Standing water.
   (c) Tall grass and seeds.
   (d) Poorly maintained fencing and gates.
   (e) Disruption of existing wildlife habitat.

(7) Foreign Object Debris (FOD) management.

(8) Hazardous materials (HAZMAT) management.

(9) Notification of construction activities.
   (a) Maintenance of a list of responsible representatives/points of contact.
   (b) Notices to Airmen (NOTAM).
   (c) Emergency notification procedures.
   (d) Coordination with ARFF Personnel.
   (e) Notification to the FAA.

(10) Inspection requirements.
    (a) Daily (or more frequent) inspections.
    (b) Final inspections.

(11) Underground utilities.

(12) Penalties.

(13) Special conditions.

(14) Runway and taxiway visual aids. Marking, lighting, signs, and visual NAVAIDs.
(a) General.
(b) Markings.
(c) Lighting and visual NAVAIDs.
(d) Signs.

(15) Marking and signs for access routes.

(16) Hazard marking and lighting.
(a) Purpose.
(b) Equipment.

(17) Protection. Of runway and taxiway safety areas, object free areas, obstacle free zones, and approach/departure surfaces
(a) Runway Safety Area (RSA).
(b) Runway Object Free Area (ROFA).
(c) Taxiway Safety Area (TSA).
(d) Taxiway Object Free Area (TOFA).
(e) Obstacle Free Zone (OFZ).
(f) Runway approach/departure surfaces.

(18) Other limitations on construction.
(a) Prohibitions.
(b) Restrictions.

b. The Safety Plan Compliance Document (SPCD) should include a general statement by the construction contractor that he/she has read and will abide by the CSPP. In addition, the SPCD must include all supplemental information that could not be included in the CSPP prior to the contract award. The contractor statement should include the name of the contractor, the title of the project CSPP, the approval date of the CSPP, and a reference to any supplemental information (that is, "I, Name of Contractor, have read the Title of Project CSPP, approved on Date, and will abide by it as written and with the following additions as noted:."). The supplemental information in the SPCD should be written to match the format of the CSPP indicating each subject by corresponding CSPP subject number and title. If no supplemental information is necessary for any specific subject, the statement, "No supplemental information," should be written after the corresponding subject title. The SPCD should not duplicate information in the CSPP:

(1) Coordination. Discuss details of proposed safety meetings with the airport operator and with contractor employees and subcontractors.

(2) Phasing. Discuss proposed construction schedule elements, including:
(a) Duration of each phase.
(b) Daily start and finish of construction, including "night only" construction.
(c) Duration of construction activities during:
   (i) Normal runway operations.
   (ii) Closed runway operations.
(iii) Modified runway “Aircraft Reference Code” usage.

(3) Areas and operations affected by the construction activity. These areas and operations
should be identified in the CSPP and should not require an entry in the SPCD.

(4) Protection of NAVAIDs. Discuss specific methods proposed to protect operating
NAVAIDs.

(5) Contractor access. Provide the following:

(a) Details on how the contractor will maintain the integrity of the airport security
fence (gate guards, daily log of construction personnel, and other).

(b) Listing of individuals requiring driver training (for certificated airports and as
requested).

(c) Radio communications.

(i) Types of radios and backup capabilities.

(ii) Who will be monitoring radios.

(iii) Whom to contact if the ATCT cannot reach the contractor’s designated person by
radio.

(d) Details on how the contractor will escort material delivery vehicles.

(6) Wildlife management. Discuss the following:

(a) Methods and procedures to prevent wildlife attraction.

(b) Wildlife reporting procedures.

(7) Foreign Object Debris (FOD) management. Discuss equipment and methods for
control of FOD, including construction debris and dust.

(8) Hazardous material (HAZMAT) management. Discuss equipment and methods for
responding to hazardous spills.

(9) Notification of construction activities. Provide the following:

(a) Contractor points of contact.

(b) Contractor emergency contact.

(c) Listing of all other requested equipment proposed for use on the airport and
the timeframe for submitting 7460-1 forms not previously submitted by the airport operator.

(d) Batch plant details, including 7460-1 submittal.

(10) Inspection requirements. Discuss daily (or more frequent) inspections and special
inspection procedures.

(11) Underground utilities. Discuss proposed methods of identifying and protecting
underground utilities.

(12) Penalties. Penalties should be identified in the CSPP and should not require an entry in
the SPCD.

(13) Special conditions. Discuss proposed actions for each special condition identified in the
CSPP.

(14) Runway and taxiway visual aids. Including marking, lighting, signs, and visual
NAVAIDs. Discuss proposed visual aids including the following:
(a) Equipment and methods for covering signage and airfield lights.
(b) Equipment and methods for temporary closure markings (paint, fabric, other).
(c) Types of temporary Visual Guidance Slope Indicators (VGSI).

(15) Marking and signs for access routes. Discuss proposed methods of demarcating access routes for vehicle drivers.

(16) Hazard marking and lighting. Discuss proposed equipment and methods for identifying excavation areas.

(17) Protection of runway and taxiway safety areas, including object free areas, obstacle free zones, and approach/departure surfaces. Discuss proposed methods of identifying, demarcating, and protecting airport surfaces including:
(a) Equipment and methods for maintaining Taxiway Safety Area standards.
(b) Equipment and methods for separation of construction operations from aircraft operations, including details of barricades.

(18) Other limitations on construction should be identified in the CSPP and should not require an entry in the SPCD.

Section 2. Plan Requirements

205. Coordination. Airport operators, or tenants conducting construction on their leased properties, should use predesign, prebid, and preconstruction conferences to introduce the subject of airport operational safety during construction (see AC 150/5500-9). In addition, the following should be coordinated as required:

a. Contractor Progress Meetings. Operational safety should be a standing agenda item for discussion during progress meetings throughout the project.

b. Scope or Schedule Changes. Changes in the scope or duration of the project may necessitate revisions to the CSPP and review and approval by the airport operator and the FAA.

c. FAA ATO Coordination. Early coordination with FAA ATO is required to schedule airway facility shutdowns and restarts. Relocation or adjustments to NAVAIDs, or changes to final grades in critical areas, may require an FAA flight inspection prior to restarting the facility. Flight inspections must be coordinated and scheduled well in advance of the intended facility restart. Flight inspections may require a reimbursable agreement between the airport operator and FAA ATO. Reimbursable agreements should be coordinated a minimum of 12 months prior to the start of construction. (See 213.a(3)(b) for required FAA notification regarding FAA owned NAVAIDs.)

206. Phasing. Once it has been determined what types and levels of airport operations will be maintained, the most efficient sequence of construction may not be feasible. In such a case, the sequence of construction may be phased to gain maximum efficiency while allowing for the required operations. The development of the resulting construction phases should be coordinated with local Air Traffic personnel and airport users. The sequenced construction phases established in the CSPP must be incorporated into the project design and must be reflected in the contract drawings and specifications.

a. Phase Elements. For each phase the CSPP should detail:
   • Areas closed to aircraft operations
• Duration of closures
• Taxi routes
• ARFF access routes
• Construction staging areas
• Construction access and haul routes
• Impacts to NAVAIDs
• Lighting and marking changes
• Available runway length
• Declared distances (if applicable)
• Required hazard marking and lighting
• Lead times for required notifications

b. Construction Safety Drawings. Drawings specifically indicating operational safety procedures and methods in affected areas (that is, construction safety drawings) should be developed for each construction phase. Such drawings should be included in the CSPP as referenced attachments and should likewise be included in the contract drawing package.

207. Areas and Operations Affected by Construction Activity. Runways and taxiways should remain in use by aircraft to the maximum extent possible without compromising safety. Pre-meetings with the FAA Air Traffic Organization (ATO) will support operational simulations. See Chapter 3 for an example of a table showing temporary operations versus current operations.

a. Identification of Affected Areas. Identifying areas and operations affected by the construction will help to determine possible safety problems. The affected areas should be identified in the construction safety drawings for each construction phase. (See 206.b above.) Of particular concern are:

(1) Closing, or partial closing, of runways, taxiways and aprons. When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxiing, landing, or taking off in either direction on that pavement is prohibited. A displaced threshold, by contrast, is established to ensure obstacle clearance and adequate safety area for landing aircraft. The pavement prior to the displaced threshold is available for take-off in the direction of the displacement and for landing and taking off in the opposite direction. Misunderstanding this difference, and issuance of a subsequently inaccurate NOTAM, can lead to a hazardous condition.

(2) Closing of Aircraft Rescue and Fire Fighting access routes.
(3) Closing of access routes used by airport and airline support vehicles.
(4) Interruption of utilities, including water supplies for fire fighting.
(5) Approach/departure surfaces affected by heights of objects.
(6) Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads.

b. Mitigation of Effects. Establishment of specific procedures is necessary to maintain the safety and efficiency of airport operations. The CSPP must address:

(1) Temporary changes to runway and/or taxi operations.
(2) Detours for ARFF and other airport vehicles.
(3) Maintenance of essential utilities.

(4) Temporary changes to air traffic control procedures. Such changes must be coordinated with the ATO.

208. Navigation Aid (NAVAID) Protection. Before commencing construction activity, parking vehicles, or storing construction equipment and materials near a NAVAID, coordinate with the appropriate FAA ATO/Technical Operations office to evaluate the effect of construction activity and the required distance and direction from the NAVAID. (See paragraph 213.e(3) below.) Construction activities, materials/equipment storage, and vehicle parking near electronic NAVAIDs require special consideration since they may interfere with signals essential to air navigation. If any NAVAID may be affected, the CSPP and SPCD must show an understanding of the “critical area” associated with each NAVAID and describe how it will be protected. Where applicable, the operational critical areas of NAVAIDs should be graphically delineated on the project drawings. Pay particular attention to stockpiling material, as well as to movement and parking of equipment that may interfere with line of sight from the ATCT or with electronic emissions. Interference from construction equipment and activities may require NAVAID shutdown or adjustment of instrument approach minimums for low visibility operations. This condition requires that a NOTAM be filed (see paragraph 213.b below). Construction activities and materials/equipment storage near a NAVAID must not obstruct access to the equipment and instruments for maintenance. Submittal of a 7460-1 form is required for construction vehicles operating near FAA NAVAIDs. (See paragraph 213.e(1) below.)

209. Contractor Access. The CSPP must detail the areas to which the contractor must have access, and explain how contractor personnel will access those areas. Specifically address:

a. Location of Stockpiled Construction Materials. Stockpiled materials and equipment storage are not permitted within the RSA and OFZ, and if possible should not be permitted within the Object Free Area (OFA) of an operational runway. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval. The airport operator must ensure that stockpiled materials and equipment adjacent to those areas are prominently marked and lighted during hours of restricted visibility or darkness. (See paragraph 218.b below.) This includes determining and verifying that materials are stabilized and stored at an approved location so as not to be a hazard to aircraft operations and to prevent attraction of wildlife and foreign object damage. See paragraphs 210 and 211 below.

b. Vehicle and Pedestrian Operations. The CSPP should include specific vehicle and pedestrian requirements. Vehicle and pedestrian access routes for airport construction projects must be controlled to prevent inadvertent or unauthorized entry of persons, vehicles, or animals onto the AOA. The airport operator should coordinate requirements for vehicle operations with airport tenants, contractors, and the FAA air traffic manager. In regard to vehicle and pedestrian operations, the CSPP should include the following, and detail associated training requirements:

(1) Construction site parking. Designate in advance vehicle parking areas for contractor employees to prevent any unauthorized entry of persons or vehicles onto the AOA. These areas should provide reasonable contractor employee access to the job site.

(2) Construction equipment parking. Contractor employees must park and service all construction vehicles in an area designated by the airport operator outside the OFZ and never in the safety area of an active runway or taxiway. Unless a complex setup procedure makes movement of specialized equipment infeasible, inactive equipment must not be parked on a closed taxiway or runway. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be well lighted. Employees should also park construction vehicles outside the OFA when not in use by
construction personnel (for example, overnight, on weekends, or during other periods when construction is not active). Parking areas must not obstruct the clear line of sight by the ATCT to any taxiways or runways under air traffic control nor obstruct any runway visual aids, signs, or navigation aids. The FAA must also study those areas to determine effects on airport design criteria, surfaces established by 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (Part 77), and on NAVAIDs and Instrument Approach Procedures (IAP). See paragraph 213.e.1 below for further information.

(3) Access and haul roads. Determine the construction contractor’s access to the construction sites and haul roads. Do not permit the construction contractor to use any access or haul roads other than those approved. Access routes used by contractor vehicles must be clearly marked to prevent inadvertent entry to areas open to airport operations. Pay special attention to ensure that if construction traffic is to share or cross any ARFF routes that ARFF right of way is not impeded at any time, and that construction traffic on haul roads does not interfere with NAVAIDs or approach surfaces of operational runways.

(4) Marking and lighting of vehicles in accordance with AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport.

(5) Description of proper vehicle operations on various areas under normal, lost communications, and emergency conditions.

(6) Required escorts.

(7) Training requirements for vehicle drivers to ensure compliance with the airport operator’s vehicle rules and regulations. Specific training should be provided to those vehicle operators providing escorts. See AC 150/5210-20, Ground Vehicle Operations on Airports, for information on training and records maintenance requirements.

(8) Situational awareness. Vehicle drivers must confirm by personal observation that no aircraft is approaching their position (either in the air or on the ground) when given clearance to cross a runway, taxiway, or any other area open to airport operations. In addition, it is the responsibility of the escort vehicle driver to verify the movement/position of all escorted vehicles at any given time.

(9) Two-way radio communication procedures.

(a) General. The airport operator must ensure that tenant and construction contractor personnel engaged in activities involving unescorted operation on aircraft movement areas observe the proper procedures for communications, including using appropriate radio frequencies at airports with and without ATCT. When operating vehicles on or near open runways or taxiways, construction personnel must understand the critical importance of maintaining radio contact, as directed by the airport operator, with:

(i) Airport operations
(ii) ATCT
(iii) Common Traffic Advisory Frequency (CTAF), which may include UNICOM, MULTICOM.
(iv) Automatic Terminal Information Service (ATIS). This frequency is useful for monitoring conditions on the airport. Local air traffic will broadcast information regarding construction related runway closures and “shortened” runways on the ATIS frequency.

(b) Areas requiring two-way radio communication with the ATCT. Vehicular traffic crossing active movement areas must be controlled either by two-way radio with the ATCT, escort, flagman, signal light, or other means appropriate for the particular airport.
(c) Frequencies to be used. The airport operator will specify the frequencies to be used by the contractor, which may include the CTAF for monitoring of aircraft operations. Frequencies may also be assigned by the airport operator for other communications, including any radio frequency in compliance with Federal Communications Commission requirements. At airports with an ATCT, the airport operator will specify the frequency assigned by the ATCT to be used between contractor vehicles and the ATCT.

(d) Proper radio usage, including read back requirements.

(e) Proper phrasing, including the International Phonetic Alphabet.

(f) Light gun signals. Even though radio communication is maintained, escort vehicle drivers must also familiarize themselves with ATCT light gun signals in the event of radio failure. See the FAA safety placard "Ground Vehicle Guide to Airport Signs and Markings." This safety placard may be downloaded through the Runway Safety Program Web site at http://www.faa.gov/airports/runway_safety/publications/ (See "Signs & Markings Vehicle Dashboard Sticker"). or obtained from the FAA Airports Regional Office.

(10) Maintenance of the secured area of the airport, including:

(a) Fencing and gates. Airport operators and contractors must take care to maintain security during construction when access points are created in the security fencing to permit the passage of construction vehicles or personnel. Temporary gates should be equipped so they can be securely closed and locked to prevent access by animals and unauthorized people. Procedures should be in place to ensure that only authorized persons and vehicles have access to the AOA and to prohibit "piggybacking" behind another person or vehicle. The Department of Transportation (DOT) document DOT/FAA/AR-00/52, Recommended Security Guidelines for Airport Planning and Construction, provides more specific information on fencing. A copy of this document can be obtained from the Airport Consultants Council, Airports Council International, or American Association of Airport Executives.

(b) Badging requirements.

(c) Airports subject to 49 CFR Part 1542, Airport Security, must meet standards for access control, movement of ground vehicles, and identification of construction contractor and tenant personnel.

210. Wildlife Management. The CSPP and SPCD must be in accordance with the airport operator’s wildlife hazard management plan, if applicable. See also AC 150/5200-33, Hazardous Wildlife Attractants On or Near Airports, and Certifaltr 98-05, Grasses Attractive to Hazardous Wildlife. Construction contractors must carefully control and continuously remove waste or loose materials that might attract wildlife. Contractor personnel must be aware of and avoid construction activities that can create wildlife hazards on airports, such as:

a. Trash. Food scraps must be collected from construction personnel activity.

b. Standing Water.

c. Tall Grass and Seeds. Requirements for turf establishment can be at odds with requirements for wildlife control. Grass seed is attractive to birds. Lower quality seed mixtures can contain seeds of plants (such as clover) that attract larger wildlife. Seeding should comply with the guidance in AC 150/5370-10, Standards for Specifying Construction of Airports, Item T-901, Seeding. Contact the local office of the United States Department of Agriculture Soil Conservation Service or the State University Agricultural Extension Service (County Agent or equivalent) for assistance and recommendations. These agencies can also provide liming and fertilizer recommendations.
d. Poorly Maintained Fencing and Gates. See 209.b(10)(a) above.

e. Disruption of Existing Wildlife Habitat. While this will frequently be unavoidable due to the nature of the project, the CSPP should specify under what circumstances (location, wildlife type) contractor personnel should immediately notify the airport operator of wildlife sightings.

211. Foreign Object Debris (FOD) Management. Waste and loose materials, commonly referred to as FOD, are capable of causing damage to aircraft landing gears, propellers, and jet engines. Construction contractors must not leave or place FOD on or near active aircraft movement areas. Materials capable of creating FOD must be continuously removed during the construction project. Fencing (other than security fencing) may be necessary to contain material that can be carried by wind into areas where aircraft operate. See AC 150/5210-24, Foreign Object Debris (FOD) Management.

212. Hazardous Materials (HAZMAT) Management. Contractors operating construction vehicles and equipment on the airport must be prepared to expeditiously contain and clean-up spills resulting from fuel or hydraulic fluid leaks. Transport and handling of other hazardous materials on an airport also requires special procedures. See AC 150/5320-15, Management of Airport Industrial Waste.

213. Notification of Construction Activities. The CSPP and SPCD must detail procedures for the immediate notification of airport users and the FAA of any conditions adversely affecting the operational safety of the airport. It must address the notification actions described below, as applicable.

a. List of Responsible Representatives/points of contact for all involved parties, and procedures for contacting each of them, including after hours.

b. NOTAMs. Only the airport operator may initiate or cancel NOTAMs on airport conditions, and is the only entity that can close or open a runway. The airport operator must coordinate the issuance, maintenance, and cancellation of NOTAMs about airport conditions resulting from construction activities with tenants and the local air traffic facility (control tower, approach control, or air traffic control center), and must provide information on closed or hazardous conditions on airport movement areas to the FAA Flight Service Station (FSS) so it can issue a NOTAM. The airport operator must file and maintain a list of authorized representatives with the FSS. Refer to AC 150/5200-28, Notices to Airmen (NOTAMs) for Airport Operators, for a sample NOTAM form. Only the FAA may issue or cancel NOTAMs on shutdown or irregular operation of FAA owned facilities. Any person having reason to believe that a NOTAM is missing, incomplete, or inaccurate must notify the airport operator. See paragraph 207.a(1) above regarding issuing NOTAMs for partially closed runways versus runways with displaced thresholds.

c. Emergency notification procedures for medical, fire fighting, and police response.

d. Coordination with ARFF. The CSPP must detail procedures for coordinating through the airport sponsor with ARFF personnel, mutual aid providers, and other emergency services if construction requires:
   - The deactivation and subsequent reactivation of water lines or fire hydrants, or
   - The rerouting, blocking and restoration of emergency access routes, or
   - The use of hazardous materials on the airfield.

e. Notification to the FAA.

   (1) Part 77. Any person proposing construction or alteration of objects that affect navigable airspace, as defined in Part 77, must notify the FAA. This includes construction equipment and proposed
parking areas for this equipment (i.e. cranes, graders, other equipment) on airports. FAA Form 7460-1, Notice of Proposed Construction or Alteration, can be used for this purpose and submitted to the appropriate FAA Airports Regional or District Office. See Appendix 1, Related Reading Material, to download the form. Further guidance is available on the FAA website at ocnraa.faa.gov.

(2) Part 157. With some exceptions, Title 14 CFR Part 157, Notice of Construction, Alteration, Activation, and Deactivation of Airports, requires that the airport operator notify the FAA in writing whenever a non-Federally funded project involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport. Notification involves submitting FAA Form 7480-1, Notice of Landing Area Proposal, to the nearest FAA Airports Regional or District Office. See Appendix 1, Related Reading Material to download the form.

(3) NAVAIDS. For emergency (short-notice) notification about impacts to both airport owned and FAA owned NAVAIDs, contact: 866-432-2622.

(a) Airport owned/FAA maintained. If construction operations require a shutdown of more than 24 hours, or more than 4 hours daily on consecutive days, of a NAVAID owned by the airport but maintained by the FAA, provide a 45-day minimum notice to FAA ATO/Technical Operations prior to facility shutdown.

(b) FAA owned.

(i) General. The airport operator must notify the appropriate FAA ATO Service Area Planning and Requirements (P&R) Group a minimum of 45 days prior to implementing an event that causes impacts to NAVAIDs. (Impacts to FAA equipment covered by a Reimbursable Agreement (RA) do not have to be reported by the airport operator.)

(ii) Coordinate work for a FAA owned NAVAID shutdown with the local FAA ATO/Technical Operations office, including any necessary reimbursable agreements and flight checks. Detail procedures that address unanticipated utility outages and cable cuts that could impact FAA NAVAIDs. In addition, provide seven days notice to schedule the actual shutdown.

214. Inspection Requirements.

a. Daily Inspections. Inspections should be conducted at least daily, but more frequently if necessary to ensure conformance with the CSPP. A sample checklist is provided in Appendix 3, Safety and Phasing Plan Checklist. See also AC 150/5200-18, Airport Safety Self-Inspection.

b. Final Inspections. New runways and extended runway closures may require safety inspections at certificated airports prior to allowing air carrier service. Coordinate with the FAA Airport Certification Safety Inspector (ACSI) to determine if a final inspection will be necessary.

215. Underground Utilities. The CSPP and/or SPCD must include procedures for locating and protecting existing underground utilities, cables, wires, pipelines, and other underground facilities in excavation areas. This may involve coordinating with public utilities and FAA ATO/Technical Operations. Note that “One Call” or “Miss Utility” services do not include FAA ATO/Technical Operations.

216. Penalties. The CSPP should detail penalty provisions for noncompliance with airport rules and regulations and the safety plans (for example, if a vehicle is involved in a runway incursion). Such penalties typically include rescission of driving privileges or access to the AOA.

217. Special Conditions. The CSPP must detail any special conditions that affect the operation of the
airport and will require the activation of any special procedures (for example, low-visibility operations, snow removal, aircraft in distress, aircraft accident, security breach, Vehicle / Pedestrian Deviation (VPD) and other activities requiring construction suspension/resumption).

218. Runway and Taxiway Visual Aids. Includes marking, lighting, signs, and visual NAVAIDS. The CSPP must ensure that areas where aircraft will be operating are clearly and visibly separated from construction areas, including closed runways. Throughout the duration of the construction project, verify that these areas remain clearly marked and visible at all times and that marking, lighting, signs, and visual NAVAIDS remain in place and operational. The CSPP must address the following, as appropriate:

a. General. Airport markings, lighting, signs, and visual NAVAIDS must be clearly visible to pilots, not misleading, confusing, or deceptive. All must be secured in place to prevent movement by prop wash, jet blast, wing vortices, or other wind currents and constructed of materials that would minimize damage to an aircraft in the event of inadvertent contact.

b. Markings. Markings must be in compliance with the standards of AC 150/5340-1, Standards for Airport Markings. Runways and runway exit taxiways closed to aircraft operations are marked with a yellow X. The preferred visual aid to depict temporary runway closure is the lighted X signal placed on or near the runway designation numbers. (See paragraph 218.b(1)(b) below.)

(1) Closed Runways and Taxiways.
(a) Permanently Closed Runways. For runways, obliterate the threshold marking, runway designation marking, and touchdown zone markings, and place Xs at each end and at 1,000-foot (300 m) intervals.
(b) Temporarily Closed Runways. For runways that have been temporarily closed, place an X at the each end of the runway directly on or as near as practicable to the runway designation numbers. Figure 2-1 illustrates.

![Figure 2-1 Markings for a Temporarily Closed Runway](image)

(c) Partially Closed Runways and Displaced Thresholds. When threshold markings are needed to identify the temporary beginning of the runway that is available for landing, the markings must comply with AC 150/5340-1. An X is not used on a partially closed runway or a runway with a displaced threshold. See paragraph 207 a(1) above for the difference between partially closed runways and runways with displaced thresholds.

(i) Partially Closed Runways. Pavement markings for temporary closed portions of the runway consist of a runway threshold bar and yellow chevrons to identify pavement areas that are unsuitable for takeoff or landing (see AC 150/5340-1).

(ii) Displaced Thresholds. Pavement markings for a displaced threshold consist of a runway threshold bar and white arrowheads with and without arrow shafts. These markings are required to identify the portion of the runway before the displaced threshold to provide centerline guidance for pilots during approaches, takeoffs, and landing rollouts from the opposite direction. See AC 150/5340-1.
(d) Taxiways.

(i) Permanently Closed Taxiways. AC 150/5300-13 notes that it is preferable to remove the pavement, but for pavement that is to remain, place an X at the entrance to both ends of the closed section. Obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed taxiway. Figure 2-2 illustrates.

![Figure 2-2 Taxiway Closure](image)

(ii) Temporarily Closed Taxiways. Place barricades outside the safety area of intersecting taxiways. For runway/taxiway intersections, place an X at the entrance to the closed taxiway from the runway. If the taxiway will be closed for an extended period, obliterate taxiway centerline markings, including runway leadoff lines, leading to the closed section. If the centerline markings will be reused upon reopening the taxiway, it is preferable to paint over the marking. This will result in less damage to the pavement when the upper layer of paint is ultimately removed.

(e) Temporarily Closed Airport. When the airport is closed temporarily, mark all the runways as closed.
(2) If unable to paint temporary markings on the pavement, construct them from any of the following materials: fabric, colored plastic, painted sheets of plywood, or similar materials. They must be properly configured and appropriately secured to prevent movement by prop wash, jet blast, or other wind currents.

(3) If necessary to remove or cover runway markings, including but not limited to, runway designation markings, threshold markings, centerline markings, edge stripes, touchdown zone markings, and aiming point markings, depending on the length of construction and type of activity at the airport. When removing runway markings, apply the same treatment to areas between stripes or numbers, as the cleaned area will appear to pilots as a marking in the shape of the treated area.

(4) If it is not possible to install threshold bars, chevrons, and arrows on the pavement, temporary outboard markings may be used. Locate them outside of the runway pavement surface on both sides of the runway. The dimension along the runway direction must be the same as if installed on the pavement. The lateral dimension must be at least one-half that of on-pavement markings. If the markings are not discernible on grass or snow, apply a black background with appropriate material over the ground to ensure they are clearly visible.

(5) The application rate of paint to mark a short-term temporary runway and taxiway markings may deviate from the standard (see Item P-620, “Runway and Taxiway Painting,” in AC 150/5370-10), but the dimensions must meet the existing standards.

c. Lighting and Visual NAVAIDs. This paragraph refers to standard runway and taxiway lighting systems. See below for hazard lighting. Lighting must be in conformance with AC 150/5340-30, Design and Installation Details for Airport Visual Aids, and AC 150/5345-50, Specification for Portable Runway and Taxiway Lights. When disconnecting runway and taxiway lighting fixtures, disconnect the associated isolation transformers. Alternately, cover the light fixture in such a way as to prevent light leakage. Avoid removing the lamp from energized fixtures because an excessive number of isolation transformers with open secondaries may damage the regulators and/or increase the current above its normal value. Secure, identify, and place any above ground temporary wiring in conduit to prevent electrocution and fire ignition sources.

(1) Permanently Closed Runways and Taxiways. For runways and taxiways that have been permanently closed, disconnect the lighting circuits.
(2) Temporarily Closed Runways. If available, use a lighted X, both at night and during the day, placed at each end of the runway facing the approach. The use of a lighted X is required if night work requires runway lighting to be on. See AC 150/5345-55, Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure. For runways that have been temporarily closed, but for an extended period, and for those with pilot controlled lighting, disconnect the lighting circuits or secure switches to prevent inadvertent activation. For runways that will be opened periodically, coordinate procedures with the FAA air traffic manager or, at airports without an ATCT, the airport operator. Activate stop bars if available. Figure 2-3 shows a lighted X by day. Figure 2-4 shows a lighted X at night.

Figure 2-3 Lighted X in Daytime

![Lighted X in Daytime](image)

Figure 2-4 Lighted X at Night

Figure 2-4 Lighted X at Night

(3) Partially Closed Runways and Displaced Thresholds. When a runway is partially closed, a portion of the pavement is unavailable for any aircraft operation, meaning taxing and landing or
taking off in either direction. A displaced threshold, by contrast, is put in place to ensure obstacle
clearance by landing aircraft. The pavement prior to the displaced threshold is available for takeoff in the
direction of the displacement, and for landing and takeoff in the opposite direction. Misunderstanding this
difference and issuance of a subsequently inaccurate NOTAM can result in a hazardous situation. For
both partially closed runways and displaced thresholds, approach lighting systems at the affected end
must be placed out of service.

(a) Partially Closed Runways. Disconnect edge and threshold lights on that part of
the runway at and behind the threshold (that is, the portion of the runway that is closed). Alternately,
cover the light fixture in such a way as to prevent light leakage.

(b) Displaced Thresholds. Edge lighting in the area of the displacement emits red
light in the direction of approach and yellow light in the opposite direction. Centerline lights are blanked
out in the direction of approach if the displacement is 700 ft or less. If the displacement is over 700 ft,
place the centerline lights out of service. See AC 150/5340-50 for details on lighting displaced thresholds.

(c) Temporary runway thresholds and runway ends must be lighted if the runway is
lighted and it is the intended threshold for night landings or instrument meteorological conditions.

(d) A temporary threshold on an unlighted runway may be marked by retroreflective,
elevated markers in addition to markings noted in paragraph 218.b(1)(c) above. Markers seen by aircraft
on approach are green. Markers at the rollout end of the runway are red. At certificated airports,
temporary elevated threshold markers must be mounted with a frangible fitting (see 14 CFR Part
139.309). At non-certificated airports, the temporary elevated threshold markings may either be mounted
with a frangible fitting or be flexible. See AC 150/5345-39, Specification for L-853, Runway and
Taxiway Retroreflective Markers.

(e) Temporary threshold lights and end lights and related visual NAVAIDS are
installed outboard of the edges of the full-strength pavement only when they cannot be installed on the
pavement. They are installed with bases at grade level or as low as possible, but not more than 3 in (7.6
cm) above ground. When any portion of a base is above grade, place properly compacted fill around the
base to minimize the rate of gradient change so aircraft can, in an emergency, cross at normal landing or
takeoff speeds without incurring significant damage. See AC 150/5370-10.

(f) Maintain threshold and edge lighting color and spacing standards as described in
AC 150/5340-30. Battery powered, solar, or portable lights that meet the criteria in AC 150/5345-50 may
be used. These systems are intended primarily for visual flight rules (VFR) aircraft operations but may be
used for instrument flight rules (IFR) aircraft operations, upon individual approval from the Flight
Standards Division of the applicable FAA Regional Office.

(g) Reconfigure yellow lenses (caution zone), as necessary. If the runway has
centerline lights, reconfigure the red lenses, as necessary, or place the centerline lights out of service.

(h) Relocate the visual glide slope indicator (VGSI), such as VASI and PAPI; other
airport lights, such as Runway End Identifier Lights (REIL); and approach lights to identify the temporary
threshold. Another option is to disable the VGSI or any equipment that would give misleading indications
to pilots as to the new threshold location. Installation of temporary visual aids may be necessary to
provide adequate guidance to pilots on approach to the affected runway. If the FAA owns and operates
the VGSI, coordinate its installation or disabling with the local ATO/Technical Operations Office.
Relocation of such visual aids will depend on the duration of the project and the benefits gained from the
relocation, as this can result in great expense.

(i) Issue a NOTAM to inform pilots of temporary lighting conditions.

(4) Temporarily Closed Taxiways. If possible, deactivate the taxiway lighting circuits.
When deactivation is not possible (for example other taxiways on the same circuit are to remain open),
cover the light fixture in such a way as to prevent light leakage.

d. Signs. To the extent possible, signs must be in conformance with AC 150/5345-44, Specification for Runway and Taxiway Signs and AC 150/5340-18, Standard for Airport Sign Systems. Any time a sign does not serve its normal function; it must be covered or removed to prevent misdirecting pilots. Note that information signs identifying a crossing taxiway continue to perform their normal function even if the crossing taxiway is closed. For long term construction projects, consider relocating signs, especially runway distance remaining signs.

219. Marking and Signs for Access Routes. The CSPP should indicate that pavement markings and signs for construction personnel will conform to AC 150/5340-18 and, to the extent practicable, with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications. Signs adjacent to areas used by aircraft must comply with the frangibility requirements of AC 150/5220-23, Frangible Connections, which may require modification to size and height guidance in the MUTCD.

220. Hazard Marking, Lighting and Signing.

a. Hazard Marking and Lighting Prevents Pilots from entering areas closed to aircraft, and prevents construction personnel from entering areas open to aircraft. The CSPP must specify prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles. Hazard marking and lighting must also be specified to identify open manholes, small areas under repair, stockpiled material, waste areas, and areas subject to jet blast. Also consider less obvious construction-related hazards and include markings to identify FAA, airport, and National Weather Service facilities cables and power lines; instrument landing system (ILS) critical areas; airport surfaces, such as RSA, OFA, and OFZ; and other sensitive areas to make it easier for contractor personnel to avoid these areas.

b. Equipment.

(1) Barricades, including traffic cones, (weighted or sturdy attached to the surface) are acceptable methods used to identify and define the limits of construction and hazardous areas on airports. Careful consideration must be given to selecting equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast. The spacing of barricades must be such that a breach is physically prevented barring a deliberate act. For example, if barricades are intended to exclude vehicles, gaps between barricades must be smaller than the width of the excluded vehicles, generally 4 ft. Provision must be made for ARFF access if necessary. If barricades are intended to exclude pedestrians, they must be continuously linked. Continuous linking may be accomplished through the use of ropes, securely attached to prevent FOD.

(2) Lights must be red, either steady burning or flashing, and must meet the luminance requirements of the State Highway Department. Batteries powering lights will last longer if lights flash. Lights must be mounted on barricades and spaced at no more than 10 ft. Lights must be operated between sunset and sunrise and during periods of low visibility whenever the airport is open for operations. They may be operated by photocell, but this may require that the contractor turn them on manually during periods of low visibility during daytime hours.

(3) Supplement barricades with signs (for example “No Entry,” “No Vehicles”) as necessary.

(4) Air Operations Area – General. Barricades are not permitted in any active safety area. Within a runway or taxiway object free area, and on aprons, use orange traffic cones, flashing or steady burning red lights as noted above, collapsible barricades marked with diagonal, alternating orange and
white stripes; and/or signs to separate all construction/maintenance areas from the movement area. Barricades may be supplemented with alternating orange and white flags at least 20 by 20 in (50 by 50 cm) square and securely fastened to eliminate FOD. All barricades adjacent to any open runway or taxiway/taxiway safety area, or open, must be as low as possible to the ground, and no more than 18 in high, exclusive of supplementary lights and flags. Barricades must be of low mass, easily collapsible upon contact with an aircraft or any of its components, and weighted or sturdily attached to the surface to prevent displacement from prop wash, jet blast, wing vortex, or other surface wind currents. If affixed to the surface, they must be tamperable at grade level or as low as possible, but not to exceed 3 in (7.5 cm) above the ground. Figure 2-5 and Figure 2-6 show sample barricades with proper coloring and flags.

Figure 2-5 Interlocking Barricades

Figure 2-6 Low Profile Barricades

(5) **Air Operations Area – Runway/Taxiway Intersections.** Use highly reflective barricades with lights to close taxiways leading to closed runways. Evaluate all operating factors when determining how to mark temporary closures that can last from 10 to 15 minutes to a much longer period of time. However, even for closures of relatively short duration, close all taxiway/runway intersections with barricades. The use of traffic cones is appropriate for short duration closures.

(6) **Air Operations Area – Other.** Beyond runway and taxiway object free areas and
aprons, barricades intended for construction vehicles and personnel may be many different shapes and
made from various materials, including railroad ties, sawhorses, jersey barriers, or barrels.

(7) Maintenance. The construction specifications must include a provision requiring the
contractor to have a person on call 24 hours a day for emergency maintenance of airport hazard lighting
and barricades. The contractor must file the contact person’s information with the airport operator.
Lighting should be checked for proper operation at least once per day, preferably at dusk.

221. Protection of Runway and Taxiway Safety Areas. Runway and taxiway safety areas, Obstacle
Free zones (OFZ), object free areas (OFA), and approach surfaces are described in AC 150/5300-13.
Protection of these areas includes limitations on the location and height of equipment and stockpiled
material. An FAA airspace study may be required. Coordinate with the appropriate FAA Airports
Regional or District Office if there is any doubt as to requirements or dimensions (See paragraph 213.e
above) as soon as the location and height of materials or equipment are known. The CSPP should include
drawings showing all safety areas, object free areas, obstacle free zones and approach departure surfaces
affected by construction.

a. Runway Safety Area (RSA). A runway safety area is the defined surface surrounding the
runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot,
overshoot, or excursion from the runway (see AC 150/5300-13). Construction activities within the
existing RSA are subject to the following conditions:

(1) No construction may occur within the existing RSA while the runway is open for
aircraft operations. The RSA dimensions may be temporarily adjusted if the runway is restricted to
aircraft operations requiring an RSA that is equal to the RSA width and length beyond the runway ends
available during construction. (see AC 150/5300-13). The temporary use of declared distances and/or
partial runway closures may provide the necessary RSA under certain circumstances. Coordinate with the
appropriate FAA Airports Regional or District Office to have declared distances information published.
See AC 150/5300-13 for guidance on the use of declared distances.

(2) The airport operator must coordinate the adjustment of RSA dimensions as permitted
above with the appropriate FAA Airports Regional or District Office and the local FAA air traffic
manager and issue a NOTAM.

(3) The CSPP and SPCD must provide procedures for ensuring adequate distance for
protection from blasting operations, if required by operational considerations.

(4) Excavations.

(a) Open trenches or excavations are not permitted within the RSA while the runway
is open. If possible, backfill trenches before the runway is opened. If the runway must be opened before
evacuations are backfilled, cover the excavations appropriately. Covering for open trenches must be
designed to allow the safe operation of the heaviest aircraft operating on the runway across the trench
without damage to the aircraft.

(b) Construction contractors must prominently mark open trenches and excavations
at the construction site with red or orange flags, as approved by the airport operator, and light them with
red lights during hours of restricted visibility or darkness.

(5) Erosion Control. Soil erosion must be controlled to maintain RSA standards, that is, the
RSA must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other
surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft
rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural
damage to the aircraft.
b. Runway Object Free Area (ROFA). Construction, including excavations, may be permitted in the ROFA. However, equipment must be removed from the ROFA when not in use, and material should not be stockpiled in the ROFA if not necessary. Stockpiling material in the OFA requires submittal of a 7460-1 form and justification provided to the appropriate FAA Airports Regional or District Office for approval.

c. Taxiway Safety Area (TSA). A taxiway safety area is a defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway. (See AC 150/5300-13.) Construction activities within the TSA are subject to the following conditions:

1. No construction may occur within the TSA while the taxiway is open for aircraft operations. The TSA dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a TSA that is equal to the TSA width available during construction (see AC 150/5300-13, Table 4-1).

2. The airport operator must coordinate the adjustment of the TSA width as permitted above with the appropriate FAA Airports Regional or District Office and the FAA air traffic manager and issue a NOTAM.

3. The CSPP and SPCD must provide procedures for ensuring adequate distance for protection from blasting operations.

4. Excavations.
   a. Open trenches or excavations are not permitted within the TSA while the taxiway is open. If possible, backfill trenches before the taxiway is opened. If the taxiway must be opened before excavations are backfilled, cover the excavations appropriately. Covering for open trenches must be designed to allow the safe operation of the heaviest aircraft operating on the taxiway across the trench without damage to the aircraft.
   b. Construction contractors must prominently mark open trenches and excavations at the construction site with red or orange flags, as approved by the airport operator, and light them with red lights during hours of restricted visibility or darkness.

5. Erosion Control. Soil erosion must be controlled to maintain TSA standards, that is, the TSA must be cleared and graded and have no potentially hazardous cuts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and fire fighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft.

d. Taxiway Object Free Area (TOFA). Unlike the Runway Object Free Area, aircraft wings regularly penetrate the taxiway object free area during normal operations. Thus the restrictions are more stringent. Except as provided below, no construction may occur within the taxiway object free area while the taxiway is open for aircraft operations.

1. The taxiway object free area dimensions may be temporarily adjusted if the taxiway is restricted to aircraft operations requiring a taxiway object free area that is equal to the taxiway object free area width available.

2. Offset taxiway pavement markings may be used as a temporary measure to provide the required taxiway object free area. Where offset taxiway pavement markings are provided, centerline lighting or reflectors are required.

3. Construction activity may be accomplished without adjusting the width of the taxiway object free area, subject to the following restrictions:
(a) Appropriate NOTAMs are issued.

(b) Marking and lighting meeting the provisions of paragraphs 218 and 220 above are implemented.

(c) Five-foot clearance is maintained between equipment and materials and any part of an aircraft (includes wingtip overhang). In these situations, flaggers must be used to direct construction equipment, and wing walkers will be necessary to guide aircraft. Wing walkers should be airline/aviation personnel rather than construction workers. If such clearance can only be maintained if an aircraft does not have full use of the entire taxiway width (with its main landing gear at the edge of the pavement), then it will be necessary to move personnel and equipment for the passage of that aircraft.

e. Obstacle Free Zone (OFZ). In general, personnel, material, and/or equipment may not penetrate the OFZ while the runway is open for aircraft operations. If a penetration to the OFZ is necessary, it may be possible to continue aircraft operations through operational restrictions. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

f. Runway Approach/Departure Areas and Clearways. All personnel, materials, and/or equipment must remain clear of the applicable threshold sitting surfaces, as defined in Appendix 2, “Threshold Siting Requirements,” of AC 150/5300-13. Objects that do not penetrate these surfaces may still be obstructions to air navigation and may affect standard instrument approach procedures. Coordinate with the FAA through the appropriate FAA Airports Regional or District Office.

1. Construction activity in a runway approach/departure area may result in the need to partially close a runway or displace the existing runway threshold. Partial runway closure, displacement of the runway threshold, as well as closure of the complete runway and other portions of the movement area also require coordination through the airport operator with the appropriate FAA air traffic manager (FSS if non-towered) and ATO/Technical Operations (for affected NAVAIDS) and airport users.

2. Caution regarding partial runway closures. When filing a NOTAM for a partial runway closure, clearly state to OCC personnel that the portion of pavement located prior to the threshold is not available for landing and departing traffic. In this case, the threshold has been moved for both landing and takeoff purposes (this is different than a displaced threshold). There may be situations where the portion of closed runway is available for taxiing only. If so, the NOTAM must reflect this condition.

3. Caution regarding displaced thresholds. Implementation of a displaced threshold affects runway length available for aircraft landing over the displacement. Depending on the reason for the displacement (to provide obstruction clearance or RSA), such a displacement may also require an adjustment in the landing distance available and accelerate-stop distance available in the opposite direction. If project scope includes personnel, equipment, excavation, other work, within the existing RSA of any usable runway end, do not implement a displaced threshold unless arrivals and departures toward the construction activity are prohibited. Instead, implement a partial closure.

222. Other Limitations on Construction. The CSPP must specify any other limitations on construction, including but not limited to:

a. Prohibitions.

1. No use of tall equipment (cranes, concrete pumps, and so on) unless a 7460-1 determination letter is issued for such equipment.

2. No use of open flame welding or torches unless fire safety precautions are provided and the airport operator has approved their use.

3. No use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.

Chapter 2 Construction Safety and Phasing Plans 28
See AC 150/5370-10.

(4) No use of flare pots within the AOA.

b. Restrictions.

(1) Construction suspension required during specific airport operations.

(2) Areas that cannot be worked on simultaneously.

(3) Day or night construction restrictions.

(4) Seasonal construction restrictions.
Chapter 3. Guidelines for Writing a CSPP

301. General Requirements. The CSPP is a standalone document written to correspond with the subjects outlined in Chapter 2, Section 1, paragraph 204. The CSPP is organized by numbered sections corresponding to each subject listed in Chapter 2, Section 1, paragraph 204, and described in detail in Chapter 2, Section 2. Each section number and title in the CSPP matches the corresponding subject outlined in Chapter 2, paragraph 204 (for example, 1. Coordination, 2. Phasing, 3. Areas and Operations Affected by the Construction Activity, and so on.). With the exception of the project scope of work outlined in Section 2. Phasing, only subjects specific to operational safety during construction should be addressed.

302. Applicability of Subjects. Each section should, to the extent practical, focus on the specific subject. Where an overlapping requirement spans several sections, the requirement should be explained in detail in the most applicable section. A reference to that section should be included in all other sections where the requirement may apply. For example, the requirement to protect existing underground FAA Instrument Landing System (ILS) cables during trenching operations could be considered FAA ATO coordination (Section 1. Coordination, paragraph 205.c), an area and operation affected by the construction activity (Section 3. Areas and Operations Affected by the Construction Activity, paragraph 207.a(4)), a protection of a NAVAID (Section 4. Protection of Navigational Aids (NAVAIDs),paragraph 208), or a notification to the FAA of construction activities (Section 9. Notification of Construction Activities, paragraph 210.a(5)(d)). However, it is more specifically an underground utility requirement (Section 11. Underground Utilities, paragraph 215). The procedure for protecting underground ILS cables during trenching operations should therefore be described in Section 11: "The contractor must coordinate with the local FAA System Support Center (SSC) to mark existing ILS cable routes along Runway 17-35. The ILS cables will be located by hand digging whenever the trenching operation moves within 10 feet of the cable markings." All other applicable sections should include a reference to Section 11: "ILS cables shall be identified and protected as described in Section 11" or "See Section 11 for ILS cable identification and protection requirements." Thus, the CSPP should be considered as a whole, with no need to duplicate responses to related issues.

303. Graphical Representations. Construction safety drawings should be included in the CSPP as attachments. When other graphical representations will aid in supporting written statements, the drawings, diagrams, and/or photographs should also be attached to the CSPP. References should be made in the CSPP to each graphical attachment and may be made in multiple sections.

304. Reference Documents. The CSPP must not incorporate a document by reference unless reproduction of the material in that document is prohibited. In that case, either copies of or a source for the referenced document must be provided to the contractor.

305. Restrictions. The CSPP should not be considered as a project design review document. The CSPP should also avoid mention of permanent ("as-built") features such as pavements, markings, signs, and lighting, except when such features are intended to aid in maintaining operational safety during the construction.

306. Coordination. Include in this section a detailed description of conferences and meetings both before and during the project. Include appropriate information from AC 150/5300-9. Discuss coordination procedures and schedules for each required FAA ATO airway facility shutdown and restart and all required flight inspections.
307. Phasing. Include in this section a detailed scope of work description for the project as a whole and each phase of work covered by the CSPP. This includes all locations and durations of the work proposed. Attach drawings to graphically support the written scope of work. Detail in this section the sequenced phases of the proposed construction. Include a reference to paragraph 308 below, as appropriate.

308. Areas and Operations Affected By Construction. Focus in this section on identifying the areas and operations affected by the construction. Describe corresponding mitigation that is not covered in detail elsewhere in the CSPP. Include references to paragraphs below as appropriate. Attach drawings as necessary to graphically describe affected areas and mechanisms proposed. Attach drawings as necessary to graphically describe affected areas and mechanisms proposed. Attach drawings as necessary to graphically describe affected areas and mechanisms proposed.

<table>
<thead>
<tr>
<th>Table 3-1 Sample Operations Effects</th>
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<tbody>
<tr>
<td><strong>Project</strong></td>
</tr>
<tr>
<td>Phase</td>
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<tr>
<td><strong>Scope of Work</strong></td>
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<tr>
<td>Operational Requirements</td>
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<tr>
<td>Runway 15 Average Aircraft Operations</td>
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<td>Runway 33 Average Aircraft Operations</td>
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<td>Runway 15-33 ARC</td>
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<td>Runway 15 Approach Visibility Minimums</td>
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<tr>
<td>Runway 33 Approach Visibility Minimums</td>
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<td>Runway 15 Declared Distances</td>
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<td>Runway 15 Approach Procedures</td>
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<td>Runway 33 Approach Procedures</td>
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<td>Runway 15 NAVAIDs</td>
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Chapter 3 Guidelines for Writing a CSPP
### Runway 33 NAVAIDS

<table>
<thead>
<tr>
<th>Taxiway G ADG</th>
<th>ILS/DMB, MALSF, PAPI, RVR</th>
<th>MALSF, PAPI, RVR</th>
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<tbody>
<tr>
<td>Taxiway E ADG</td>
<td>I</td>
<td>IV (N/A between T/W and R/W 15 end)</td>
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<tr>
<td>ATCT (hours open)</td>
<td>06:00 – 24:00 local</td>
<td>06:00 – 24:00 local</td>
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<td>ARFF Index</td>
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<td>Special Conditions</td>
<td>Air National Guard (ANG) military operations</td>
<td>Military operations relocated to alternate ANG Base</td>
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<tr>
<td></td>
<td>Airline XYZ requires VGSI</td>
<td>Airline XYZ requires VGSI</td>
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</tbody>
</table>

Complete the following chart for each phase to determine the area that must be protected along the runway edges:

<table>
<thead>
<tr>
<th>Runway</th>
<th>Aircraft Approach Categorya, B, C, or D</th>
<th>Airplane Design Groupi, II, III, or IV</th>
<th>RSA Width in Feet Divided by 2a</th>
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*See AC 150/5300-13 to complete the chart for a specific runway.

Complete the following chart for each phase to determine the area that must be protected before the runway threshold:

<table>
<thead>
<tr>
<th>Runway End Number</th>
<th>Airplane Design Groupi, II, III, or IV</th>
<th>Aircraft Approach Categorya, B, C, or D</th>
<th>Minimum Safety Area Prior to the Thresholda</th>
<th>Minimum Distance to Threshold Based on Required Approach Slopea</th>
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*See AC 150/5300-13 to complete the chart for a specific runway.

### 309. Navigation Aid (NAVAID) Protection

List in this section all NAVAID facilities that will be affected by the construction. Identify NAVAID facilities that will be placed out of service at any time prior to or during construction activities. Identify individuals responsible for coordinating each shutdown and when each facility will be out of service. Include a reference to paragraph 306 above for FAA ATO NAVAID shutdown, restart, and flight inspection coordination. Outline in detail procedures to protect each NAVAID facility remaining in service from interference by construction activities. Include a reference to paragraph 314 for the issuance of NOTAMs as required. Include a reference to paragraph 316 for the protection of underground cables and piping serving NAVAIDs. If temporary visual aids are proposed to replace or supplement existing facilities, include a reference to paragraph 319. Attach drawings to graphically indicate the affected NAVAIDs and the corresponding critical areas.

### 310. Contractor Access

This will necessarily be the most extensive section of the CSPP. Provide
sufficient detail so that a contractor not experienced in working on airports will understand the unique restrictions such work will require. Due to this extent, it should be broken down into subsections as described below:

a. **Location of Stockpiled Construction Materials.** Describe in this section specific locations for stockpiling material. Note any height restrictions on stockpiles. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify stockpiles. Include a reference to paragraph 311 for provisions to prevent stockpile material from becoming wildlife attractants. Include a reference to paragraph 312 for provisions to prevent stockpile material from becoming FOD. Attach drawings to graphically indicate the stockpile locations.

b. **Vehicle and Pedestrian Operations.** While there are many items to be addressed in this major subsection of the CSPP, all are concerned with one main issue: keeping people and vehicles from areas of the airport where they don’t belong. This includes preventing unauthorized entry to the AOAs and preventing the improper movement of pedestrians or vehicles on the airport. In this section, focus on mechanisms to prevent construction vehicles and workers traveling to and from the worksite from unauthorized entry into movement areas. Specify locations of parking for both employee vehicles and construction equipment, and routes for access and haul roads. In most cases, this will best be accomplished by attaching a drawing. Quote from AC 150/5210-5 specific requirements for contractor vehicles rather than referring to the AC as a whole, and include special requirements for identifying Hazardous Material (HAZMAT) vehicles. Quote from, rather than incorporate by reference, AC 150/5210-20 as appropriate to address the airport’s rules for ground vehicle operations, including its training program. Discuss the airport’s recordkeeping system listing authorized vehicle operators.

c. **Two-Way Radio Communications.** Include a special section to identify all individuals who are required to maintain communications with Air Traffic (AT) at airports with active towers, or monitor Common Traffic Advisory Frequencies (CTAF) at airports without or with closed ATCT. Include training requirements for all individuals required to communicate with AT. Individuals required to monitor AT frequencies should also be identified. If construction employees are also required to communicate by radio with Airport Operations, this procedure should be described in detail. Usage of vehicle mounted radios and/or portable radios should be addressed. Communication procedures for the event of disabled radio communication (that is, light signals, telephone numbers, others) must be included. All radio frequencies should be identified (Tower, Ground Control, CTAF, UNICOM, ATIS, and so on).

d. **Airport Security.** Address security as it applies to vehicle and pedestrian operations. Discuss TSA requirements, security badging requirements, perimeter fence integrity, gate security, and other needs. Attach drawings to graphically indicate secured and/or Security Identification Display Areas (SIDA), perimeter fencing, and available access points.

311. **Wildlife Management.** Discuss in this section wildlife management procedures. Describe the maintenance of existing wildlife mitigation devices, such as perimeter fences, and procedures to limit wildlife attractants. Include procedures to notify Airport Operations of wildlife encounters. Include a reference to paragraph 310 for security (wildlife) fence integrity maintenance as required.

312. **Foreign Object Debris (FOD) Management.** In this section, discuss methods to control and monitor FOD: worksite housekeeping, ground vehicle tire inspections, runway sweeps, and so on. Include a reference to paragraph 315 for inspection requirements as required.

313. **Hazardous Materials (HAZMAT) Management.** Describe in this section HAZMAT management procedures: fuel deliveries, spill recovery procedures, Material Safety Data Sheet (MSDS) availability, and other considerations. Any specific airport HAZMAT restrictions should also be
identified. Include a reference to paragraph 310 for HAZMAT vehicle identification requirements. Quote

314. Notification of Construction Activities. List in this section the names and telephone numbers of
points of contact for all parties affected by the construction project. We recommend a single list that
includes all telephone numbers required under this section. Include emergency notification procedures for
all representatives of all parties potentially impacted by the construction. Identify individual
representatives— and at least one alternate— for each party. List both on-duty and off-duty contact
information for each individual, including individuals responsible for emergency maintenance of airport
construction hazard lighting and barricades. Describe procedures to coordinate immediate response to
events that might adversely affect the operational safety of the airport (such as interrupted NAVADA
service). Explain requirements for and the procedures for the issuance of Notices to Airmen (NOTAMs),
notification to FAA required by 14 CFR Part 77 and Part 157 and in the event of affected NAVADA. For
NOTAMs, identify an individual, and at least one alternate, responsible for issuing and cancelling each
specific type of Notice to Airmen (NOTAM) required. Detail notification methods for police, fire
fighting, and medical emergencies. This may include 911, but should also include direct phone numbers
of local police departments and nearby hospitals. The local Poison Control number should be listed.
Procedures regarding notification of Airport Operations and/or the ARFF Department of such
emergencies should be identified, as applicable. If airport radio communications are identified as a means
of emergency notification, include a reference to paragraph 310. Differentiate between emergency and
nonemergency notification of ARFF personnel, the latter including activities that affect ARFF water
supplies and access roads. Identify the primary ARFF contact person and at least one alternate. If
notification is to be made through Airport Operations, then detail this procedure. Include a method of
confirmation from the ARFF department.

315. Inspection Requirements. Describe in this section inspection requirements to ensure airfield
safety compliance. Include a requirement for routine inspections by the resident engineer (RE) and the
construction contractors. If the engineering consultants and/or contractors have a Safety Officer who will
conduct such inspections, identify this individual. Describe procedures for special inspections, such as
those required to reopen areas for aircraft operations. Part 139 requires daily airfield inspections at
certificated airports, but these may need to be more frequent when construction is in progress. Discuss the
role of such inspections on areas under construction. Include a requirement to immediately remedy any
deficiencies, whether caused by negligence, oversight, or project scope change.

316. Underground Utilities. Explain how existing underground utilities will be located and protected.
Identify each utility owner and include contact information for each company/agency in the master list.
Address emergency response procedures for damaged or disrupted utilities. Include a reference to
paragraph 314 above for notification of utility owners of accidental utility disruption as required.

317. Penalties. Describe in this section specific penalties imposed for noncompliance with airport
rules and regulations, including the CSPP, SIDA violations, Vehicle/Pedestrian Deviations (VPD), and
others.

318. Special Conditions. Identify any special conditions that may trigger specific safety mitigation
actions outlined in this CSPP: low visibility operations, snow removal, aircraft in distress, aircraft
accident, security breach, VPD, and other activities requiring construction suspension/resumption. Include
a reference to paragraph 310 above for compliance with airport safety and security measures and for radio
communications as required. Include a reference to paragraph 319 below for emergency notification of all
involved parties, including police/security, ARFF, and medical services.

319. Runway and Taxiway Visual Aids. Include marking, lighting, signs, and visual NAVAIDS.
Detail temporary runway and taxiway marking, lighting, signs, and visual NAVAIDs required for the construction. Discuss existing marking, lighting, signs, and visual NAVAIDs that are temporarily altered, obliterated, or shut down. Consider non-federal facilities and address requirements for reimbursable agreements necessary for alteration of FAA facilities and for necessary flight checks. Identify temporary TORA signs or runway distance remaining signs if appropriate. Identify required temporary visual NAVAIDs such as REIL or PAPI. Quote from, rather than incorporate by reference, AC 150/5340-1, Standards for Airport Markings, AC 150/5340-18, Standards for Airport Sign Systems, and AC 150/5340-30, as required. Attach drawings to graphically indicate proposed marking, lighting, signs, and visual NAVAIDs.

320. Marking and Signs for Access Routes. Detail plans for marking and signs for vehicle access routes. To the extent possible, signs should be in conformance with the Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD) and/or State highway specifications, not hand lettered. Detail any modifications to the guidance in the MUTCD necessary to meet frangibility/height requirements.

321. Hazard Marking and Lighting. Specify all marking and lighting equipment, including when and where each type of device is to be used. Specify maximum gaps between barricades and the maximum spacing of hazard lighting. Identify one individual and at least one alternate responsible for maintenance of hazard marking and lighting equipment in the master telephone list. Include a reference to paragraph 314 above. Attach drawings to graphically indicate the placement of hazard marking and lighting equipment.

322. Protection of Runway and Taxiway Safety Areas. This section should focus exclusively on procedures for protecting all safety areas, including those altered by the construction: methods of demarcation, limit of access, movement within safety areas, stockpiling and trenching restrictions, and so on. Reference AC 150/5300-13: Airport Design as required. Include a reference to paragraph 310 above for procedures regarding vehicle and personnel movement within safety areas. Include a reference to paragraph 310 above for material stockpile restrictions as required. Detail requirements for trenching, excavations, and backfill. Include a reference to paragraph 321 for hazard marking and lighting devices used to identify open excavations as required. If runway and taxiway closures are proposed to protect safety areas, or if temporary displaced thresholds and/or revised declared distances are used to provide adequate Runway Safety Area, include a reference to paragraphs 314 and 319 above. Detail procedures for protecting the runway OFZ, runway OFA, taxiway OFA and runway approach surfaces including those altered by the construction: methods of demarcation, limit of cranes, storage of equipment, and so on. Quote from, rather than incorporate by reference, AC 150/5300-13: Airport Design as required. Include a reference to paragraph 323 for height (i.e. crane) restrictions as required. One way to address the height of equipment that will move during the project is to establish a three-dimensional “box” within which equipment will be confined that can be studied as a single object. Attach drawings to graphically indicate the safety area, OFZ, and OFA boundaries.

323. Other Limitations on Construction. This section should describe what limitations must be applied to each area of work and when each limitation will be applied: limitations due to airport operations, height (i.e. crane) restrictions, areas which cannot be worked at simultaneously, day/night work restrictions, winter construction, and other limitations. Include a reference to paragraph 307 above for project phasing requirements based on construction limitations as required.

Chapter 3 Guidelines for Writing a CSPP
### Appendix 1. Related Reading Material

Obtain the latest version of the following free publications from the FAA on its Web site at [http://www.faa.gov/airports/](http://www.faa.gov/airports/).

<table>
<thead>
<tr>
<th>AC</th>
<th>Title and Description</th>
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<tbody>
<tr>
<td>AC 150/5200-28</td>
<td>Notices to Airmen (NOTAMs) for Airport Operators. Guidance for using the NOTAM System in airport reporting.</td>
</tr>
<tr>
<td>AC 150/5200-30</td>
<td>Airport Winter Safety and Operations.</td>
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<tr>
<td>AC 150/5200-33</td>
<td>Guidance for airport owners/operators on the development of an acceptable airport snow and ice control program and on appropriate field condition reporting procedures.</td>
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<tr>
<td>AC 150/5210-5</td>
<td>Hazardous Wildlife Attractants On or Near Airports.</td>
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<tr>
<td>AC 150/5210-20</td>
<td>Guidance on locating certain land uses that might attract hazardous wildlife to public-use airports.</td>
</tr>
<tr>
<td>AC 150/5210-5</td>
<td>Painting, Marking, and Lighting of Vehicles Used on an Airport.</td>
</tr>
<tr>
<td>AC 150/5300-13</td>
<td>Guidance, specifications, and standards for painting, marking, and lighting vehicles operating in the airport air operations areas.</td>
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<tr>
<td>AC 150/5310-24</td>
<td>Ground Vehicle Operations on Airports.</td>
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<tr>
<td>AC 150/5310-24</td>
<td>Guidance to airport operators on developing ground vehicle operation training programs.</td>
</tr>
<tr>
<td>AC 150/5320-15</td>
<td>Airport Design.</td>
</tr>
<tr>
<td>AC 150/5320-15</td>
<td>FAA standards and recommendations for airport design, establishes approach visibility minimums as an airport design parameter, and contains the Object Free area and the obstacle free zone criteria.</td>
</tr>
<tr>
<td>AC 150/5320-15</td>
<td>Airport Foreign Object Debris Management.</td>
</tr>
<tr>
<td>AC 150/5340-28</td>
<td>Guidance for developing and managing an airport foreign object debris (FOD) program.</td>
</tr>
<tr>
<td>AC 150/5320-15</td>
<td>Guidance on selecting a water source and meeting standards for a distribution system to support aircraft rescue and fire fighting service operations on airports.</td>
</tr>
<tr>
<td>AC 150/5340-1</td>
<td>Basic information on the characteristics, management, and regulations of industrial wastes generated at airports. Guidance for developing a Storm Water Pollution Prevention Plan (SWPPP) that applies best management practices to eliminate, prevent, or reduce pollutants in storm water runoff with particular airport industrial activities.</td>
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<tr>
<td>AC 150/5340-18</td>
<td>Standards for Airport Markings.</td>
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<tr>
<td>AC 150/5340-18</td>
<td>FAA standards for markings used on airport runways, taxiways, and aprons.</td>
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<tr>
<td>AC 150/5340-18</td>
<td>Standards for Airport Sign Systems.</td>
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<tr>
<td>AC 150/5340-28</td>
<td>FAA standards for the siting and installation of signs on airport runways and taxiways.</td>
</tr>
<tr>
<td>AC 150/5340-28</td>
<td>Precision Approach Path Indicator (PAPI) Systems.</td>
</tr>
<tr>
<td>AC 150/5340-28</td>
<td>FAA standards for PAPI systems, which provide pilots with visual glide slope guidance during approach for landing.</td>
</tr>
<tr>
<td>AC</td>
<td>Title and Description</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>AC 150/5340-30</td>
<td>Design and Installation Details for Airport Visual Aids</td>
</tr>
<tr>
<td>AC 150/5345-39</td>
<td>Specification for L-853, Runway and Taxiway Retroreflective Markers</td>
</tr>
<tr>
<td>AC 150/5345-44</td>
<td>Specification for Runway and Taxiway Signs</td>
</tr>
<tr>
<td>AC 150/5345-53</td>
<td>FAA specifications for unlighted and lighted signs for taxiways and runways</td>
</tr>
<tr>
<td>AC 150/5345-55</td>
<td>Details on the Airport Lighting Equipment Certification Program (ALECP)</td>
</tr>
<tr>
<td>AC 150/5345-60</td>
<td>FAA standards for portable runway and taxiway lights and runway end identifier lights for temporary use to permit continued aircraft operations while all or part of a runway lighting system is inoperative.</td>
</tr>
<tr>
<td>AC 150/5345-55</td>
<td>Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure</td>
</tr>
<tr>
<td>AC 150/5370-10</td>
<td>Standards for Specifying Construction of Airports</td>
</tr>
<tr>
<td>FAA Order 5200-11</td>
<td>FAA Ports (ARP) Safety Management System (SMS)</td>
</tr>
<tr>
<td>FAA Order 5200-11 Basics for implementing SMS within ARP. Includes roles and responsibilities of ARP management and staff as well as other FAA lines of business that contribute to the ARP SMS.</td>
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</tr>
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<td>FAA Order 5200-11 FAA Order 5200.11 Basics for implementing SMS within ARP. Includes roles and responsibilities of ARP management and staff as well as other FAA lines of business that contribute to the ARP SMS.</td>
<td></td>
</tr>
<tr>
<td>FAA Order 98-05</td>
<td>Grasses Attractive to Hazardous Wildlife</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>FAA Form 7460-1 Notice of Proposed Construction or Alteration</td>
<td></td>
</tr>
<tr>
<td>FAA Form 7480-1 Notice of Landing Area Proposal</td>
<td></td>
</tr>
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</table>


Title 14 CFR Part 139 Certification of Airports
Title 49 CFR Part 1542 Airport Security

## Appendix 2. Definition of Terms

<table>
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<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>7460-1</td>
<td>Notice Of Proposed Construction Or Alteration. For on-airport projects, the form submitted to the FAA regional or airports division office as formal written notification of any kind of construction or alteration of objects that affect navigable airspace, as defined in 14 CFR Part 77, safe, efficient use, and preservation of the navigable airspace. (See guidance available on the FAA website at <a href="http://oacaa.faa.gov">oacaa.faa.gov</a>.) The form may be downloaded at <a href="http://www.faa.gov/airports/resources/forms">http://www.faa.gov/airports/resources/forms</a>, or filed electronically at <a href="https://oacaa.faa.gov">https://oacaa.faa.gov</a>.</td>
</tr>
<tr>
<td>7480-1</td>
<td>Notice Of Landing Area Proposal. Form submitted to the FAA Airports Regional Division Office or Airports District Office as formal written notification whenever a project without an airport layout plan on file with the FAA involves the construction of a new airport; the construction, realigning, altering, activating, or abandoning of a runway, landing strip, or associated taxiway; or the deactivation or abandoning of an entire airport. The form may be downloaded at <a href="http://www.faa.gov/airports/resources/forms">http://www.faa.gov/airports/resources/forms</a>.</td>
</tr>
<tr>
<td>AC</td>
<td>Advisory Circular</td>
</tr>
<tr>
<td>ACRC</td>
<td>Aircraft Reference Code</td>
</tr>
<tr>
<td>ACSI</td>
<td>Airport Certification Safety Inspector</td>
</tr>
<tr>
<td>ADG</td>
<td>Airplane Design Group</td>
</tr>
<tr>
<td>AIP</td>
<td>Airport Improvement Program</td>
</tr>
<tr>
<td>AL/ECIP</td>
<td>Airport Lighting Equipment Certification Program</td>
</tr>
<tr>
<td>ANG</td>
<td>Air National Guard</td>
</tr>
<tr>
<td>AOA</td>
<td>Air Operations Area. Any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operations area includes such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runways, taxiways, or aprons.</td>
</tr>
<tr>
<td>ARFF</td>
<td>Aircraft Rescue and Fire Fighting</td>
</tr>
<tr>
<td>ARP</td>
<td>FAA Office of Airports</td>
</tr>
<tr>
<td>ASDA</td>
<td>Accelerate-Stop Distance Available</td>
</tr>
<tr>
<td>ATCT</td>
<td>Airport Traffic Control Tower</td>
</tr>
<tr>
<td>ATIS</td>
<td>Automatic Terminal Information Service</td>
</tr>
<tr>
<td>ATO</td>
<td>Air Traffic Organization</td>
</tr>
<tr>
<td>Certified Airport</td>
<td>An airport that has been issued an Airport Operating Certificate by the FAA under the authority of 14 CFR Part 139, Certification of Airports.</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>Construction</td>
<td>The presence and movement of construction-related personnel, equipment, and materials in any location that could infringe upon the movement of aircraft.</td>
</tr>
<tr>
<td>CSIPP</td>
<td>Construction Safety And Phasing Plan. The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CTA F</td>
<td>Common Traffic Advisory Frequency</td>
</tr>
<tr>
<td>Displaced Threshold</td>
<td>A threshold that is located at a point on the runway other than the designated beginning of the runway. The portion of pavement behind a displaced threshold is available for takeoffs in either direction or landing from the opposite direction.</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>FOD</td>
<td>Foreign Object Debris</td>
</tr>
<tr>
<td>HAZMAT</td>
<td>Hazardous Materials</td>
</tr>
<tr>
<td>IFR</td>
<td>Instrument Flight Rules</td>
</tr>
<tr>
<td>ILS</td>
<td>Instrument Landing System</td>
</tr>
<tr>
<td>LDA</td>
<td>Landing Distance Available</td>
</tr>
<tr>
<td>LOC</td>
<td>Localizer antenna array</td>
</tr>
<tr>
<td>Movement Area</td>
<td>The runways, taxiways, and other areas of an airport that are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading aprons and aircraft parking areas (reference 14 CFR Part 139).</td>
</tr>
<tr>
<td>MSDS</td>
<td>Material Safety Data Sheet</td>
</tr>
<tr>
<td>MUTCD</td>
<td>Manual on Uniform Traffic Control Devices</td>
</tr>
<tr>
<td>NAVAID</td>
<td>Navigation Aid</td>
</tr>
<tr>
<td>NAVAID Critical Area</td>
<td>An area of defined shape and size associated with a NAVAID that must remain clear and graded to avoid interference with the electronic signal.</td>
</tr>
<tr>
<td>Non-Movement Area</td>
<td>The area inside the airport security fence exclusive of the Movement Area. It is important to note that the non-movement area includes pavement traversed by aircraft.</td>
</tr>
<tr>
<td>NOTAM</td>
<td>Notices to Airmen</td>
</tr>
<tr>
<td>Obstruction</td>
<td>Any object/obstacle exceeding the obstruction standards specified by 14 CFR Part 77, subpart C.</td>
</tr>
<tr>
<td>OE / AAA</td>
<td>Obstruction Evaluation / Airport Airspace Analysis</td>
</tr>
<tr>
<td>OFA</td>
<td>Object Free Area. An area on the ground centered on the runway, taxiway, or taxi lane centerline provided to enhance safety of aircraft operations by having the area free of objects except for those objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes. (See AC 150/5300-13, for additional guidance on OFA standards and wingtip clearance criteria.)</td>
</tr>
<tr>
<td>OFZ</td>
<td>Obstacle Free Zone. The airspace below 150 ft (45 m) above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for runways visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or taking off from the runway and for missed approaches. The OFZ is subdivided as follows: Runway OFZ, Inner Approach OFZ, Inner Transitional OFZ, and Precision OFZ. Refer to AC 150/5300-13 for guidance on OFZ.</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>P&amp;R</td>
<td>Planning and Requirements Group</td>
</tr>
</tbody>
</table>

Appendix 2: Definition of Terms
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>PAPI</td>
<td>Precision Approach Path Indicators</td>
</tr>
<tr>
<td>PFC</td>
<td>Passenger Facility Charge</td>
</tr>
<tr>
<td>PLASI</td>
<td>Pulse Light Approach Slope Indicators</td>
</tr>
<tr>
<td>Project Proposal Summary</td>
<td>A clear and concise description of the proposed project or change that is the object of Safety Risk Management.</td>
</tr>
<tr>
<td>RE</td>
<td>Resident Engineer</td>
</tr>
<tr>
<td>REIL</td>
<td>Runway End Identifier Lights</td>
</tr>
<tr>
<td>RNAV</td>
<td>Area Navigation</td>
</tr>
<tr>
<td>ROFA</td>
<td>Runway Object Free Area</td>
</tr>
<tr>
<td>RSA</td>
<td>Runway Safety Area. A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway, in accordance with AC 150/5300-13.</td>
</tr>
<tr>
<td>SIDA</td>
<td>Security Identification Display Area</td>
</tr>
<tr>
<td>SMS</td>
<td>Safety Management System</td>
</tr>
<tr>
<td>SPCD</td>
<td>Safety Plan Compliance Document. Details developed and submitted by a contractor to the airport operator for approval providing details on how the performance of a construction project will comply with the CSPP.</td>
</tr>
<tr>
<td>SRM</td>
<td>Safety Risk Management</td>
</tr>
<tr>
<td>Taxiway Safety Area</td>
<td>A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway, in accordance with AC 150/5300-13.</td>
</tr>
<tr>
<td>TDG</td>
<td>Taxiway Design Group</td>
</tr>
<tr>
<td>Temporary</td>
<td>Any condition that is not intended to be permanent.</td>
</tr>
<tr>
<td>Temporary Runway End</td>
<td>The beginning of that portion of the runway available for landing and taking off in one direction, and for landing in the other direction. Note the difference from a displaced threshold.</td>
</tr>
<tr>
<td>Threshold</td>
<td>The beginning of that portion of the runway available for landing. In some instances, the landing threshold may be displaced.</td>
</tr>
<tr>
<td>TODA</td>
<td>Takeoff Distance Available</td>
</tr>
<tr>
<td>TOFA</td>
<td>Taxiway Object Free Area</td>
</tr>
<tr>
<td>TORA</td>
<td>Takeoff Run Available. The length of the runway less any length of runway unavailable and/or unsuitable for takeoff run computations. See AC 150/5300-13 for guidance on declared distances.</td>
</tr>
<tr>
<td>TSA</td>
<td>Taxiway Safety Area</td>
</tr>
<tr>
<td>UNICOM</td>
<td>Transportation Security Administration</td>
</tr>
<tr>
<td>VASI</td>
<td>A radio communications system of a type used at small airports.</td>
</tr>
</tbody>
</table>

Appendix 2 Definition of Terms
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>VGSI</td>
<td>Visual Glide Slope Indicator. A device that provides a visual glide slope indicator to landing pilots. These systems include precision approach path indicators (PAPI), visual approach slope indicators (VASI), and pulse light approach slope indicators (PLASI).</td>
</tr>
<tr>
<td>VFR</td>
<td>Visual Flight Rules</td>
</tr>
<tr>
<td>VOR</td>
<td>VHF Omnidirectional Radio Range</td>
</tr>
<tr>
<td>VPD</td>
<td>Vehicle / Pedestrian Deviation</td>
</tr>
</tbody>
</table>
Appendix 3. Safety and Phasing Plan Checklist

This appendix is keyed to Section 2. Plan Requirements. In the electronic version of this AC, clicking on the paragraph designation in the Reference column will access the applicable paragraph. There may be instances where the CSPP requires provisions that are not covered by the list in this appendix.

This checklist is intended as an aid, not as a required submittal.

<table>
<thead>
<tr>
<th>Coordination</th>
<th>Reference</th>
<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Considerations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirements for pre-design, pre-bid, and pre-construction conferences to introduce the subject of airport operational safety during construction are specified.</td>
<td>205</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Operational safety is a standing agenda item for construction progress meetings.</td>
<td>205</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Scheduling of the construction phases is properly addressed.</td>
<td>206</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Areas and Operations Affected by Construction Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawings showing affected areas are included.</td>
<td>207.a</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Closed or partially closed runways, taxiways, and aprons are depicted on drawings.</td>
<td>207 a(1)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Access routes used by ARFF vehicles affected by the project are addressed.</td>
<td>207 a(2)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Access routes used by airport and airline support vehicles affected by the project are addressed.</td>
<td>207 a(3)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Underground utilities, including water supplies for fire fighting and drainage.</td>
<td>207 a(4)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Approach/Departure surfaces affected by heights of temporary objects are addressed.</td>
<td>207 a(5)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Construction areas, storage areas, and access routes near runways, taxiways, aprons, or helipads are properly depicted on drawings</td>
<td>207.a</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Temporary changes to taxi operations are addressed.</td>
<td>207 b(1)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Coordination</td>
<td>Reference</td>
<td>Addressed</td>
<td>Remarks</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
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<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Detours for ARFF and other airport vehicles are identified.</td>
<td>207 b(2)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Maintenance of essential utilities and underground infrastructure is addressed.</td>
<td>207 b(3)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Temporary changes to air traffic control procedures are addressed.</td>
<td>207 b(4)</td>
<td>No</td>
<td>NA</td>
</tr>
</tbody>
</table>

**NAVAIDS**

| Critical areas for NAVAIDs are depicted on drawings.                        | 208       | No        | NA      |
| Effects of construction activity on the performance of NAVAIDS, including unanticipated power outages, are addressed. | 208       | No        | NA      |
| Protection of NAVAID facilities is addressed.                               | 208       | No        | NA      |
| The required distance and direction from each NAVAID to any construction activity is depicted on drawings. | 208       | No        | NA      |
| Procedures for coordination with FAA ATO/Technical Operations, including identification of points of contact, are included. | 208, 213.a, 213.c(3)(a), 218.a | No        | NA      |

**Contractor Access**

| The CSPP addresses areas to which contractor will have access and how the areas will be accessed. | 209       | No        | NA      |
| The application of 49 CFR Part 1542 Airport Security, where appropriate, is addressed.               | 209       | No        | NA      |
| The location of stockpiled construction materials is depicted on drawings.                           | 209.a     | No        | NA      |
| The requirement for stockpiles in the ROFA to be approved by FAA is included.                        | 209.a     | No        | NA      |
| Requirements for proper stockpiling of materials are included.                                      | 209.a     | No        | NA      |

Appendix 3 Safety and Phasing Plan Checklist
<table>
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<th>Coordination</th>
<th>Reference</th>
<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction site parking is addressed.</td>
<td>209 b(1)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Construction equipment parking is addressed.</td>
<td>209 b(2)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Access and haul roads are addressed.</td>
<td>209 b(3)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>A requirement for marking and lighting of vehicles to comply with AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport, is included.</td>
<td>209 b(4)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Proper vehicle operations, including requirements for escorts, are described.</td>
<td>209 b(5), 209 b(6)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Training requirements for vehicle drivers are addressed.</td>
<td>209 b(7)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Two-way radio communications procedures are described.</td>
<td>209 b(9)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Maintenance of the secured area of the airport is addressed.</td>
<td>209 b(10)</td>
<td>No</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Wildlife Management**

| The airport operator’s wildlife management procedures are addressed.          | 210       | No        | NA      |

**Foreign Object Debris Management**

| The airport operator’s FOD management procedures are addressed.               | 211       | Yes       | No      |

**Hazardous Materials Management**

| The airport operator’s hazardous materials management procedures are addressed. | 212       | Yes       | No      |

**Notification of Construction Activities**

| Procedures for the immediate notification of airport user and local FAA of any conditions adversely affecting the operational safety of the airport are detailed. | 213       | Yes       | No      |

Appendix 3 Safety and Phasing Plan Checklist
<table>
<thead>
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<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance of a list by the airport operator of the responsible representatives/points of contact for all involved parties and procedures for contacting them 24 hours a day, seven days a week is specified.</td>
<td>213.a</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>A list of local ATCT Technical Operations personnel is included.</td>
<td>213.a</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>A list of ATCT managers on duty is included.</td>
<td>213.a</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>A list of authorized representatives to the OCC is included.</td>
<td>213.b</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Procedures for coordinating, issuing, maintaining and cancelling by the airport operator of NOTAMS about airport conditions resulting from construction are included.</td>
<td>208, 213.b, 218.b(4)(i)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Provision of information on closed or hazardous conditions on airport movement areas by the airport operator to the OCC is specified.</td>
<td>213.b</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Emergency notification procedures for medical, fire fighting, and police response are addressed.</td>
<td>213.c</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Coordination with ARFF personnel for non-emergency issues is addressed.</td>
<td>213.d</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Notification to the FAA under 14 CFR parts 77 and 157 is addressed.</td>
<td>213.e</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Reimburseable agreements for flight checks and/or design and construction for FAA owned NAVAIDS are addressed.</td>
<td>213.c(5)(b)</td>
<td>No</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Inspection Requirements**

| Daily inspections by both the airport operator and contractor are specified. | 214.a     | No        | NA      |
| Final inspections at certificated airports are specified when required.     | 214.b     | No        | NA      |

**Underground Utilities**

<p>| Procedures for protecting existing underground facilities in excavation areas are described. | 215      | No        | NA      |</p>
<table>
<thead>
<tr>
<th>Coordination</th>
<th>Reference</th>
<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penalty provisions for noncompliance with airport rules and regulations and the safety plans are detailed.</td>
<td>216</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Special Conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any special conditions that affect the operation of the airport or require the activation of any special procedures are addressed.</td>
<td>217</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Runway and Taxiway Visual Aids - Marking, Lighting, Signs, and Visual NAVAIDs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The proper securing of temporary airport markings, lighting, signs, and visual NAVAIDs is addressed.</td>
<td>218.a</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Fragmentability of airport markings, lighting, signs, and visual NAVAIDs is specified.</td>
<td>218.a, 218.c, 219, 220.b(4)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>The requirement for markings to be in compliance with AC 150/5340-1, Standards for Airport Markings is specified.</td>
<td>218.b</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The requirement for lighting to conform to AC 150/5340-30, Design and Installation Details for Airport Visual Aids, AC 150/5345-50, Specification for Portable Runway and Taxiway Lights, and AC 150/5345-53 Airport Lighting Certification Program, is specified.</td>
<td>218.b(1)(0)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The use of a lighted X is specified where appropriate.</td>
<td>218.b(1)(b), 218.b(3)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The requirement for signs to conform to AC 150/5345-44, Specification for Runway and Taxiway Signs, AC 50/5340-18, Standards for Airport Sign Systems, and AC 150/5345-53, Airport Lighting Certification Program, is specified.</td>
<td>218.c</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Marking and Signs For Access Routes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The CSPP specifies that pavement markings and signs intended for construction personnel should conform to AC 150/5340-18 and, to the extent practicable, with the MUTCD and/or State highway specifications.</td>
<td>219</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Hazard Marking and Lighting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prominent, comprehensible warning indicators for any area affected by construction that is normally accessible to aircraft, personnel, or vehicles are specified.</td>
<td>220.a</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Appendix 3 Safety and Phasing Plan Checklist
<table>
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<tr>
<th>Coordination</th>
<th>Reference</th>
<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard marking and lighting are specified to identify open manholes, small areas under repair, stockpiled material, and waste areas.</td>
<td>220.a</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP considers less obvious construction-related hazards.</td>
<td>220.a</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Equipment that poses the least danger to aircraft but is sturdy enough to remain in place when subjected to typical winds, prop wash and jet blast is specified.</td>
<td>220.b(1)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The spacing of barricades is specified such that a breach is physically prevented barring a deliberate act.</td>
<td>220.b(1)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Red lights meeting the luminance requirements of the State Highway Department are specified.</td>
<td>220.b(2)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Barricades, temporary markers, and other objects placed and left in areas adjacent to any open runway, taxiway, taxi lane, or apron are specified to be as low as possible to the ground, and no more than 18 in. high.</td>
<td>220.b(4)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Barricades marked with diagonal, alternating orange and white stripes are specified to indicate construction locations in which no part of an aircraft may enter.</td>
<td>220.b(4)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Highly reflective barriers with lights are specified to barricade taxiways leading to closed runways.</td>
<td>220.b(5)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Markings for temporary closures are specified.</td>
<td>220.b(5)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The provision of a contractor’s representative on call 24 hours a day for emergency maintenance of airport hazard lighting and barricades is specified.</td>
<td>220.b(7)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

**Protection of Runway and Taxiway Safety Areas**

<table>
<thead>
<tr>
<th>Coordination</th>
<th>Reference</th>
<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>The CSPP clearly states that no construction may occur within a safety area while the associated runway or taxiway is open for aircraft operations.</td>
<td>221 a(1), 221 c(1)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP specifies that the airport operator coordinates the adjustment of RSA or TSA dimensions with the ATCT and the appropriate FAA Airports Regional or District Office and issues a local NOTAM.</td>
<td>221 a(2), 221 c(2)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Coordination</th>
<th>Reference</th>
<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedures for ensuring adequate distance for protection from blasting operations, if required by operational considerations, are detailed.</td>
<td>221.c(3)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP specifies that open trenches or excavations are not permitted within a safety area while the associated runway or taxiway is open.</td>
<td>221.a(4)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Appropriate covering of excavations in the RSA or TSA that cannot be backfilled before the associated runway or taxiway is open is detailed.</td>
<td>221.a(4)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP includes provisions for prominent marking of open trenches and excavations at the construction site.</td>
<td>221.a(4)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Grading and soil erosion control to maintain RSA/TSA standards are addressed.</td>
<td>221.c(5)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP specifies that equipment is to be removed from the ROFA when not in use.</td>
<td>221.b</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP clearly states that no construction may occur within a taxiway safety area while the taxiway is open for aircraft operations.</td>
<td>221.c</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Appropriate details are specified for any construction work to be accomplished in a taxiway object free area.</td>
<td>221.d</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Measures to ensure that personnel, material, and/or equipment do not penetrate the OFZ or threshold sitting surfaces while the runway is open for aircraft operations are included.</td>
<td>221.e</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Provisions for protection of runway approach/departure areas and clearways are included.</td>
<td>221.f</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Other Limitations on Construction**

<table>
<thead>
<tr>
<th>Coordination</th>
<th>Reference</th>
<th>Addressed</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>The CSPP prohibits the use of open flame welding or torches unless adequate fire safety precautions are provided and the airport operator has approved their use.</td>
<td>222.a(2)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP prohibits the use of flare pots within the AOA at any time.</td>
<td>222.a(4)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The CSPP prohibits the use of electrical blasting caps on or within 1,000 ft (300 m) of the airport property.</td>
<td>222.a(3)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Appendix 4. Construction Project Daily Safety Inspection Checklist

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects. The list below is one tool that the airport operator or contractor may use to aid in identifying and correcting potentially hazardous conditions. It should be customized as appropriate for each project.

### Potentially Hazardous Conditions

<table>
<thead>
<tr>
<th>Item</th>
<th>Action Required</th>
<th>or</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation adjacent to runways, taxiways, and aprons improperly backfilled.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departure areas, or in OFZ.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment or material near NAVAIDs that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tall and especially relatively low visibility units (that is, equipment with slim profiles) — cranes, drills, and similar objects — located in critical areas, such as OFZ and approach zones.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on any apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Action Required</td>
<td>or</td>
<td>None</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>----</td>
<td>------</td>
</tr>
<tr>
<td>Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barriering, and lighting of temporarily closed portions of AOA create aviation hazards.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wildlife attractants such as trash (food scraps not collected from construction personnel activity), grass seeds, tall grass, or standing water on or near airports.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obliterated or faded temporary markings on active operational areas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway/taxiway lighting, loss of navigation, visual, or approach aids, disruption of weather reporting services, and/or loss of communications.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restrictions on ARFF access from fire stations to the runway/taxiway system or airport buildings.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of radio communications with construction vehicles in airport movement areas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircraft operations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix 4 Construction Project Daily Safety Inspection Checklist
<table>
<thead>
<tr>
<th>Item</th>
<th>Action Required</th>
<th>or</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site burning, which can cause possible obscuration.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction work taking place outside of designated work areas and out of phase.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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PROJECT SPECIFICATIONS

FOR

Voluntary Airport Low Emissions (VALE) Compressed Natural Gas (CNG) Fueling Station

PREPARED FOR

Birmingham Airport Authority
Birmingham-Shuttlesworth International Airport
5900 Messer Airport Highway
Birmingham, Alabama 35212

ISSUED FOR BID

December 8, 2016
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<td>LABELING, TAGGING AND IDENTIFICATION OF CONTROL PANELS, AUTO VALVES, AND FIELD INSTRUMENTS</td>
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<td>STORM UTILITY DRAINAGE PIPING</td>
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</tr>
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</tr>
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</table>
PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies procedural requirements for Work-related (non-administrative) submittals including Shop Drawings, substitutions, product data, samples, test data, operations and maintenance data, and other miscellaneous Work-related submittals.

B. Administrative Submittals: Procedures concerning items such as listing of manufacturers, Suppliers, Subcontractors, Construction Progress Schedule, schedule of Shop Drawing submissions, bonds, payment applications, insurance certificates, and schedule of values are specified elsewhere.

C. Work-Related Submittals:

1. Substitutes and “Or Equal” Items:
   a. Includes material or equipment which CONTRACTOR requests OWNER to accept, after Effective Date of the Agreement.

2. Shop Drawings:
   a. Includes technical data and drawings specially prepared for this Project, including fabrication and installation drawings, diagrams, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.
   b. Standard catalog type information prepared without specific reference to Project is not considered as Shop Drawing.

3. Product Data:
   a. Includes standard catalog type printed information on manufactured materials, equipment and systems that has not been specially prepared for this Project, including manufacturer’s product specifications, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.

4. Samples:
   a. Includes fabricated and manufactured physical examples of materials, products, and units of work, includes complete units, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.
   b. Mock-ups are special forms of samples too large or otherwise inconvenient for handling in manner specified for transmittal of sample submittals.

5. Test Results:
   a. Includes source and field quality inspection and test reports, actual performance curves, and certifications of results prepared specifically for equipment, material, and systems provided for this Project.
   b. Standard catalog charts or standard test results are considered Product Data.

6. Operations and Maintenance Data:
a. Includes information and directions for operating and maintaining equipment provided and installed for this Project. May be standard for equipment or prepared specifically for this Project.

7. Miscellaneous Submittals:
   a. Work-related submittals that do not fit in previous categories, includes schedules, photographs, guarantees, warranties, certifications, maintenance agreements, workmanship bonds, survey data and reports, physical work records, copies of industry standards, field measurement data, extra materials, keys, and similar information, devices, and materials applicable to Work.

1.2 SUBMITTAL PROCEDURES

A. Scheduling:

1. Provide preliminary and final submittal schedule indicating time requirements for coordination of submittals with performance of Work for items of materials and equipment for which submittals are required by Specifications.

2. In addition, times scheduled shall indicate completion of submittal approval process for substitutions, Shop Drawings, product data, and samples for Project not later than 45 days after effective date of Agreement. Completion of submittal process for above submittals will have been achieved when submittals have been returned to CONTRACTOR with submittal action of either “Approved” or “Approved as Noted”. For planning purposes, OWNER has set goal of 14 days for review of simple/single discipline submittals, and 28 days for review of complex/multiple discipline submittals after submittals are received in OWNER’S office. Each resubmittal shall have same review times.

3. Adjust submittal schedule to reflect revisions to Construction Progress Schedule.

B. Coordination:

1. Coordinate preparation and processing of submittals with performance of Work. Coordinate each submittal with other submittals and related activities such as substitution requests, testing, purchasing, fabrication, delivery, and similar activities requiring sequential activity.

2. Coordinate submission of different units of interrelated Work so one submittal not be delayed by OWNER’S need to review related submittal. OWNER may withhold action on submittal requiring coordination with other submittals until related submittals are provided.

3. Prepare and transmit each submittal sufficiently in advance of scheduled performance of related Work and other applicable activities.

C. Submittal Preparation:

1. Stamp and sign each submittal certifying to review of submittal, verification of material, and equipment, field measurement, field construction criteria, and coordination of information within submittal with Contract Documents.

2. Transmittal Form: Identify following:
   a. Date of submittal and dates of previous submittals.
b. Project title and number.

c. Submittal number.

d. Contract identification.

e. Names of:
   1. CONTRACTOR
   2. Supplier
   3. Manufacturer

f. If submittal is for substitute item of material or equipment, identify as “substitute” on transmittal and include “Contractor’s Application for Consideration of Substitute” with submittal.

g. Identification of equipment and material with equipment identification numbers, motor numbers, and Specification section number.

h. Variations from Contract Documents.

D. Resubmittal Preparation:

1. Comply with requirements described in Submittal Preparation above, and in addition:
   a. Identify on transmittal form submittal is resubmission.

b. Make corrections or changes in submittals required by OWNER’S notations on returned submittal.

c. Respond to OWNER’S notations:
   1. On transmittal or separate page attached to CONTRACTOR’S resubmission transmittal, answer or acknowledge in writing notations or questions indicated by OWNER on OWNER’S transmittal form returning reviewed submission to CONTRACTOR.
   2. Identify each response by question or notation number established by OWNER.
   3. If CONTRACTOR does not respond to each notation or question, resubmission will be returned without action by OWNER until CONTRACTOR provides written response to OWNER’S notations or questions.

d. CONTRACTOR-initiated revisions or variations.
   1. On transmittal form, identify variations or revisions from previously reviewed submittal, other than those called for by OWNER.
   2. OWNER’S responsibility for variations or revisions is established in Article SC 6.17 of Supplementary Conditions.

1.3 SPECIFIC SUBMITTAL REQUIREMENTS

A. General:
   1. Specific submittal requirements for individual units of Work are specified in applicable Specification section. Except as otherwise indicated in Specification sections, comply with requirements specified below for each indicated type of submittal.

   2. If OWNER has responded to Written Clarification/Interpretation/Request submitted by CONTRACTOR, CONTRACTOR shall include OWNER’S response with applicable submittal.
B. Requests for Substitute Items:

1. Collect data for items to be submitted for review as substitute items into one submittal for each item of material or equipment in accordance with Paragraph SC 6.05 of Supplementary Conditions.

2. Include completed “Contractor’s Application for Consideration of Substitution” form as required by Supplementary Conditions.

3. Submit with other scheduled submittals for material or equipment allowing time for OWNER to evaluate additional information required to be submitted.

4. If CONTRACTOR requests to substitute for material or equipment specified, but not identified in Specification as requiring submittals, CONTRACTOR shall indicate substitution submittal in Submittal Schedule.

C. Shop Drawings:

1. Submit newly prepared information, with graphic information at accurate scale and name of preparer indicated (firm name). Show dimensions and note which are based on field measurement, identify materials and equipment included in Work, and revisions on resubmittals. Indicate compliance with standards and notation of coordination requirements with other Work. Encircle, bubble or otherwise indicate selections of products or materials and/or variations from Contract Documents or previous submittals. Highlighting may be used in addition to circling or bubbling of appropriate materials or variations from Contract Documents or previous submittals to direct the attention of the reviewer, but may not be utilized exclusively due to the difficulty in continuity of selections through copying and/or scanning of the submittal. Other acceptable means of selection of materials, products or variations from Contract Documents or previous submittals include striking out selections not included as part of the submittal, providing an arrow pointing directly to the selection or other means that remain after copying and/or scanning.

2. If Drawings prepared by OWNER are used in preparation of Shop Drawings, remove OWNER’S identification.

3. Provide 8 in. by 3 in. blank space for CONTRACTOR and OWNER stamps.

4. Submittals:
   a. Submit 1 electronic (PDF) and three (3) black line print for drawings for OWNER/OWNER.
   b. Submit more copies of prints if CONTRACTOR requires return of prints.

D. Product Data:

1. Preparation:
   a. Collect required data into single submittal for each unit of Work or system. Where product data includes information on several similar materials or equipment, some of which are not required for use on Project or not included in submittal, mark copies to show which items are not applicable to Project.

   b. Where product data must be specially prepared for equipment, materials or systems, because standard printed data is not suitable for use, submit data as Shop Drawing
and not as product data.

2. Submittals:
   a. Submit one electronic (PDF) copy and three (3) printed copies for OWNER/OWNER.
   b. Submittal is final when OWNER returns submittal marked “No Exceptions Taken”, or “Make Corrections Noted”.

3. Distribution:
   a. Maintain one set of product data (for each submittal) at Project site, available for reference by OWNER and others.

E. Samples:

1. Preparation:
   a. Provide samples physically identical with proposed materials or equipment to be incorporated into Work. Where variations in color, pattern or texture are inherent in material or product represented by sample, submit multiple units (not less than 3) showing approximate limits of variations.
   b. Provide full set of option samples where selection by OWNER is required.
   c. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards.
   d. Submit samples for OWNER’S visual review of general generic kind, color, pattern, texture, and for final check of coordination of these characteristics with other related elements of Work.
   e. Mock-ups and similar samples specified in Specification sections are recognized as special type of samples. Comply with samples submittal requirements to greatest extent possible.

2. Submittals:
   a. At CONTRACTOR’S option, and depending upon nature of anticipated response from OWNER, initial submittal of samples may be preliminary or final submittal.
   b. Preliminary submittal, of single set of samples, required where Specification’s indicate OWNER’S selection of color, pattern, texture or similar characteristics from manufacturer’s range of standard choices is necessary. Preliminary submittals will be reviewed and returned with OWNER’S “Action” noted.
   c. Final Submittals: Submit two sets of samples in final submittal, 1 set will be returned.

3. Distribution:
   a. Maintain returned set of samples at Project site, in suitable condition and available for quality control comparisons throughout course of performing Work.

F. Test Results:

1. Preparation:
   a. Identify each test by Specification section and type of test.

2. Submittals:
   a. Submit one copy in electronic (PDF) format and three (3) printed copies for
OWNER/OWNER.

b. Submittal is to confirm that results of tests verify materials, products, and systems comply with Contract Documents and are not for approval.

3. Distribution:
   a. Unless otherwise required in Specifications, test results shall be submitted to OWNER’S field office or if OWNER has no field office to OWNER’S office.

G. Miscellaneous:

1. Guarantees, Warranties, Maintenance Agreements, and Workmanship Bonds:
   a. Refer to Specification sections for requirements. Submittal is considered final when submittal returned by OWNER, marked “Approved” or “Approved as Noted”.
   
b. In addition to copies desired for CONTRACTOR’S use, furnish 2 executed copies. Provide 2 additional copies where required for maintenance data.

2. Survey Data:
   a. Refer to Specification sections for requirements on property surveys, building or structure condition surveys, field measurements, quantitative records of actual Work, damage surveys, photographs, and similar data. Copies will not be returned.
   
b. Survey Copies:
      1. Three copies and one electronic (PDF) copy.
      2. Final Property Survey: Three copies and one electronic (PDF) copy.
      3. Condition Surveys: Three copies and one electronic (PDF) copy.

3. Certifications:
   a. Refer to Specification sections for requirement on submittal of certifications. Submit 6 copies. Certifications are submitted for review of conformance with specified requirements and information.

4. Closeout Submittals:
   a. Refer to Specification sections for requirements on submittal of closeout information, materials, tools, and similar items.
      1. Materials and Tools: Spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.
      2. Operating and maintenance data.

H. Operating and Maintenance (O&M) Data:

1. Submit one electronic (PDF) copy for OWNER review after equipment requiring O&M data has been returned “No Exceptions Taken” or “Make Corrections Noted”.

2. Submit three (3) printed copies of FINAL O&M Data and one electronic (PDF) copy of FINAL O&M data after O&M data submittal has been marked “No Exceptions Taken” or “Make Corrections Noted”.

3. Organize operations and maintenance information into suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Include emergency instructions, safety precautions, spare parts listing, copies of warranties, wiring diagrams, recommended “turn-around” cycles, inspection procedures, Shop Drawings, Product Data, and similar applicable information.
a. Manufacturer’s printed instructions regarding safety precautions for both (a) protection of personnel operating equipment and systems and (b) prevention of damage to equipment and systems.

b. Shop Drawings, Product Data, and other submittals included in O&M data shall be corrected to include, in same format and style as original submittal, review comments.

4. Binders for FINAL O&M Data: Commercial quality D-Ring binder with durable and cleanable plastic covers. Paperboard and laminated paperboard covers are not acceptable.
   a. Do not fill binders to more than 75% of capacity.
   b. When multiple binders are used for an item of equipment, organize contents into related groupings. Each binder cover shall bear identification of specific contents.

5. Cover Label: Label each binder cover and spine with typed or printed title “OPERATION AND MAINTENANCE INSTRUCTIONS” and following:
   a. Project title.
   b. Name(s) of applicable building(s) or structure(s) as shown on Drawings in which equipment located.
   c. Name of equipment as set forth in Contract Documents.

I. General Distribution:
   1. Unless required elsewhere, provide distribution of submittals to Subcontractors, suppliers, governing authorities, and others as necessary for proper performance of Work.
   2. Provide copies of submittals bearing OWNER’S action stamp to:
      b. Record documents file.

1.4 ACTION ON SUBMITTALS

A. OWNER’S Action:
   1. General:
      a. Except for submittals for record and similar purposes, where action and return on submittals is required or requested, OWNER will review each submittal, mark with appropriate action, and return. Where submittal must be held for coordination, OWNER will so advise CONTRACTOR without delay.
      b. OWNER will stamp each submittal with uniform, self-explanatory action stamp, appropriately marked with submittal action.
   2. Notification of Insufficient Information:
a. If information submitted is not sufficient to complete review of submittal, OWNER will send transmittal to CONTRACTOR notifying CONTRACTOR that additional information is required.

b. Submittal will be placed in an “On Hold” status and not returned until CONTRACTOR provides additional information.

3. Unsolicited Submittals: OWNER will return unsolicited submittals to CONTRACTOR without reviewing.

B. Action Stamp:

1. Marking: No Exceptions Taken.
   a. Final Unrestricted Release: When submittals are marked as “No Exceptions Taken”, Work covered by submittal may proceed provided it complies with Contract Documents. Acceptance of Work depends on that compliance.

   a. Final-But-Restricted Release: When submittals are marked as “Make Correction Noted”, Work covered by submittal may proceed provided it complies with OWNER’S notations or corrections on submittal and with Contract Documents. Acceptance of Work depends on that compliance. Resubmittal not required.

   a. Submittal Not Accepted: When submittals are marked as “Rejected, See Remarks”, do not proceed with Work covered by submittal. Work covered by submittal does not comply with Contract Documents.
   b. Prepare new submittal for different material or equipment supplier or different product line or material of same supplier complying with Contract Documents.

   a. Returned for Resubmittal: When submittals are marked as “Amend and Resubmit”, do not proceed with Work covered by submittal. Do not permit Work covered by submittals to be used at Project site or elsewhere where Work is in progress.
   b. Revise submittal or prepare new submittal in accordance with OWNER’S notations in accordance with resubmittal requirements of this section. Resubmit without delay. Repeat if required to obtain different action marking.

PART 2 - PRODUCTS
(Not Used)

PART 3EXECUTION
(Not Used)

END OF SECTION 01 33 00
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment, and incidentals necessary for the following:

1. Demolition and removal of entire buildings, structures, and foundations.
2. Demolition and removal of site elements.
3. Required demolition is indicated on the contract documents.

B. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 SUBMITTALS

A. Proposed Demolition Activities:

1. Submit proposed schedule of demolition activities. Indicate starting and ending dates for each activity as appropriate. Indicate starting and ending dates for all interruptions and restoration of utility services.
2. Submittal of proposed demolition activities will be reviewed by the Architect only to determine that proposed activities will not interfere with the Owner's operations.

B. Photographs: Before starting work file photographs with the Architect that document existing conditions on the site and adjacent to the site that later could be mistaken for damage caused by demolition operations.

C. Project Record Documents:

1. Identify location of capped utilities.
2. Indicate unanticipated structural, electrical, or mechanical conditions.

1.3 PROJECT CONDITIONS

A. Existing Conditions:

1. After the project is begun, the Contractor is responsible for the condition of structures to be demolished. The Owner does not warrant that the condition of structures to be demolished will not have changed since the time of inspection for bidding purposes.
2. The Owner reserves the right to remove and salvage portions of the structure prior to the start of demolition.
B. Unforeseen Conditions: Should unforeseen conditions be encountered that affect design or function of project, investigate fully and submit an accurate, detailed, written report to the Engineer/Architect. While awaiting the Engineer/Architect's response, reschedule operations if necessary to avoid delay of overall project.

1.4 SEQUENCING AND SCHEDULING

A. Arrange demolition schedule so as not to interfere with the Owner's operations.

B. Schedule and coordinate demolition activities in accordance with requirements specified elsewhere in Division 01.

1.5 UTILITY PROTECTION

A. Forty-eight (48) hours prior to excavation, the Contractor shall call the U.P.C. (Utilities Protection Center) 1-800-282-7411 to locate and protect existing utilities. Any damage to these utilities is to be repaired at no additional cost to the Owner. The Contractor is responsible for locating all utilities, either private or public prior to beginning demolition work.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and sealed.

B. Survey existing conditions and correlate with the contract documents and specifications to determine extent of demolition required.

C. Insofar as is practicable, arrange operations to reveal unknown or concealed structural conditions for examination and verification before removal or demolition.

D. Verify actual conditions to determine in advance whether removal or demolition of any element will result in structural deficiency, overloading, failure, or unplanned collapse.

E. Perform continuing surveys as the work progresses to detect hazards resulting from demolition or construction activities.

3.2 PREPARATION

A. Hazardous Materials: Remove, drain, purge, or otherwise dispose of hazardous materials present before proceeding with demolition operations. Comply with applicable regulations concerning disposal.

B. Traffic: Do not obstruct walks or public ways without the written permission of governing authorities and of the Architect and the Owner. Where routes are permitted to be closed, provide alternate routes if required.
C. Protection:
   1. Provide for the protection of persons passing around or through the area of demolition.
   2. Perform demolition so as to prevent damage to adjacent improvements and facilities to remain.
   3. Provide protective measures to ensure free and safe passage of persons to and from occupied areas.
   4. Erect temporary protection such as walks, fences, railings, canopies, etc., where required by authorities having jurisdiction.
   5. Protect walls, floors, and other new or existing work from damage during demolition operations.
   6. Protect existing site appurtenances and landscaping to remain.
   7. Erect a plainly visible fence at least 5 feet from trunks of individual trees or around outer perimeter of clumps of trees.

D. Damages: Without cost to the Owner and without delay, repair any damages caused to facilities to remain.

3.3 UTILITY SERVICES

   A. Comply with requirements specified in Division 33.
   B. Arrange with utility companies and shut off all utilities serving structures as necessary.
   C. Disconnect and cap indicated utilities before starting demolition operations.
   D. Identify location of capped utilities on project record documents.
   E. Obtain written approval before interrupting existing utilities.
   F. Bypass Connections: Provide as necessary to maintain service to occupied areas.
   G. Notify the Engineer/Architect and the Owner at least 72 hours in advance of changeover.

3.4 EXPLOSIVES

   A. Do not use explosives.

3.5 POLLUTION CONTROLS

   A. Control as much as practicable the spread of dust and dirt.
   B. Observe environmental protection regulations.
   C. Do not allow water usage resulting in freezing or flooding.
   D. Do not allow adjacent improvements to remain to become soiled by demolition operations.

3.6 DEMOLITION - GENERAL
A. Remove: Unless items are otherwise indicated to be reinstalled or salvaged, remove and scrap.

B. Remove and Re-Installs: Remove items indicated; clean, service, and otherwise prepare for service; reinstall in the same location (or in the location indicated).

C. Remove and Install New: Remove and dispose of items indicated and install new items in the same location (or in the location indicated).

D. Remove and Salvage: Items indicated to be salvaged will remain the Owner’s property. Carefully remove and clean items indicated to be salvaged; pack or crate to protect against damage; identify contents of containers; deliver to the locations indicated.

E. Remove and Scrap: Remove and dispose of items indicated.

1. All demolished or removed items and materials shall be considered scrap except for those indicated to remain, those indicated to be reinstalled, those indicated to be salvaged, and historical items.
2. Do not store removed items of value to the contractor on site.

F. Existing to Remain: Construction or items indicated to remain shall be protected against damage during demolition operations. Where practicable, and with the Architect’s permission, the Contractor may elect to remove items to a suitable storage location during demolition and then properly clean and reinstall the items.

G. Historical items, relics, and similar items (including but not limited to cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner) which may be encountered in the course of demolition will remain the Architect’s property. Notify the Architect if such items are encountered. Obtain the Owner’s and the Architect’s acceptance of removal methods, and salvage these items to the Architect.

H. Detailed requirements for cutting are specified under Division 32-Pavement Repairs and Restorations.

I. Perform work in a systematic manner.

J. Demolish and remove existing construction only to the extent required by new construction and as indicated in the contract documents.

K. Remove debris daily.

L. Use any methods permitted by governing regulations and the requirements of the Contract Documents.

3.7 DEMOLITION ON OR BELOW GRADE

A. Where portions of concrete slabs-on-grade are to be removed, first outline the portion with a concrete saw to a depth of at least 1-inch.

B. Remove concrete slabs-on-grade.

C. Completely remove below-grade construction, including foundations, footings and utility
lines to be abandoned, except as noted otherwise on the contract documents.

3.8 FILLING BELOW-GRADE AREAS AND VOIDS

A. Below-grade areas and voids resulting from demolition of structures shall be filled or excavated further, as appropriate, according to requirements specified elsewhere in Division 31.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of materials resulting from demolition operations. Do not allow materials to accumulate on site.
B. Transport materials resulting from demolition operations and legally dispose of off-site.
C. Off-site disposal location shall not be within one-half mile of any portion of the project site or within sight of the project site.
D. Do not burn removed materials on project site.
E. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

3.10 REPAIRS AND PATCHING

A. Perform repairs in accordance with patching requirements specified elsewhere in Division 1 under Division 32- Pavement Repairs and Restorations.

3.11 CLEANING

A. Remove tools and equipment. Dispose of scrap.
B. Leave exterior areas free of debris.
C. Clean soils, smudges, and dust from surfaces to remain.
D. Return structures and surfaces to remain to the condition that existed prior to commencement of demolition.

END OF SECTION 02 41 00
PART 1 - GENERAL

1.1 SECTION INCLUDES

   A. Section includes the design and erection of formwork, shoring and reshoring for cast-in-place concrete and accessories.

   B. The design of the formwork, shoring, and reshoring is solely the responsibility of the contractor and must be performed by a professional engineer licensed in the State of Georgia.

1.2 RELATED SECTIONS

   A. Section 03 20 00 - Concrete Reinforcing.

   B. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES


   B. ACI 301 - Standard Specifications for Structural Concrete.

   C. ACI 318 - Building Code Requirements for Structural Concrete.

   D. ACI 347 - Recommended Practice for Concrete Formwork.


   F. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

   G. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.4 SUBMITTALS

   A. Submit locations of construction joints for approval.

   B. Submit manufacturer's data for waterstops, form release agent, vapor retarder, curing compound, joint filler, curing compound, and other products.

   C. Design formwork in a manner such that existing or new construction is not overloaded.

   D. Submit samples for joint filler, waterstops, vapor retarder, and sealing products.

   E. Shop drawings that include elements designed by the fabricator shall be signed and sealed by a
Professional engineer licensed in the State of Alabama. As an alternate, the design Professional shall require a signed and sealed cover letter with the shop drawings substantiating the design information. The delegated design engineer must review the shop and erection drawings and confirm in this cover letter that the shop and erection drawings properly incorporate their design.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Construct forms with wood, plywood, metal, fiberglass or a combination of these.

B. Form materials shall have sufficient strength to prevent distortion.

2.2 FORMS FOR EXPOSED FINISH CONCRETE

A. Unless otherwise specified, formwork for exposed concrete surfaces shall consist of plywood, metal, metal framed plywood, or other acceptable surface. Formwork shall provide a continuous straight and smooth surface conforming to the joint system as specified on the Architect's drawings. Form material shall have sufficient thickness to withstand pressure of concrete without bow or deflection. Plywood shall be exterior grade overlaid plywood complying with U.S. Product Standard PS-1 and as follows:

B. Medium density overlay, Class 1 or better, mill-release agent treated and edge sealed.

2.3 FORMS FOR UNEXPOSED FINISH CONCRETE

A. See specification section 03 35 00 CONCRETE FINISHING for finishes.

2.4 FORMWORK ACCESSORIES

A. Formwork accessories that are embedded in concrete, including ties and hangers, shall be commercially manufactured products. Do not use nonfabricated wire form ties.

2.5 FORM RELEASE AGENT

A. Formwork coatings shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 450 g/l but not greater than that permitted by the State Fire Marshall. Products: Provide one of the following: "Eucoslip VOX", Euclid Chemical Co. "Enviroform", Conspec Marketing and Manufacturing Co., Inc. "Cast-Off WB", Sonneborn Building Products

2.6 WATERSTOPS

A. Waterstops at construction joints and control joints indicated by the Drawings shall be sized to suit the joints.

B. Waterstops shall be flat dumbbell type or centerbulb type.

2.8 EXPANSION JOINT FILLER
A. Asphalt impregnated premolded fiberboard expansion joint filler shall conform with ASTM D1751 and be 1/2-inch thick by full thickness of slab or joint, unless indicated otherwise on the Drawings.

2.9 CONSTRUCTION JOINTS
A. Provide key type steel forms.

2.10 EMBEDDED PLATE ASSEMBLIES
A. Embedded steel plates, angles, and channels shall conform to ASTM A36, 36 ksi minimum yield strength, unless noted otherwise on the contract drawings.
B. Headed steel studs and their attachment to steel shall conform to the requirements of AWS D1.1.
C. Provide 3/4-inch diameter headed steel studs with 6-inch minimum embedment, unless noted otherwise.
D. Provide heat-resistant ceramic arc shields with studs.

PART 3 - EXECUTION

3.1 GENERAL
A. Erect formwork in accordance with ACI 301, ACI 318, and ACI 347.
B. Maintain formwork and shoring to support loads until such loads can be supported by concrete structure.

3.2 TOLERANCES
A. Finished work shall comply with ACI 117 tolerances.

3.3 SURFACE PREPARATION
A. For concrete exposed to view, seal form joints to prevent leakage.
B. Before reinforcement is placed, coat contact surfaces of form with form release agent in accordance with manufacturer's recommendations. Do not allow excess form release agent to accumulate in forms or come in contact with concrete surfaces against which fresh concrete will be placed. Copies of this document shall be furnished to the Owner for Owner's use in providing to the Project Manager and Contract Compliance Specialist during the construction phase. (Note: In recognition of the fact that the Construction Professional is allowed to choose from any one of the multiple specified manufacturers, the requirement for furnishing the actual manufacturer's recommendations for the product/system selected shall be a required submittal.)

3.4 CHAMFERS
A. Provide 3/4-inch chamfer at all corners.
3.5 FOUNDATION ELEMENTS

A. Form foundation elements if soil or other conditions are such that earth trench forms are unsuitable.

B. Sides of exterior grade beams, foundation walls, and turned-down slabs shall be formed.

C. Maintain minimum coverage of reinforcing steel as indicated on Structural Drawings.

3.6 INSERTS

A. Install and secure in position required inserts, hangers, sleeves, anchors, and nailers.

B. Anchor bolts by using templates with two nuts to secure in position.

3.7 EMBEDS

A. Set and secure embedded plates, bearing plates, and anchor bolts in accordance with approved setting drawings and in such a manner to prevent displacement during placement of concrete.

3.9 FORM REMOVAL

A. Remove forms carefully in such manner and at such time as to ensure complete safety of structure. Do not remove forms shoring, or reshoring until members have acquired sufficient strength to support their weight and the load thereon safely.

3.10 PROVISIONS FOR OTHER TRADES

A. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings and recesses from trades providing such items.

B. Accurately place and securely support items built into forms. Obtain approval for openings not shown on Drawings.

3.11 CLEANING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed.

3.12 FORM SURFACES

A. Coat contact surfaces of forms with a formcoating compound before reinforcement is placed. Apply in accordance with manufacturer's recommendations. Rust-stained steel formwork is not acceptable. Copies of this document shall be furnished to the Owner for Owner's use in providing to the Project Manager and Contract Compliance Specialist during the construction phase. (Note: In recognition of the fact that the Construction Professional is allowed to choose from any one of the multiple specified manufacturers, the requirement for furnishing the actual manufacturer's recommendations for the product/system selected shall be a required submittal.)

3.13 CONSTRUCTION JOINTS
A. Provide construction joints in accordance with ACI 318.
   . Obtain Design Professional’s prior approval for use and location of joints.

C. Provide 1-1/2 inch deep key type construction joints at end of each placement for slabs, beams, walls, and footings. Bevel forms for easy removal.

D. Remove loose particles and latency from surface prior to placing the next lift. Chip the surface to a depth sufficient to expose sound concrete.

END OF SECTION 03 11 00
SECTION 03 20 00  
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED SECTIONS
A. Section 03 11 00 - Concrete Formwork.
B. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES
B. ACI 301 - Standard Specifications for Structural Concrete.
C. ACI 315 - Details and Detailing of Concrete Reinforcement.
D. ACI 318 - Building Code Requirements for Structural Concrete.
E. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
F. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
I. AWS D1.4 - Structural Weld Code - Reinforcing Steel.

1.3 SUBMITTALS
A. Submit shop drawings as follows:
   1. Notify Design Professional prior to detailing reinforcing steel shop drawings.
   2. Indicate size, spacings, locations and quantities of reinforcing steel and wire fabric, bending and cutting schedules, splice lengths, stirrup spacing, supporting and spacing devices. Detail reinforcing steel in accordance with ACI 315 and CRSI Standards.
   3. Written description of reinforcement without adequate sections, elevations, and details is not acceptable.
   4. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.
B. Submit a certification from each manufacturer or supplier stating that materials meet the requirements of the ASTM and ACI standards referenced.

C. Submit mill test reports.

D. Submit manufacturer's data for tensile and compressive splicers.

1.4 QUALITY ASSURANCE

A. Coordinate and schedule in a timely manner with the Structural Testing/Inspection Agency the following quality related items:
   1. Verify reinforcing steel for quantity, size, location, and support.
   2. Verify proper reinforcing steel concrete coverage.

B. Materials from each type shall be provided from the same source for the entire project.

1.5 STORAGE AND PROTECTING

A. Store reinforcing steel above ground so that it remains clean. Maintain steel surfaces free from materials and coatings which might impair bond.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Deformed reinforcing steel shall conform to ASTM A615, refer to Structural Drawings for grade (Grade 60 minimum).

B. Welded steel wire fabric shall conform to ASTM A1064.

2.2 ACCESSORY MATERIALS

A. Annealed steel tie wire shall be 16-1/2 gage minimum.

B. Bar supports shall be plastic-tipped steel Class I bar supports conforming to CRSI Specifications. Concrete brick may be used to support reinforcement to obtain proper clearance from earth.

2.3 SPLICERS

A. Tensile splicers shall be capable of developing 125% of the reinforcing steel ASTM specified minimum yield strength.

B. Compression splicers shall be the mechanical type such that the compression stress is transmitted by end bearing held in concentric contact.

2.4 DOWEL ADHESIVE

A. Adhesives for dowels into existing concrete shall only be acceptable if they are from manufacturers approved by ICC Evaluation Services, Inc, with an evaluation service report submitted for Design Professional's review. (Note: The ICC Evaluation Service report must
PART 3 – EXECUTION

3.1 FABRICATION

A. Fabricate steel in accordance with ACI 318 and CRSI standards.

B. Bend bars cold. Do not heat or flame cut bars. No field bending of bars partially embedded in concrete is permitted, unless specifically approved Design Professional and checked by Testing and Inspection Agency for cracks.

C. Weld only as indicated. Perform welding in accordance with AWS D12.1 and or AWS D1.4.

D. Tag reinforcing steel for easy identification

3.2 INSTALLATION

A. Before placing concrete, clean reinforcement of foreign particles and coatings.

B. Place, support, and secure reinforcement against displacement in accordance with ACI 318 and CRSI standards. Do not deviate from alignment or measurement.

C. Place concrete beam reinforcement support parallel to main reinforcement.

D. Locate welded wire fabric in the top half of slabs. Overlap mesh two squares or 8” minimum at side and end joints.

E. Furnish and install dowels or mechanical splices at intersections of walls, columns and piers to permit continuous reinforcement or development lengths at such intersections.

F. Maintain cover and tolerances in accordance with ACI and CRSI Specifications, unless indicated otherwise on Structural Drawings.

G. Welding of reinforcement is not permitted

3.3 SPLICES

A. Do not splice reinforcement except as indicated on Structural Drawings.

B. Tension couplers may be used and installed in accordance with manufacturer's specifications.

END OF SECTION 03 20 00
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Related Sections include the following:
   1. Division 31 Section "Earthwork" for drainage fill under slabs-on-grade.
   2. Division 32 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS


1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mix water to be withheld for later addition at Project site.
   2. Include certification test regarding total chloride-ion content, not to exceed 0.15%.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar sizes, concrete cover, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
   1. Indicate all construction joints required to construct the structure. Location at construction joints is subject to the approval of Architect.
   2. Detailing and orientation of Shop Drawing Plans and Schedules shall be consistent with the Construction Drawings. The reviewer reserves the right to reject and order redrawn any Shop Drawings that could cause field placement problems due to crowding, illegibility, or lack of detailing. Complicated structures shall have each level of reinforcing detailed individually. All resubmitted Shop Drawings shall have changes clouded.

D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Cementitious materials and aggregates.
   2. Form materials and form-release agents.
   3. Steel reinforcement and reinforcement accessories.
   4. Admixtures.
   5. Curing materials.
7. Adhesives.
8. Epoxy joint filler.

E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

F. Field quality control test and inspection reports.

G. Minutes of preinstallation conference

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work 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. Project personnel shall be qualified as ACI-certified flatwork technicians and finishers.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer must be certified according to the National Ready-Mixed Concrete Association's Certification of Ready-Mixed Concrete Production Facilities.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 329.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technicians and Concrete Laboratory Testing Technician-Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician-Grade II.
   3. Qualifications of the testing personnel shall be in accordance with the 2009 IBC.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
   1. ACI 301, "Specification for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   3. ACI 311, "Recommended Practice for Concrete Inspection."
   4. ACI 318, "Building Code Requirements for Reinforced Concrete."
   5. ACI 347, "Recommended Practice for Concrete Formwork."
   6. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
   8. ACI 306, "Cold Weather Concreting."
   9. ACI 305, "Hot Weather Concreting."
   10. CRSI "Recommended Practice for Placing Reinforcing Bars."
   11. ACI 315, "Detailing Manual."
12. ACI 308, “Curing Concrete.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Columns, Pedestals, and Supports: Metal or wood forms that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.


E. Form Release Agent: Commercially formulated form release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82, as drawn.

   1. All welded wire fabric for gages W2.9 and heavier shall be fabricated from as-drawn steel wire into flat sheets. Lighter gages may come in rolls if the rolls are unrolled on a flat, hard surface at the Site and roll curvature taken out.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI’s "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Deformed Bar Anchors (DBA): Conforming to ASTM A496 with a minimum yield strength of 75,000 psi. All bar anchors shall be arc stud welded to steel members.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Portland Cement: ASTM C 150, Type II.

C. Fly Ash: ASTM C 618, Class C or F.

D. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
   1. Class: Severe weathering region, Class 4S or 5S. Water:

E. Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.


C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

2.6 VAPOR RETARDERS

A. Porous Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

2.8 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
   1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
   2. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.0217-inch-thick galvanized steel sheet.
   1. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
   1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. All Concrete (unless specifically noted otherwise): Proportion normal-weight concrete mix as follows:

D. Footings: Proportion normal-weight concrete mix as follows:
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with 2- to 4-inch slump.

E. Lean Concrete
1. Minimum Cementitious Content: 310 lb./cu.yd.
   a. Fly ash content not to exceed 95 lb./cu.yd
2. Maximum Slump: 8 inches.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 15 percent.

G. Maximum Water-Cementitious Materials Ratio shall be 0.70 for lean concrete, 0.64 for footings, and 0.53 for all other normal-weight concrete, unless otherwise indicated.

H. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete exposed to deicers or subject to freezing and thawing while moist.

I. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.

J. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete subject to severe or very severe sulfate exposure.

K. Air Content: Concrete for all slabs, walks, ramps, pavements, beams, walls, columns, etc, exposed to the weather or in a location vulnerable to deicers, and architectural concrete for exterior exposure shall contain entrained air and shall have a minimum of 564 lb of cement/cu yd (6 bags of cement). For any such concrete, the water-cement ratio shall not exceed 5 gal/sack of cement (0.44 absolute ratio by weight). The total air required is 6% (+1-1/2%), at discharge. Add air-entraining admixture at manufacturer's prescribed rate to achieve the required air content.

L. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

M. Calcium chloride and admixtures containing calcium chloride shall not be used. Water soluble chloride ions in the total concrete mix shall not exceed 0.15%, expressed as a percent by weight of cement.
1. Submit a minimum of one test of the chloride content of the proposed group of design mixes. The test shall be not older than one year and shall be performed on the mix with the highest possible chloride content (the mix with the largest possible amount of admixtures).

N. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and
parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.13 EMBEDDED ITEMS

A. It is solely the Contractor’s responsibility to coordinate with all Trades for the setting of sleeves, anchors, dovetail slots, inserts, frames, flashing reglets, and other items to be embedded and to provide all openings required for the installation of other work.
   1. Such coordination shall include, but not be limited to, review of all Contract Documents and the various subcontractor’s Shop Drawings.
   2. No insert shall be allowed to displace reinforcement.
   3. All inserts embedded in concrete exposed to the environment shall be hot-dipped galvanized.

B. Mechanical and electrical equipment, pipes, and conduits shall be anchored to concrete by either embedded unistrut or threaded inserts. Embedded unistrut shall have a maximum depth of 7/8 inch and the length shall not exceed 12 inches. Minimum 2’-0” clearance shall be maintained between embedded unistrut segments. Concrete threaded inserts shall be 3/4 inch malleable iron with a working capacity of 3000 lbs. Refer to and comply with the Drawings for locations. Coordinate with Electrical Contractors for their requirements for supporting equipment.

C. Continuous concrete:
   1. The anchors of the inset shall not be allowed to project past the body of the insert.
   2. The maximum height of the insert body shall be as follows:
      a. Inserts placed in slabs and joists = 7/8 inch.

D. Embedment of conduits and pipes shall be in accordance with ACI 318, "Conduits and Pipes Embedded in Concrete," except that;
   1. No conduits shall be embedded in concrete slabs, beams, girders, walls and columns unless specifically detailed on the Structural Drawings.
   2. Aluminum shall not be embedded in concrete.

E. Structural Integrity: Do not provide any sleeves or openings in structural members unless shown on the Structural Drawings.

F. Anchor Bolts: The Contractor shall be responsible for the correct orientation and exact center line location of anchor bolts.
PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
   1. Wall or column footings may be trenched (excavated neat) and cast without formwork if the soil is suitable and the size of footing does not increase by more than 2 inches in any direction.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
   1. ¼” in 5 feet.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
   1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
   1. The new floor construction must meet and match the existing floor line and elevation where tie-ins to adjacent structures are made.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer’s written instructions, before placing reinforcement.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer’s written instructions, before placing reinforcement. Form release agent shall conform with ANSI/NSF Standard 61 for all concrete exposed to potable water.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor bolts, accurately located, to elevations required.
   2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. It shall be solely the responsibility of the Contractor to remove the forms in a manner which will ensure complete safety of the structure.

B. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must also be hard enough to not be damaged by form-removal operations and curing and protection operations must be maintained.

C. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
   1. At least 70 percent of 28-day design compressive strength.
   2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.

D. 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 for exposed surfaces. Apply new form-release agent.

E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by ARCHITECT.
3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by ARCHITECT.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of slabs.
   2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for slabs in the middle third of spans.
   4. Locate horizontal joints in columns at the top of footings.
   5. Space vertical joints in walls at a maximum of 40'-0" unless otherwise indicated on the Drawings. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness, as follows:
   1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section “Joint Sealants,” are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Engineer of Record. If water is added it cannot exceed the amount of mix water withheld at the batch as indicated by the batch ticket.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.
   1. If a variation in texture or color is evident, the Contractor shall revise construction procedures until uniformity is maintained.
   2. In no case shall concrete be allowed to drop freely for more than 3'-0". For drops greater than 3'-0", use a tremie or other approved method for placing.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
   1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
   2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.
   1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
   2. Do not apply rubbed finish to smooth-formed finish.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
   1. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
C. Trowel and Fine-Broom Finish: Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Foundations: Provide foundations as shown on Drawings. Set anchor bolts at correct elevations, complying with diagrams or templates of manufacturer furnishing equipment.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods for unformed surfaces.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings, unless manufacturer guarantees that curing compounds will not negatively affect floor covering adhesion.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by ARCHITECT. Remove and replace concrete that cannot be repaired and patched to ARCHITECT's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by ARCHITECT.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to ARCHITECT's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to ARCHITECT's approval.

3.13 FIELD QUALITY CONTROL

A. Testing Agency

1. The Design Professional will engage a qualified independent testing and inspecting agency to sample materials, perform tests, submit test reports, inspect rebar placement, and to report on quality of construction during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change. No concrete shall be placed that does not meet specified slump requirements. Sump exceeding the specified maximum, when occurring in 2 consecutive tests made on different portions of the same sample, will be cause for rejection of that truckload and shall be reported to the ARCHITECT immediately. The replacement of such concrete shall be done at no additional expense to the Architect.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix. No concrete shall be placed that does not meet specified air content requirements.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory-cure one set of four standard cylinder specimens for each composite sample.

7. Compressive Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
   a. A compressive strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive strength tests equals or exceeds specified compressive strength and no compressive strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to owner, ARCHITECT, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

E. If the 28-day test results do not meet the specified strength f’c, the mix proportions shall be adjusted for the remaining portion of the structure at no additional expense to the Architect. Where concrete is considered partially deficient, the Architect may require additional testing to be made at no additional expense to the Architect. Any such testing shall be done by an independent testing laboratory. If additional tests do not indicate concrete meets the Project requirements, Contractor shall remove and replace deficient concrete as directed by ARCHITECT. In lieu of additional testing, Contractor has option to immediately remove and replace deficient concrete at no additional expense to the Architect or Project Schedule.

F. Nondestructive Testing: Impact hammer, sonoscope, or other non-destructive device may be permitted by ARCHITECT, but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by ARCHITECT. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by ARCHITECT. Additional tests shall be paid for by the Contractor at no additional expense to the Architect or Architect. Concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least 90% of the specified strength f’c and if not single core is less than 85% of the specified strength f’c.

H. Inspection Services: Inspection work shall be performed in accordance with ACI 311 by an independent testing laboratory.
   1. The inspecting agency shall perform the following duties:
      a. Inspect formwork, placed reinforcing steel, shoring, bracing, embedded items, joints, etc.
      b. Inspect concrete handling, placing, consolidating, finishing, curing, protection, and repair or patching.
c. Inspect stripping, form removal, shoring and reshoring.

d. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

e. Submit certified reports the same day that duties are performed to all those designated by the ARCHITECT or the Architect. Any noncompliance with Project requirements shall be reported immediately.

f. Testing agency will also provide inspections required by IBC and Schedule of Special inspections in Section 01 40 00.

2. The Contractor shall fully cooperate with the inspecting agency in their performance of specified duties and render any necessary physical assistance.

3. The Contractor shall give a minimum of 24 hrs. notice to the inspecting agency before concreting operations are to begin.

4. The reinforcing steel and embedded item placement must be completed before inspection. Concrete placement shall not commence until the area has been inspected and given final approval by the inspecting agency.

End of Section 03 30 00
SECTION 03 35 00
CONCRETE FINISHING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

A. AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
B. ACI 301(2010; Errata 2011) Specifications for Structural Concrete
C. ACI 303R (2012) Guide to Cast-In-Place Architectural Concrete Practice
E. ASTM INTERNATIONAL (ASTM)

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 FINISHING FORMED SURFACES

A. Forms, form materials, and form construction are specified in Section 03 11 00 CONCRETE FORMING. Finish formed surfaces as specified herein. Unless another type of architectural or special finish is specified, leave surfaces with the texture imparted by the forms except that defective surfaces must be repaired. Apply other finishes to the following structures or portions of structures:

3.2 REPAIRS

A. Repair in accordance with ACI 301M ACI 301, Section 5.

3.3 FINISHING UNFORMED SURFACES

A. The finish of all unformed surfaces must meet the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE when tested as specified herein.

1. General: The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed must not be less than 50 degrees F. In hot weather meet all requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE paragraphs HOT WEATHER REQUIREMENTS and PREVENTION OF PLASTIC SHRINKAGE CRACKING. In hot weather when the rate of evaporation of surface moisture, as determined by use of Figure 2.1.5 of ACI 305R, may reasonably be
expected to exceed 1.0 kg/square meter 0.2 pounds per square foot per hour. Make provisions for windbreaks, shading, fog spraying, or wet covering with a light-colored material in advance of placement, and take such protective measures as quickly as finishing operations will allow. Float finish unformed surfaces that are not to be covered by additional concrete or backfill, with additional finishing as specified below, and true to the elevation indicated. Bring surfaces to receive additional concrete or backfill to the elevation indicated, properly consolidate, and leave true and regular. Unless otherwise indicated, evenly slope exterior surfaces for drainage. Where drains are provided, evenly slope interior floors to the drains. Carefully make joints with a jointing or edging tool. Protect the finished surfaces from stains or abrasions. Grate tampers or "jitterbugs" cannot be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing is not be permitted. If bleedwater is present prior to finishing, carefully drag off the excess water or remove by absorption with porous materials such as burlap. During finishing operations, take extreme care to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Remove and replace any slabs with surfaces which exhibit significant crazing. During finishing operations, check surfaces with a 3 m 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

2. Rough Slab Finish: In accordance with ACI 301M ACI 301, Section 5.

3. Float Finish: In accordance with ACI 301M ACI 301, Section 5.

4. Trowel Finish: In accordance with ACI 301M ACI 301, Section 5.

5. Non-Slip Finish: Construct non-slip floors in accordance with ACI 301M ACI 301, Section 5.

6. Rubbed Finish: Immediately after removing the forms, form ties shall be broken back a minimum of three-quarters (¾) inch from the surface, honeycomb, voids, and other surface defects grouted. The surfaces shall then be thoroughly dampened and rubbed with a No. 16 carborundum stone or equal abrasive to create a uniform surface paste. The rubbing shall be continued to remove all form marks and surface irregularities producing a smooth, dense surface. After setting, the surface shall then be rubbed with a No. 30 carborundum stone until the surface is smooth in texture and uniform in color. Unless otherwise shown in the plans only exposed wall surfaces shall have a rubbed finish.

7. Finishing of Unformed Surfaces: Unless otherwise shown on the plans, unformed surfaces shall be finished as follows:

   a. Slabs: Screed with straightedge to remove low and high spots bringing the surface to the required finish elevation of slope and float with a steel float at least three (3) feet in width. When the concrete has reached its initial set, finish with a steel trowel. Use a steel power trowel for large areas. Leave finish essentially free of trowel marks, uniform in texture and appearance and plane to the correct tolerance. Dusting the surface with dry cement, sand, or sprinkling with water is prohibited. No wetting of concrete surfaces during slab finishing operations shall be permitted. Further, no concrete finishing operation shall be permitted while there is water on the surface of slabs and other flatwork.

   b. Finishes that are exposed and subject to foot traffic shall receive a broom finish with a texture of plus or minus one-sixteenth (・1/16) inch or as designated on the plans.
c. Tops of Walls with Bearings: Strike smooth tops of walls and similar unformed surfaces that shall have bearings or bearing pads, and finish with a steel trowel.

d. Construction Joint Surfaces: Surface shall be broom or raked finished. Surface shall be water or grit blasted prior to placing additional concrete, such as columns on column footings and column footings on reservoir slabs.

e. Pavements: Immediately following the final consolidation of the surface, float the pavement longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, place and screed additional concrete, and operate the float until a satisfactory surface has been produced. Advance the floating operation not more than half the length of the float and then continued over the new and previously floated surfaces. After finishing is completed but while the concrete is still plastic, eliminate minor irregularities and score marks in the pavement surface by means of long-handled cutting straightedges. Use straightedges that are 12 feet in length and operated from the sides of the pavement and from bridges. Equip a straightedge operated from the side of the pavement with a handle 3 feet longer than one-half the width of the pavement. Test the surface for trueness with a 12 foot straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. Advance the straightedge along the pavement in successive stages of not more than one-half the length of the straightedge. Immediately fill depressions with freshly mixed concrete, strike off, consolidate, and refinish. Also strike and refinish projections above the required elevation. Continue the straightedge testing and finishing until the entire surface of the concrete is true. Before the surface sheen has disappeared and well before the concrete becomes nonplastic, give the surface of the pavement a nonslip sandy surface texture. A strip of clean, wet burlap from 3 to 5 feet wide and 2 feet longer than the pavement width shall be carefully pulled across the surface. Round edges and joints with an edger having a radius of 1/8 inch.

f. Sidewalks: Apply a lightly broomed finish.

g. Curb and Gutter: Finish exposed surfaces using a stiff bristled brush.

END OF SECTION 03 35 00
SECTION 09 90 00
PAINTING AND COATING

PART 1 - GENERAL

1.1 Description

This section includes materials and application of painting and coating systems for the following surfaces:

A. Exposed metal.
B. Buried metal.
C. Metal in contact with concrete.
D. Pressure vessels.
E. Shade Structure.

1.2 Submittals

A. Submit shop drawings in accordance with the General Provisions.
B. Submit manufacturer’s data sheets showing the following information:
   1. Percent solids by volume
   2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats
   3. Recommended surface preparation.
   4. Recommended thinners.
   5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
   6. Application instructions including recommended equipment and temperature limitations.
   7. Curing requirements and instructions.
C. Submit color swatches.
   1. Submit certificate identifying the type and gradation of abrasives used for surface preparation.
   2. Submit material safety data sheets for each coating.

PART 2 - MATERIALS

2.1 Painting and Coating Systems:

A. The following index lists the various painting and coating systems by service and generic type: PAINT COATINGS SYSTEM INDEX

<table>
<thead>
<tr>
<th>Title</th>
<th>Generic Coating</th>
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<tbody>
<tr>
<td>Exposed Metal Coating Systems</td>
<td></td>
</tr>
<tr>
<td>Exposed Metal, Corrosive Environment</td>
<td>High-build epoxy (two-coat system)</td>
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</table>
These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

2.2 Exposed Metal Coating Systems

A. System No. 10—Exposed Metal, Corrosive Environment:
   1. Type: High-build epoxy finish coat having a minimum volume solids of 60%, with an inorganic zinc prime coat.
   2. Service Conditions: For use with metal structures or pipes subjected to water condensation; chemical fumes, such as hydrogen sulfide; salt spray; and chemical contact.
   4. Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a thickness of 3 mils.
   5. Finish Coat: 5 mils.

B. System No. 18—Organic Zinc Primer for Shop Coating and Field Touch-Up:
   1. Type: Organic zinc primer having a minimum zinc content of 14 pounds per gallon.
   2. Service Conditions: For use as a shop-applied primer or field touch-up primer over inorganic zinc prime coatings on exposed metal.
   4. Coating: Coating shall be of the two- or three-component converted epoxy, epoxy phenolic, or urethane type applied to a minimum dry-film thickness of 3 mils. Organic zinc primer shall be manufactured by the prime coat manufacturer.

2.3 Buried Metal Coating Systems

A. System No. 25—Buried Metal Piping and Tubing:
   1. Type: Cold-applied coal-tar tape, hot-applied coal-tar tape, extruded polyethylene, cold-applied wax tape, or polyethylene tape.
   2. Service Conditions: Buried ferrous and nonferrous piping and tubing.
   3. Coat with one of the following systems:
      a. Wrap with cold-applied coal-tar tape conforming to AWWA C209. Minimum thickness of tape shall be 35 mils. Apply tape with manufacturer’s prime coat. Wrap with hot-applied coal-tar tape conforming to AWWA C203, Section 4.6.
Minimum thickness of tape shall be 50 mils. Apply tape with manufacturer’s recommended prime coat. Use chloride-free primers with the above coatings when applying to stainless steel piping or tubing.

4. Coat field joints of buried piping that has a shop-applied coating with primer and tape conforming to AWWA C209. Use Type 1 tape of 35-mil thickness. Perform electrical inspection of shop and field coating in accordance with Section 5 of AWWA C209.

5. Install buried pipes with wrapped coatings by extending the wrapping to the first joint after entering a building, penetrating a slab, or 6 inches above finished grade. Wrap joints spirally with a minimum overlap of 50% of the tape width.

2.4 Coating Systems for Nonferrous Metals

A. System No. 52--Exposed Metal, Galvanized Steel and Copper:
   1. Type: Synthetic resin or epoxy primer
   2. Service Conditions: Coat galvanized steel and copper surfaces with this system before applying topcoat.
   3. Surface Preparation of Galvanized Steel: Surfaces shall be flat with no protrusions. Remove high spots and tears in the galvanizing with hand and power grinders. Comply with ASTM D6386, paragraph 5.2.1. Do not remove the galvanized coating below the specified thickness. Solvent clean galvanized surfaces per ASTM D6386, paragraph 5.3.2. Then sweep blast per ASTM D6386, paragraph 5.4.1. Use one of the abrasive materials that are described in ASTM D6386, paragraph 5.4.1. Surface preparation for weathered and partially weathered galvanized steel shall be in accordance with ASTM D6386, paragraphs 6 and 7. Apply prime coating within one hour of the surface preparation.
   4. Surface Preparation of Copper: Solvent clean or steam clean copper surfaces per SSPC SP-1; do not use alkali cleaning. Then dust blast.
   5. Prime Coat: Apply to a minimum thickness of 4 mils.
   6. Intermediate and Finish Coats: Epoxy as described in System No. 10. Do not include the inorganic zinc prime coat described in that system.

2.5 Coating Systems for Fusion Epoxy-Coated Steel Surfaces

A. System No. 66--Fusion Epoxy-Coated Steel, Color Coding:
   1. Type: Epoxy having a minimum volume solids content of 60%.
   2. Application: Color coding of pipe or steel surfaces already coated with fusion bonded epoxy.
   3. Surface Preparation: SSPC SP-1. Then roughen the epoxy surface with power tool cleaning per SP-3 or a light sandblast per SP-7.
   4. Prime Coat: None.
   5. Finish Coat: Apply to a minimum dry-film thickness of 5 mils.

B. System No. 67--Fusion Epoxy-Coated Steel, Color Coding:
   1. Type: One-component acrylic enamel having a minimum volume solids content of 35%. Application: Color coding of pipe or steel surfaces already coated with fusion bonded epoxy.
   2. Surface Preparation: SSPC SP-1. Then roughen the epoxy surface with power tool cleaning per SP-3 or a light sandblast per SP-7.
   3. Prime Coat: None.
   4. Finish Coat: Apply to a minimum dry-film thickness of 4 mils.
PART 3 EXECUTION

3.1 Weather Conditions

A. Do not paint in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5°F above the dew point.

B. Do not apply paint when the relative humidity is above 85%.

C. Do not paint when temperature of metal to be painted is above 120°F.

D. Do not apply alkyd, inorganic zinc, silicone aluminum, or silicone acrylic paints if air or surface temperature is below 40°F or expected to be below 40°F within 24 hours.

E. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60°F or expected to drop below 60°F in 24 hours.

3.2 Surface Preparation Procedures

A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting.

B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

C. Do not abrasive blast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove sharp edges, burrs, and weld spatter.

D. Do not abrasive blast PVC equipment. Do not abrasive blast epoxy- or enamel-coated pipe that has already been factory coated, except to repair scratched or damaged coatings.

E. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Apply coatings within two hours of blasting or before any rust bloom forms.

F. Surface preparation shall conform with the SSPC specifications as follows:

<table>
<thead>
<tr>
<th>Surface Preparation</th>
<th>SSP Code</th>
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<tbody>
<tr>
<td>Solvent Cleaning</td>
<td>SP-1</td>
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<tr>
<td>Hand Tool Cleaning</td>
<td>SP-2</td>
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<tr>
<td>Power Tool Cleaning</td>
<td>SP-3</td>
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<tr>
<td>White Metal Blast Cleaning</td>
<td>SP-5</td>
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<tr>
<td>Commercial Blast Cleaning</td>
<td>SP-6</td>
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<tr>
<td>Brush-Off Blast Cleaning</td>
<td>SP-7</td>
</tr>
<tr>
<td>Pickling</td>
<td>SP-8</td>
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</table>
G. Wherever the words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” or “blast cleaning” or similar words are used in these specifications or in paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC (Society for Protective Coatings), surface preparation specifications listed above.

H. Dust blasting is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any contamination or oxide and to provide a surface profile for the coating.

I. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be 2 to 3 mils. Verify the surface profile by measuring with an impresser tape acceptable to the Owner’s Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner’s Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner’s Representative.

J. Do not apply any part of a coating system before the Owner’s Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner’s Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this specification.

3.3 Abrasive Blast Cleaning

A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

B. After abrasive blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said eight-hour period.

C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.4 Procedures for Items Having Shop-Applied Prime Coats
A. After application of primer to surfaces, allow coating to cure for a minimum of two hours before handling to minimize damage.

B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.

C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.5 Field Touch-Up of Shop-Applied Prime Coats

A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisodium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.

C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared per SSPC SP-11. Remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

E. Use repair procedures on damaged primer that protects adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles, and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

F. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

G. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer per System No. 18 to cover scratches or abraded areas.

H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.
3.6 Painting Systems

A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.

B. Deliver paints to the jobsite in the original, unopened containers.

3.7 Paint Storage and Mixing

A. Store and mix materials only in areas designated for that purpose by the Owner’s Representative. The area shall be well-ventilated, with precautionary measures taken to prevent fire hazards. Post “No Smoking” signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use. Store paint at an ambient temperature from 50°F to 100°F.

B. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.8 Procedures for the Application of Coatings

A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.

E. Apply coating systems to the specified minimum dry-film thicknesses as determined per SSPC PA-2.

F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any
dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. Apply the brush coat prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer’s recommendation.

I. Each coat shall cover the surface of the preceding coat completely, and there shall be a visually perceptible difference in applied shade or tint of colors.

J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner’s Representative.

K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

3.9 Surfaces Not To Be Coated

A. Do not paint the following surfaces unless otherwise noted in the drawings or in other specification sections. Protect during the painting of adjacent areas:

1. Concrete surfaces.
2. Stainless steel tubing, fittings and valves.
3. Glass.
4. Roofings.
5. Fencing.
6. Electrical fixtures except for factory coatings.
7. Nameplates.
8. Grease fittings.
10. Buried metal pipe and metal conduit: Unless otherwise specified, buried metal pipe and metal conduit shall be tape-wrapped or coated for corrosion protection. Said protective coating shall be continuous below ground and extend to 12” above finish surface grade.
11. Fiberglass items, unless specifically required in the FRP specifications.
13. Paved surfaces.

3.10 Protection of Surfaces Not To Be Painted

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.11 Surfaces To Be Coated

A. The exact coating to be applied in any location is not designated by the descriptive phrases
in the coating system titles such as “corrosive environment,” “buried metal,” or “submerged metal.” Coat surfaces with the specific coating systems as described below:

1. Coat aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications.
2. Coat valves as described the same as the adjacent piping. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping.
3. Coat existing and new ASME pressure vessels white as directed by Owner’s Representative

3.12 Dry-Film Thickness Testing

A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Measure coating thickness specified for stainless steel, aluminum, and copper surfaces with an eddy-current type thickness gauge per ASTM D1400. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide detector as manufactured by Tinker and Rasor or K-D Bird Dog.

C. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.

D. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80%, nor more than 120%, of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.

E. Perform tests in the presence of the Owner’s Representative.

3.13 Repair of Improperly Coated Surfaces

A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.14 Cleaning

A. During the progress of the work, remove discarded materials, rubbish, cans, and rags at the end of each day’s work.
B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.

C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION 09 99 00
SECTION 13 34 19
METAL CANOPY SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Freestanding, pre-engineered metal canopies including steel framing, metal roof, roof drains and leaders, fascia components, and metal ceiling and accessories. Reinforced Footings designed by Canopy Manufacturer’s Engineer, anchor bolts provided. Reinforced concrete footings per detail sheet S100.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-In-Place Concrete: Reinforced Concrete Footings, Concrete islands and Concrete Paving.
B. Section 05 50 00 - Metal Fabrications.
C. Section 07 90 00 - Joint Sealers.
D. Division 22 - Plumbing: Plumbing services and connections.
E. Division 26 - Electrical: Electrical wiring and connections.

1.3 REFERENCES

B. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures (copyrighted by ASCE, ANSI approved).
D. ASTM International (ASTM):
F. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (copyrighted by NFPA, ANSI approved) - hereinafter referred to as NEC.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide pre-engineered canopies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated for the specific location where Canopy will be installed:
   1. Uniform pressure as indicated on drawings - minimum design wind load per ASCE 7, CH. 6.
B. Thermal Movements: Provide pre-engineered canopies that allow for thermal movements
resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.5 SUBMITTALS

A. General: Submit under provisions of Section 01 30 00 - Submittal Procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:

   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Submit shop drawings. Include plans, elevations, sections, details, and attachments to other work. Canopy supplier shall furnish complete canopy drawings signed and sealed by a professional engineer licensed in the state where the canopy shall be installed.

D. Samples:

   1. Submit samples for initial color selection. Submit samples of each specified finish. Submit samples in form of manufacturer's color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full range of variations expected.

E. Certificates: Submit product certificates signed by the manufacturer certifying material compliance with specified performance characteristics and criteria, and physical requirements.

F. Warranty Data: Submit warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in engineering and manufacturing pre-engineered canopies with a minimum documented experience of twenty years and with a quality assurance program utilizing a quality inspection for each system.

B. Welding: Qualify procedures and personnel according to the following:

   1. Welding shall be in accordance with AWS D1.1 (with E70XX electrodes).
   2. Steel shop connections shall be welded and field connections shall be bolted (unless otherwise noted on the Drawings). Shop welds may be changed to field welds with the approval of the project engineer.
   3. Slag shall be cleaned from welds and inspected. Steel shall be painted with red oxide rust-inhibitive primer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
D. Source Limitations: Obtain pre-engineered metal canopy through one source from a single manufacturer who shall manufacture and install the canopy.

E. Product Options:

1. Information on the Drawings and in the Specifications establishes requirements for system's aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance. Do not modify intended aesthetic effects, as judged solely by the Architect, except with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.

2. The Drawings indicate size, profiles, and dimensional requirements of pre-engineered metal canopies and are based on the specific system indicated. Refer to Section 01600 - Product Requirements. Do not modify intended aesthetic effects, as judged solely by the Architect, except with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.

F. Coordination:

1. The General Contractor shall conduct site meetings to verify project requirements, substrate conditions, utility connections, manufacturer's drawings and installation instructions. Comply with Division 1 section on project meetings.

2. The General Contractor shall prepare for and pour the concrete footers for the pre-engineered metal canopies. Manufacturer shall furnish recommended footing drawings as per IBC Section 1807.3 and prints and rebar details for concrete footings, as well as provide anchor bolts to be embedded in concrete footer. Such items shall be delivered to project site in time for installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect components and accessories from corrosion, deformation, damage, and deterioration when stored at job site. Keep materials free from dirt and foreign matter.

1.8 PROJECT CONDITIONS

A. Field Measurements: The Contractor shall verify location and elevation of footings relative to finished grade, columns, and other construction contiguous with pre-engineered metal canopies by field measurements before fabrication and indicate measurements on shop drawings.

1. Established Dimensions: The Contractor shall, where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal canopies without field measurements. Contractor is responsible to coordinate footer locations and elevations with any interferences with or attachments to abutting structures.

1.9 WARRANTY

A. Manufacturer warrantees the products it manufactures to be free of defects in materials, leaks, and workmanship for 1 year from date of shipment.
B. Manufacturer offers a 20-year limited warrantee on finishes against peeling, flaking, and chipping of deck when properly maintained, and will pass on manufacturer's warrantees for accessory items.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: Subject to compliance with requirements, provide products by Austin Mohawk and Company, Inc., or comparable product by one of, but not limited to, the following:

3. Southeastern Canopies, Shelby, AL (205) 669.9955

B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Structural Steel:

1. Material and work shall conform to the latest AISC 360.
2. Structural steel shall be painted with a rust inhibitive (red oxide) primer (std).

B. Sheet Metal:

1. Decking: 3 inch (76 mm) by 16 inch (406 mm) by 20 gage smooth white, ASTM A 653/A 653M GR40, Fy = 40 ksi, galvanized steel with baked enamel finish.
2. Center and Tapered Gutter: 24 gage hot-dip galvanized steel baked enamel finish.
4. Internal Downspout: 3 inch (76 mm) diameter PVC.

2.3 PRE-ENGINEERED METAL CANOPY

A. General: Provide a complete, integrated set of manufacturer's standard design canopy components using a flexible frame with fixed base wherein the steel framing system uses stacked I Beam construction transferring the moment to the concrete footing without requiring a rigid connection between steel frame members. The beam arrangements allow for a cantilever design which can bring the columns from the perimeter of the structure to the inner protected zones between the drive lanes. These mutually dependent components form a pre-engineered canopy, ready for construction on project site. Said pre-engineered metal canopy will be designed to meet all site structural wind, snow and seismic requirements.

B. Canopy Fascia:

1. Aluminum Composite Panel (ACM): Provide minimum 4 mm thick ACM with a fluorocarbon paint finish, masked on one side. Manufacturer shall warranty finish for 10, 20 or 30 years depending on the color selected from full line of panel manufacturer's color chart. The color to be selected will be a close match to the existing exterior panels of the newly renovated Airport Terminal. A second choice for the color of the fascia might be a close match to the
dark blue accent panels on the newly renovated Airport Terminal. The Owner will approve all final color selections.

C. Canopy Finishes: Comply with NAAMM MFM for recommendations for applying and designating finishes.

1. 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.

D. Fabrication: Fabricate pre-engineered canopies completely in factory.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the General Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

1. Examine supporting foundations for compliance with manufacturer’s requirements, including installation tolerances and other conditions affecting performance of supporting members.
2. Verify the rough-in of required mechanical and electrical services prior to placement of the structure.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. A work area shall be required extending 10 feet (3 m) beyond buildings and canopies in all directions to the extent practical. The work area shall be flat, comprised of hard-packed soil or gravel, asphalt, or concrete, and free of open excavation, debris, construction equipment and construction workers. An additional flat work space a minimum of 25 feet (7.6 m) by 25 feet (7.6 m) or as practical shall be provided adjacent to the canopy and/or building for unloading and storing materials. Site to meet OSHA guidelines to allow lift equipment and scaffolding to maneuver the work area.

B. Set pre-engineered metal canopy plumb and aligned. Level base plates true to plane with full bearing on concrete bases.

C. Fasten pre-engineered metal canopy columns to anchor bolts and/or foundation bolts.

D. Provide anchor bolts as follows:

1. Anchor bolts or foundation bolts will be set by the General Contractor in accordance with approved site specific drawings. They must not vary from the size and dimensions shown on
the erection drawings. Use of a plywood template is recommended. Remove template prior to column erection.

2. Anchor bolts shall conform to ASTM A 307, and shall have a minimum of 7 inches (178 mm) of exposed thread and 23 inch (584 mm) minimum embedment with 1-1/4 inch (32 mm) nut and washer as embedment end.

E. Provide bolted connections as follows:

1. Structural erection bolts shall conform to ASTM A 325/A 325M.
2. Bolts shall be tightened to snug tight per latest RCSC specifications (unless otherwise specified).

F. Provide screws as follows:

1. Fastening shall be performed per installation prints provided by the manufacturer.
2. Self-drilling and self-tapping screws shall have a sufficient cut point and a 1/2 inch (13 mm) outside diameter dished metal-backed neoprene washer to be used in water sealing applications.

G. Provide pedestrian protection and warnings during construction which comply with local, Federal, and OSHA codes.

H. Prior to steel erection of any kind, the General Contractor shall grade, backfill and otherwise prepare the job site to allow for rolling scaffold and ensure safe working conditions including the removal or relocation of overhead power lines.

I. Any grade or elevation situations which deviate from the approved manufacturer’s plans shall be conveyed to the manufacturer prior to fabrication.

J. All anchor bolts and/or leveling plates shall be set within 1/4 inch (6 mm) tolerance on layout and grade level.

K. Temporary electrical power shall be provided.

L. Connect electrical power service to power distribution system according to requirements specified in Division 26 - Electrical.

M. Dumpster for trash and debris shall be provided by the General Contractor.

3.4 ADJUSTING AND CLEANING

A. After completing installation, inspect exposed finishes and repair damaged finishes.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

End of Section 13 34 19
SECTION 15 45 09
COMPRESSED NATURAL GAS FUELING STATION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. The CNG Fueling Station shall provide 3600 psi temperature-compensated, fast fill fueling, unattended service, 24 hour/7 days a week/ 52 weeks per year with the exception of maintenance and unplanned outage occurrences. Operation of the CNG Refueling Station shall be monitored from a remote location. The system shall consist of all new equipment throughout.

B. Major system components shall include the following:

1. One (1) skid-mounted single-tower inlet desiccant adsorptive gas dryer with pre and post filters and manual on-board regeneration.
2. Two (2) skid-mounted compressor systems, each system including its own electric motor, compressor, inter/after stage coolers, oil and condensate removal, blowdown vessel, suction and discharge pulsation dampeners’ and inlet, inter-stage and discharge filters.
3. Weather resistant, sound attenuating enclosure for each compressor skid.
4. Three (3) ASME code, spherical, gas storage vessels in cascade configuration complete with all valves, fittings and appurtenances.
5. One (1) Priority Valve Panel in weather-resistant enclosure.
6. One (1) two (2)-hose fast fill dispenser with in-dispenser sequencing and fuel management system.
7. All associated instruments, valves, controls, piping and hoses.
8. Emergency shutdown (ESD) system.
9. Fire extinguishers supplied and located in accordance with code.
10. Separate remote power and control panel (Motor Starter panel, MSP) in weather resistant enclosure (NEMA-4X).
11. Emergency standby generator with skid-mounted, fuel tank and weather resistant sound-attenuated enclosure.

C. Contractor-furnished packaging services required to ensure compatible sizing and selection of all ancillary compressor system components including: intercooler, vessels, filters and piping. System component packaging furnished by the Contractor (approval required by owner) shall be based on natural gas delivery requirement of at least 75 standard cubic feet per minute (SCFM) with a suction inlet of 10 psig and a discharge of 4,500 psig (See requirements in paragraph 3 below).

D. Pressure and Gas flow criteria:

<table>
<thead>
<tr>
<th>Description</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Inlet Pressure at Outlet of MSA Riser</th>
<th>Horsepower</th>
<th>Max Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter Set Assembly</td>
<td>The Gas Provider</td>
<td>N/A</td>
<td>15 – 20 psig</td>
<td>N/A</td>
<td>Gas Company provided</td>
</tr>
<tr>
<td>Dryer</td>
<td>Open</td>
<td>N/A</td>
<td>10-15 psig</td>
<td>N/A</td>
<td>360scfm</td>
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<tr>
<td>Compressors</td>
<td>Open</td>
<td>CNG 50-75</td>
<td>10 psig (regulated)</td>
<td>50</td>
<td>75 scfm each</td>
</tr>
</tbody>
</table>

E. All components, appurtenances, materials, labor, shop testing and field testing as required to provide a complete and operational compressed natural gas system as shown on the plans and as
specification herein.

1.2 REFERENCES

A. Equipment and installation shall comply with all required codes and standards, including—but not limited to—the following:

B. Title 8


D. Birmingham Fire Code

E. Piping Code ANSI / ASME B31.3

F. Uniform Plumbing Codes

G. NFPA 70 National Electric Code

H. NEC 1996 or newer rated Class 1, Group D, Division including the deburring of all electrical conduit lines and no more than 360 degree bends in a single run.

I. All applicable local and State of Alabama Codes apply

J. All equipment including the compressor skid, gas dryer, CNG ASME/Spherical storage vessels and any auxiliary equipment including control panel and air compressor shall be mounted as shown on the attached preliminary drawings.

K. Mandatory safety equipment required in accordance with the Uniform Fire Code to include fire extinguishers at dispensing area, and an alarm system including warning lights.

L. ANSI/IAS NGV1, Standard for CNG Vehicle (NGV) Fueling Connection Devices

M. ANSI NGV4.1 -1999 –NGV Dispensing Systems (CNG vehicular fuel dispensing systems)

N. ANSI NGV4.2 -1999 –Hoses for NGV’s and Dispensing Systems (CNG dispenser and vehicular hose assemblies)

O. ANSI NGV4.4– 1999 – Breakaway devices for natural gas dispensing hoses and systems

P. ANSI NGV4.6 – 1999 – Manually operated valves for natural gas dispensing systems

Q. ANSI NGV4.7 (most current edition) – Automatic operated valves for natural gas dispensing systems

R. ANSI NGV4.8 – 2002 – Natural gas vehicle fueling station reciprocating compressor guidelines

S. ANSI PRD1 -1998 (with 1999 & 2007 addenda) – Basic requirements for pressure relief devices for natural gas vehicle fuel containers

T. 40 CFR (Code of Federal Regulations) 80.33 – Controls applicable to natural gas retailers and wholesale purchaser-consumers

U. SAE J1616 – Recommended Practice for Compressed Natural Gas Vehicle Fuel
V. 2013 ASHRAE Handbook - Fundamentals

W. ASME Boiler and Pressure Vessel Code, Section VIII (Pressure Vessels), Division 1 or 2

X. Underwriter Laboratory listing for all motors and electrical equipment.

Y. OSHA specification 1910.145

Z. ANSI specification Z535.

AA. API 420

BB. AWS D1.1

1.3 SUBMITTALS

A. Submit complete plans, specifications, catalog information, cut and data sheets, descriptive drawings and literature for each equipment item to be furnished under this Section. All exceptions to the specifications shall be noted.

B. Submittals shall include manufacturer's installation drawings for approval by the Engineer.

C. Submit dimensioned plans showing the skid mounted system layout with all major system components clearly identified and keyed to the items listed below. Actual components to be used shall be identified by manufacturer's name and model number on the shop drawings. The plans shall include operating parameters of each major equipment item including flow rates, pressures and pipe sizes. The shop drawings shall show locations of all major instrumentation and control components. The shop drawings shall also show locations of all pipe supports, method of attachment of major components to their mounting skid, all seismic bracing details, welded connection details, pipe joint details and skid construction details. The following system components shall be included and identified in the Contractor's plans.

1. Compressor(s) and electric motor(s)
2. Intercooler(s) and aftercooler(s)
3. Oil and condensate removal system
4. Gas recovery vessel
5. Fast-Fill Dispensing system including anchorage
6. Distribution valve panel (priority/ESD)
7. Instruments
8. Pressure and temperature gauges
9. Pressure transmitters
10. Fire, check, pressure relief (safety), ball valves, needle valves, block and bleed valves
11. Pressure regulators
12. Tubing
13. Process piping diagram
14. Solenoid actuated valves
15. Spherical storage vessels
16. Single tower dessicant dryer
17. Fuel priority panel

D. Calculations: Submit calculations and/or manufacturer's data to substantiate the system components listed. Such documentation shall demonstrate the adequacy of these components to provide overall system performance as required by these specifications, calculations and supporting documentation shall be signed and stamped by a Mechanical Engineer currently registered in the State of Alabama.
E. The Contractor shall provide with his/her submittals, a manufacturer’s suggested list of spare parts for all equipment furnished under this Section. Such list shall include all spare parts, which the manufacturer(s) expect to be required for maintenance/replacement purposes during the first two (2) years of equipment operation. The list shall include part numbers, part description and current pricing. Prices are to be valid for a period of one (1) year following the date of system commissioning.

F. The Contractor shall provide six (6) copies of complete written field testing procedures for review and approval by Owner at least three weeks in advance of such field testing. Owner to witness field testing (if desired).

G. Provide manufacturer’s certification of satisfactory shop performance.

H. Submit Owner personnel training schedule and outline of topics to be covered in training sessions.

I. Submit equipment mounting dimensions for installation of cast-in-place anchor bolts.

J. Submit manufacturer’s recommendations for painting and coating of equipment and piping.

K. Submit outline of O&M Manual format and contents for approval by Engineer.

L. Submit welding procedures per American Welding Society format.

M. Submit seismic calculations by a structural engineer for skid-mounted equipment, all process piping and attachment of the skid to its concrete base. Also provide centers of gravity and weights for independent verification of calculations by Owner.

1.4 SYSTEM DESCRIPTION

A. Each CNG compressor system shall be capable of compressing at least 75 standard cubic feet per minute of natural gas (Suction inlet of 10 psig – Discharge pressure of 4,500 psig), taken from Alagasco metered source from distribution pressure. In this configuration, the suction inlet pressure from the meter set assembly will be “float”.

B. Natural Gas:

1. Provider: Alagasco
2. Specific Gravity: 0.57
3. Temperature: 50-60 degrees F
4. Heating Value: 1010 BTU/SCF
5. Moister Content: 7 lb/MMSCF
6. Typical Gas Composition:
   a. Methane: 97%
   b. Ethylene: 1.1%
   c. Propane: 0.13%
   d. Nitrogen: 1.1%
   e. CO2: 0.53%
7. Gas Pressure at Station Inlet: Float (10psig to 15psig downstream of the MSA)
8. Ambient Air Temperature: 10 degrees F Low / 100 degrees F High

C. Electric Service – Alabama Power Company

1. Electrical power supplied to the compressor motor will be 480V three-phase, 60 hertz from new service.
2. Electrical power supplied to other systems will be 120 VAC, single-phase, 60 hertz. Provider must ensure that adequately sized control transformers, UPS, and surge suppression equipment are provided.

D. Design Conditions

1. Compressor System:
   a. Compressor suction gas temperature: 100°F max.
   b. Compressor suction gas pressure: 10 psig
   c. Discharge pressure from each compressor: 4500 psig
   d. Design flow rate from each compressor: 75 scfm
   e. Design compressor prime mover: 50 hp electric motor
   f. CNG Dispensing Rate: 1,200 SCFM maximum for each hose of the proposed two-hose fast fill dispenser.
   g. Gas Quality: CNG dispensed into all vehicles shall meet the requirements as specified by SAE J1616 recommended practice.

E. Station Performance Criteria

1. The fueling station shall be capable of delivering 150 SCFM of compressed natural gas with two (2) compressors running, providing direct fill, (equivalent to 1.2 gallons of gasoline equivalent (GGE) per minute on one (1) hose, and 0.6 GGE with two (2) hoses).

2. After the compressors have been operating, and have filled the three (3) storage spheres, the station shall be capable of delivering at least 8 GGE per minute per hose, to within 95% of a temperature compensated fill of 3600 psig @ 70°F to each CNG powered vehicle.

3. The facility shall have sufficient redundancy with direct fill and storage to meet the above requirements during normal operations throughout the year and during scheduled and unscheduled maintenance or repair activities.

F. Climate Design Criteria

1. Outdoor ambient air design criteria shall be based on weather data tabulated in the latest edition of the ASHRAE Handbook of Fundamentals for the Birmingham Airport, Birmingham, Alabama. Winter design conditions shall be based on the 99.6 percent column dry bulb temperature in the ASHRAE Fundamentals Volume. Summer design conditions for sensible heat load calculations shall be based on the 0.4 percent dry bulb temperature with its mean coincident wet bulb temperature. Design conditions for the summer ventilation load and all dehumidification load calculations shall be based on the 0.4% dew point, with its mean coincident dry bulb temperature.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: The compressed natural gas system specified herein shall be furnished by a single packager regularly engaged in the production of compressed natural gas delivery systems and associated control components. The responsibility for performance in compliance with this specification in its entirety shall not be divided among individual suppliers of components comprising the system, but shall be assumed solely by the packager of the compressed natural gas system.
B. Compressed Natural Gas System Packager’s Qualifications: The Contractor shall pre-qualify all potential packagers of the compressed natural gas system and shall not submit such system for approval unless the following conditions have been met:

1. The manufacturer/packager of the compressed natural gas system shall have been regularly engaged in the manufacturer/packaging of such systems for at least five (5) years and have at least three (3) installations similar to the one specified herein in active service.
2. Such installations shall have been in satisfactory service for at least one (1) year and their application shall be in the delivery of compressed natural gas fueling systems for automotive applications.
3. Approval of the proposed manufacturer/packager of the compressed natural gas system shall be contingent upon satisfactory verification by the Owner of prior installations.

C. The compressed natural gas system control panel, skid components, dispenser and storage vessels shall carry a U.L. label (or other approved third party listing) for its intended purpose under these Specifications. All system components shall comply in all respects with NFPA 52 - Compressed Natural Gas (CNG) Vehicular Fuel Systems, NFPA 70, UL 508, UL 508A and UL 1604. Certification by the third party inspection firm shall be evidenced by the application of a sticker on the compressor enclosure, CNG dispenser, on the electrical power and control panel and the storage vessels.

D. All equipment shall be permanently affixed and accessible for maintenance and operation in accordance with all code requirements. All calculations required by permitting agencies must be provided, stamped and signed by a professional engineer licensed by the State of Alabama.

E. The supplier shall notify Owner no later than 10 working days prior to factory testing of the compressor systems so that the Owner’s representative will have adequate time to witness the test prior to shipment (if desired). Witnessing of the testing does not relieve the supplier of the responsibility to comply with the specifications.

1.6 WARRANTY

A. The Contractor shall furnish a one (1) year warranty for all work covered by this Section for material and workmanship except piston rings and valves. The warranty shall cover full cost of labor and material to repair or replace any faulty installation. The warranty shall be subject to approval by the Owner and shall be provided prior to project completion. Warranty shall commence following startup and acceptance of installation by Owner. Piston rings and valves shall be guaranteed for a minimum life of 6,000 hours. Contractor shall replace piston rings and/or valves at no charge if they need replacement prior to 6,000 hours. Contractor shall guarantee a twenty four hour maximum on site response time for any warranty service calls.

1.7 MANUFACTURER’S SERVICES

A. The Contractor shall provide a manufacturer's representative for the equipment specified herein to be present at the jobsite and/or classroom designated by Owner for the minimum man-days listed for the services below, travel time excluded:

1. Two man-days for installation assistance, inspection and certification of the installation (includes Contractor inspection of field installed underground piping prior to backfill).
2. Two man-days for pre-startup classroom and jobsite training for Owner personnel.

B. The training for Owner personnel shall cover the following topics for collective training requirements that include all station components:

1. Special instruction in setting up and operating the card reader.
2. Routine operation and maintenance of all compressed natural gas fueling station components.
3. Daily and weekly inspections (maintenance checklist forms shall be provided by the Contractor).
4. Long-term maintenance and service requirements.
5. Safety procedures.
7. Emergency fueling support.
8. System operation overview.
9. Trouble shooting procedures.

C. The owner shall be allowed to video record the training provided.

D. The Contractor and Owner will jointly verify that the required training is conducted.

E. An authorized representative of the compressed natural gas system supplier as described in this Section, shall inspect the installation of all work furnished under this Section and shall provide a certificate of satisfactory installation.

PART 2 – COMPONENTS

2.1 NATURAL GAS DRYER

A. General: This specification covers the minimum requirements for a single tower gas dryer skid used to dry natural gas before it is compressed into CNG. The skid shall include a coalescing pre-filter, natural gas dryer, particulate filter with all instrumentation hardware and enclosures needed for an operational system as described herein.

B. Design Conditions: The natural gas drier skid shall be compatible with the compressor skid and shall be operational under the following minimum conditions:

- Inlet Gas Flow rate: 360 SCFM
- Inlet Gas Pressure: 10-50°-90°F
- Inlet Gas Temperature: 7 LBS H20/MMSCF
- Inlet Gas Water Content: 10°F
- Capacity MM SCF *
- Temperature (min): 10 min * Ambient Temperature (max):
- Inlet Gas Water Content: -20°F to 500°F
- Maximum Outlet Gas Water content: 0.5 LBS H20/MMSCF
- Outlet Gas Dew Point: -80°F
- Duty Cycle: 5 HRS/DAY

* Based on 7 lbs H20/MMSCF

C. Components:

1. A coalescing pre-filter shall be located at the inlet to the dryer. The filter cartridge shall remove 99.99% of particles 0.01 microns and larger and 99.9% of aerosols 0.1 microns and larger.

a. The filter housing shall be aluminum or carbon steel bowl/aluminum head style vessel. The filter shall be fitted with a drain port for removal of collected liquids. The filter cartridge shall be sealed to the housing.

b. The drain port shall be fitted with a manual drain valve.
c. The pre-filter shall be designed and installed to allow replacement of the
cartridge filter element without removing the housing from the piping system.
d. The pre-filter shall be furnished with two (2) inlet/outlet isolation ball valves.

2. The natural gas dryer shall be insulated single tower, heat regenerative, closed
loop type using molecular sieve desiccant. Gas shall not be exhausted to the
atmosphere under normal operating conditions. Regeneration shall be with a volume
of gas, which is circulated through the regeneration system. The regeneration gas flow
shall be co-current to the adsorption flow to prevent any dew point spike on switchover.

3. The desiccant tower shall be an ASME U-stamped carbon steel vessel with a 1/16"
corrosion allowance.

a. The tower shall be furnished with a chamber pressure gauge.
b. Stainless steel desiccant support screen and inlet diffuser shall be installed.
c. Desiccant shall be molecular sieve for minimal co-adsorption of mercaptan (odorizer).

4. Regeneration of the desiccant shall be accomplished on skid equipment using natural
gas. Operator attended regeneration shall be manually initiated by a panel mounted
push button once the manual isolation valves are correctly positioned. The
regeneration time shall be approximately six (6) hours. Regeneration shall be
manually initiated based on the dryer outlet dew point. Once initiated, regeneration
shall proceed automatically to conclusion.

a. The gas blower shall be a positive displacement type with an electric motor rated in
accordance with NFPA 52. Blower/motor shall be installed in an ASME "U" or "UM"
stamped carbon steel pressure vessel with the same pressure and temperature
rating as the dryer vessel.
b. The gas heater shall use Incoloy sheathed, low watt density electric heating
elements mounted inside an insulated heating chamber. An outlet temperature
gauge or remote digital indicator on a display panel shall be furnished. The heater
vessel shall be an ASME "U" or "UM" stamped carbon steel pressure vessel with
the same pressure and temperature rating as the dryer vessel.
c. An air to gas fin tube after-cooler complete with electric motor and non-sparking
fan blades with motor in compliance to Class I, Div. II, Group D electrical class shall
be provided.
d. A high efficiency coalescing separator, ASME "U" or "UM" stamped pressure
vessel carbon steel/aluminum construction shall be provided complete with
an integral stainless steel or carbon steel reservoir complete with a manual drain
valve. The reservoir shall have a liquid capacity to at least (2) regeneration cycles.
e. Regeneration shall be controlled by preset electronic timers for the heating and
cooling cycles.
f. Two (2) manual inlet and outlet regeneration isolation valves shall be provided. The
outlet regeneration valve shall be a lockable ball type bronze body with chromium
plated ball and stainless steel trim rated for gas service with screwed ends.
The inlet regeneration valve shall be a lockable high temperature rated gate valve
with socket weld ends and lockable handle.
g. Four (4) filter inlet and outlet isolation valves shall be provided at the filters. Valves
shall be lockable ball type bronze body with chromium plated ball and
stainless steel trim rated for gas service with threaded ends.

5. Fiberglass insulation with aluminum cladding shall be installed on the desiccant tower
heater housing and hot gas piping to prevent accidental physical contact with any hot
surfaces. Insulation shall be suitable for outdoor service.

6. Heavy duty structural steel open frame skid shall be provided with four (4) lifting eyes for
handling during installation.
7. A precision dew point monitor with digital dew point indication in degrees C, F, PPMV or LBS H$_2$O/MMSCF shall be installed at the dryer control panel. The moisture sensor shall be installed at the dryer outlet to verify the gas dew point on a continuous basis. Two alarm lights shall be provided, the first to signal deteriorating dew point performance and finally when regeneration is required. A set of form "C" dry contacts shall be provided for remote signal.

8. Electrical construction shall be in accordance with NFPA 70 for Class I, Div. II, Group D. Electrical service is 460/230 VAC, 3 Phase and 120 VAC, 1 Phase. Terminal strips shall be furnished with all internal wiring complete to these terminals strips. Wires and terminal strips shall be labeled. The natural gas dryer shall be furnished with a grounding connection.

9. A particulate after filter shall be located at the outlet of this dryer. The filter cartridge shall remove 100% of particles 1.0 microns and larger.
   a. The filter housing shall be a carbon steel or aluminum bowl/aluminum head style vessel. The filter shall be fitted with a vent port and vent valve. The filter cartridge shall be sealed to the housing.
   b. The after filter shall be designed and installed to allow replacement of the cartridge filter element without removing the housing from the piping system.
   c. The after filter shall be furnished with two (2) inlet/outlet isolation ball valves.

10. Bypass: Dryer shall have a bypass system so that when dryer is out of commission, the station will remain operational. The system shall be capable of bypassing gas at the full rated capacity of the dryer and station. Bypass shall be manually operated with isolation valves.

D. Instrumentation and Controls: The following instruments and controls shall be provided as a minimum:

1. 2 1/2" dial locally mounted desiccant chamber pressure gauge
2. 3" dial heater outlet temperature indicator or digital readout on remote display
3. 3" dial after-cooler inlet temperature indicator or digital readout on remote display
4. 3" dial after-cooler outlet temperature indicator or digital readout on remote display
5. Waterproof NEMA 7 electrical control panel suitable for Class I, Division II, Group D, area or NEMA 4 with internal components rated for Class I, Division II, Group D area
6. Dryer outlet dew point meter
7. Power On-Off switch
8. Regeneration with manual START/STOP push buttons
9. Single input voltage connected at the control panel mounted at the dryer
10. Control voltage shall be 120VAC/1 Phase/60 HZ provided by a step down transformer
11. Operator attended regeneration shall be manually initiated by a panel mounted push button once the manual isolation valves are correctly positioned. The regeneration time shall be approximately six (6) hours.
13. Pre-filter and after filter differential pressure gauges locally mounted to the filter head. Range 0-6 psig shall be provided.
14. High heater sheath over-temperature alarm and shutdown.
15. High after cooler outlet temperature alarm and shutdown.

E. Skid:

1. Manufacturer/Packager shall furnish all piping systems for all equipment mounted on the skid. Piping shall terminate at skid edge with flanged or threaded connections. Connections shall be sealed for shipment.
   a. Pipe shall be carbon steel, SA53 or SA106, Grade B, with wall thickness, as
required, to meet design conditions. Minimum schedule 40 for 2" and under.

b. Fittings for 2" and under shall be threaded forged steel, Class 3000, ASTM A-197. Fittings larger than 2" shall be butt weld, ASTM A234 WPB, of the same wall thickness as the adjoining pipe.

c. Stud bolts shall be alloy steel, ASTM A-193, Grade B7, with two (2) heavy hex nuts, ASTM A-194, Grade 2H.

d. Flanges shall be forged steel, raised face, ASTM A-105, bored to match the I.D. of the pipe. Flange ratings, shall be as required for the design requirements of the piping systems.

2. All welding and welder qualification shall conform to the requirements of the ASME Boiler and Pressure Vessel Code or API Standard 1104. All filter metals shall be in accordance with AWS or ASTM Standards.

3. All electrical systems for all electrical equipment shall be furnished and installed on the skid or to remote power and control panel (see plans).

4. Skid, equipment, piping and all other materials, which are not insulated, shall be painted with one prime and one finish coat. Equipment, which is received by the manufacturer with a shop primer, shall be touched up if defective before finish coats. Surface preparation and paint application shall be in accordance with manufacturer's instructions. Paint shall be manufacturer's standard type and color.

F. Testing and Documentation:

1. The natural gas dryer shall be furnished with clear and concise printed instructions and diagrams adequate for field installation, maintenance and operation.

2. After thorough inspection and purging, all piping and tubing shall be tested at operating pressure. Dryer shall be tested under simulated operating conditions under pressure and certified prior to shipment.

3. The manufacturer or packager shall conduct a complete system check-out, start-up, adjustment and training at the site. This shall include complete pneumatic and electrical checkout and calibration of all control devices and accessories.

4. Gas Dryer and Filter Manufacturers all require “Made in America” Certification. Models to meet design and performance criteria stated above.

2.2 COMPRESSOR SYSTEMS (COMPRESSOR NO. 1; COMPRESSOR NO. 2)

A. Equipment and System Design and Performance Criteria are as follows:

1. Compressor. “System” is for one compressor. Requirements for each of the two compressor systems listed below.

   a. Minimum output 75 SCFM at 10 psig suction pressure and 4,500 discharge pressure. Capable of operating without overheating at a pressure of 5 psig suction. Below 5 psig suction inlet will set alarm and shut the compressor down.

   b. Air-cooled, four-stage, lubricated, balanced, reciprocating compressor. Compressor shall be rated for continuous operation.

   c. The compressor shall be driven by an electric motor and shall be specifically designed to compress natural gas. No converted air compressor or used compressor shall be permitted.

   d. Compressor shall be provided with belt drive assemblies.

   e. All drive assemblies shall include adjustable motor mountings and shall have suitable guards on all moving parts per OSHA requirements.

   f. Gas shall be cooled after each stage of compression by means of intra/after coolers. Temperature of discharge gas shall not exceed ambient temperature by more than 15 degrees Fahrenheit. Interstage natural gas temperatures at any point in the compressor equipment shall not exceed 325 degrees Fahrenheit.
g. Safety devices shall include self-resetting pressure relief devices at appropriate pressures for each stage of compression and for the captive tank.

h. Compressor and motor shall be noise attenuated so as not to exceed 85 dba 10-feet from the compressor skid in all directions.

i. Equipment vibrations shall not exceed following displacement measured with a threecomponent measuring system:

<table>
<thead>
<tr>
<th>Frequency (cycles per second)</th>
<th>Displacement (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10</td>
<td>0.0020</td>
</tr>
<tr>
<td>10 – 20</td>
<td>0.0010</td>
</tr>
<tr>
<td>20 – 30</td>
<td>0.0006</td>
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<tr>
<td>30 – 40</td>
<td>0.0004</td>
</tr>
<tr>
<td>40 – 50</td>
<td>0.0003</td>
</tr>
<tr>
<td>50 +</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

j. Minimum piston ring service life shall be guaranteed at 6,000 hours.

k. Gas coolers suitable for service in ambient temperatures of between 10 degrees Fahrenheit and 100 degrees Fahrenheit, and designed to deliver gas at a maximum temperature of ambient plus 15 degrees Fahrenheit.

l. The compressor shall have a guaranteed maximum oil carryover of no more than 0.5 lbs./MMSCF of natural gas. The Supplier shall submit the manufacturer’s written guarantee of compliance with oil carryover.

m. The compressor shall include an inlet line assembly, including a particulate filter, check valve, solenoid valve, isolation valve (ESD), flexible hose, and relief valve.

n. An automatic condensate drain system including blow-down valves, check valves, ASME rated blow-down (recovery) vessel, blow-down vessel relief-valve, and blow-down vessel drain piped to the edge of the skid and the pipe shall have a needle valve installed at the end. A high-pressure shutdown switch shall be installed to shut down the compressor and annunciate a fault when the blow-down (recovery) vessel pressure reaches 90% of the vessel relief valve setting.

o. An integral discharge line assembly including two (2) coalescing filters (one equipped with a pre-coalescing filter element), relief valve, check valve, and isolation valve.

p. Particle and coalescing filters shall have isolation valves and be equipped with differential pressure gauges and drain valve kits (Ball valve/needle valve combination).

q. All tubing from 1/4” – 1-1/2” shall utilize double ferrule fittings.

2. Electric Motor

a. Compressor shall be driven by an explosion proof electric motor rated for continuous duty and high ambient temperatures with a minimum service factor of 1.15.

b. The motor shall be equipped with controls to allow automatic starting, warm-up, cool down and shutdown at pressures and times selectable by the station operator.

c. The motor shall be equipped with safety devices to initiate automatic shutdown in the event of low oil pressure, high coolant (air) temperature, high or low suction (inlet) pressure, high compressor discharge pressure, high compressor discharge temperature, overspeed and overcrank.

d. The electric motor shall be rated for continuous duty at the rated horsepower required by the compressor at full cfm output without using the service factor rating.

e. The motor shall be 50 HP, 480 VAC, 3-phase, 3-wire, and labeled by the manufacturer for use in at least Class I, Division 2, Group D locations.

f. The motor shall comply with the Energy Policy Act of 1992 and be rated for premium efficiency. The motor starter shall be silicon controlled rectifier (SCR) solid-state type reduced voltage starter with integral bypass contactor. Motor starter shall be in the
electrical control panel located in a non-hazardous area.

3. Oil and Condensate Remover (Separator)
   a. Each stage is to be equipped with a coalescing filter to remove oil and condensates. This filter is to be mounted after each stage cooling cycle. Piping and coolers shall be oriented to be self-draining to the blow-down vessel. Residual gas is to be automatically drained on compressor shutdown to a gas recovery vessel. All filter housings are to be flushed to the blow-down vessel on shutdown of the compressor.
   b. Condensate and oil to be 98% (minimum) removed prior to gas being discharged.
   c. Each cooling stage shall have a cooler that conforms to ASME, Section VIII, Division I. All heat exchangers are to be oversized a minimum of 10% to compensate for fouling and damaged passes (requiring plugs). Heat exchangers shall be made with non-corrosive materials.
   d. Coolers shall be air-cooled, electric motor driven. Fan blades shall be aluminum or plastic composite construction and shall be driven by a separate direct driven fan motor.

4. Gas Recovery Vessel
   a. The gas recovery system shall be designed to take the compressor blowdown gas and store the gas in a captive gas recovery vessel for re-compression upon the next startup of the compressor.
   b. The vessel shall be ASME rated and have the necessary capacity and working pressure to store the blowdown gas without relieving gas to the atmosphere or to the station suction line. The vessel shall have full capacity relief protection. The vessel shall have a relief valve. Equipment supplier shall provide relief valve sizing calculations to Engineer for review and acceptance prior to relief valve purchase.

5. Filters
   a. The compressor shall be equipped with a suction particulate filter, inter-stage, and discharge coalescing filters. The filters shall capture solid particles and aerosols greater than 0.6 microns and 0.2 microns, respectively. Suction and discharge filters shall be equipped with differential pressure gauges. All filter housings shall be drained to the blow-down vessel upon compressor shutdown. Coalescing filters shall be installed in series, and located as far as possible downstream of the final stage after – cooler but before the priority valve panel.

6. Enclosure
   a. A totally enclosed weatherproof and sound attenuating enclosure shall be provided for the compressor skid. All materials shall be non-combustible or fire-rated. The enclosure shall be of welded steel construction. The enclosure shall be designed to limit equipment noise levels to a maximum of 85 dBA at ten (10) feet outside the enclosure in all directions.
   b. Each enclosure will contain at least two (2) 150W (minimum) light fixtures suitable for Class 1, Division 2, Group D locations, sufficient to provide lighting in all interior areas of the enclosure for maintenance and inspection, shall be provided, complete with explosion proof wall mounted manual switch at entrance.
   c. All materials shall be non-combustible or fire rated.
   d. Sufficient access shall be provided to perform major work on the compressor, including the removal of the electric motor, and other components. All electric panels shall have the necessary clearances in front of openings as required by the electrical code.
   e. The skid assembly shall comply with design requirements of appropriate sections of
the Local Building Code for Seismic, mechanical and wind forces. The skid shall be of welded steel construction and shall have lifting lugs. The skid shall accommodate anchoring to a concrete foundation using grout and an epoxy filled, drilled anchor bolt system.

f. The skid assembly shall have a vibration switch installed to shut down compressor operation in the event of excessive vibration.

g. The skid assembly shall be designed to shed water away from the structure.

h. Exterior surface shall be weatherproof and coated with the manufacturer's recommended coating system.

7. System

a. Interstage coolers, piping, separators and appurtenances must be designed for a minimum of 20% or 30 psi (whichever is greater) above the interstage discharge pressure at maximum suction pressure and 4,500 psig discharge pressure.

b. Final discharge cooler, piping, filter housings (filter housings have an MAWP of 5,000 psig) and appurtenances must be designed for a maximum of 5,500 psig and equipped with an ASME “UV” stamped safety relief valve set and sealed at 5,500 psig valve set and sealed at the interstage design pressure.

d. First stage suction and discharge and each subsequent stage suction and discharge is to be equipped with a locally mounted pressure gauge and transducer with a remote LCD pressure readout.

e. First stage suction and discharge and each subsequent stage suction and discharge is to be equipped with a locally mounted temperature thermocouple with a remote LCD temperature readout.

f. All guards including fan and belt guards are to be included and are to be of a spark-proof construction.

g. Gas vented during the compressor unloading cycle shall be captured in the gas recovery vessel and cycled back to the compressor suction on the next start-up.

h. A local PLC based control system and instrumentation panel shall be furnished for the compressor.

i. All controls and instrumentation shall comply with the NEC code requirements for class I, Division 2, Group D, and weatherproof or classified intrinsically safe and weatherproof.

j. All pressure and temperature gauges shall be stainless steel. No sensing element containing brass or copper shall be permitted. Pressure gauges shall be oil filled and have rear blowout protection.

k. Each compressor shall have, as a minimum, the following control devices and indicators. Contractor shall furnish and install additional instrumentation as recommended by the compressor manufacturer/packager.

1. High/Low suction gas pressure shutdown
2. Interstage high discharge pressure shutdown
3. Final discharge pressure; high shutdown
4. Low crankcase oil pressure shutdown
5. Low crankcase oil level shutdown
6. Low cylinder lubricator oil level shutdown
7. High last stage discharge temperature
8. Emergency shutdown (ESD) as per NFPA 52
9. Excessive vibration shutdown switch
10. Hour meter
11. Key lock-out
12. Compressor automatic start cycle failure
13. Manual shutdown
14. Lights to indicate main power is energized, compressor running or standby
15. Common alarm contact for remote annunciation
16. High/low oil temperature
17. High pressure in blowdown recovery tank
18. Excessive motor starts

l. In addition, a common termination point must be provided for the connection of remote shutdown switches, 120 VAC remote annunciation of shutdown alarm, and other field wiring connections.
m. The Contractor shall provide and install an emergency shutdown switch near the compressor as shown on the plans. The ESD switch will shut down the compressor and shut off flow to the dispensers.

2.3 STORAGE SYSTEM

A. Design and Performance Criteria: The storage system shall consist of three (3) spherical vessels, 12,000 scf minimum capacity each at 5,000 psig, in a cascade configuration with the compressor and associated piping and controls to enable the storage to supply the dispensers full time while the compressor supplies either the dispensers or the storage vessels. The system will allow the storage vessels to provide high flow rates to the vehicles when the vessels are fully charged. The overall system shall be designed to prevent short cycling of the compressors, limited to maximum six (6) starts per hour. The storage system vessels shall be placed as shown on plans and configured in three (3) pressure banks to operate as a cascaded system with the compressors.

B. Characteristics

1. ASME UPV Code, Section VIII, Division I, Appendix 22, Safety Factor 3:1 for dry gas, non-corrosive service.

2. Performance: The pressure vessels shall be designed for a maximum allowable working pressure (MAWP) of no less than 5,500 psi over the entire metal temperature range of -20°F to +200°F.

3. Physical Characteristics: Vessels are spheres mounted as shown on the plans to minimize rust and maintenance. Frames shall be oriented and connected to a concrete foundation as shown on drawings.

4. Each vessel in the assembly will be furnished with a 1" full port stainless steel ball valve on the front (to the vessel port that requires no reduction below 1-inch), a spring loaded safety relief valve with a full port lockable minimum ¾" stainless steel ball valve (to the vessel port that requires no reduction below ¾-inch), a Code 62 face seal block, needle valve (for bleed) and a pressure gauge between the vessel and pressure safety valve (Anderson Greenwood or equal). All pressure safety valves (PSV) and discharge pipe assemblies are to be braced to meet manufacturer’s recommendations and all code requirements. All valves, fittings, gauges and appurtenant facilities shall be pressure rated to conform to code requirements.

5. Each vessel shall be capable of storing at least 12,000 scf @ 5,000 psig. The minimum water volume of each vessel shall be 250 gallons.

6. Protective Coating: Vessel exteriors shall be blast cleaned in accordance with SSPC-SP 10. Near White Metal Blast and primed within 24 hours of blasting. The primer shall be epoxy based. Primer thickness for the vessel exteriors (and frames if applicable) shall be a minimum of 2.5 mils. The topcoat shall be a
high build of white urethane paint with a minimum dry film thickness of 5 mils as measured with a suitable electronic paint thickness gauge.

7. Drain Valves: Each vessel shall include an outlet (minimum ½” NPT, maximum ¾” NPT) located at the low point of the vessel that may be used to remove effluents (compressor oil, moisture, etc.) that may be collected inside the vessel. The drain port shall be equipped with a stainless steel ball valve installed in the vessel drain port and a needle valve installed in close proximity to the end of the drain line. The drain valve shall be mounted for ease of maintenance access and as shown diagrammatically on the plans. Piping or valve connections shall be suitable to drain into a containment vessel. The drain valve and associated piping shall be braced and plugged with suitable hardware that shall withstand operating pressures and local Building Code forces for seismic and wind forces.

8. Environmental Conditions: The pressure vessels and frame assembly shall be fabricated to be used for outdoor service.

9. The ball and needle valves shall have a minimum safety factor design of 4:1 or greater to conform to all applicable codes based on the vessel design pressure in accordance with NFPA 52.

10. The PSVs shall be adequately sized to protect the vessel against a fire condition in accordance with the American Petroleum Institute (API) RP 520 and shall be set to operate (open) at a pressure not to exceed the vessel stamped design pressure. Supplier shall submit manufacturer’s PSV sizing calculations. The PSV shall be mounted in a vertical position and adequately braced to withstand the reactive forces imposed on the PSV body and connection piping during a blow-down condition. The discharge port of the PSV shall be pipe vertical to a minimum height shown on plans with a vertical (upward) discharge. The vent pipe OD shall be as shown on plans and shall be adequately braced. Wherever possible, all fittings used to connect shut-off valves, PSVs etc., to the vessel shall be of SS construction and shall have, as a minimum, a pressure rating (including safety factor) equal to the vessel design pressure. All fittings used to connect the PSV shall be face seal zero clearance fittings to facilitate easy removal of the valves for service. The PSV shall be equipped with a lockable ball valve to facilitate removal without depressurizing the vessel.

11. After all leak testing is completed the vessel shall be depressurized to a pressure of 10 to 20 psig and sealed for shipment. The retained, dry test medium shall insure that a positive pressure is maintained to prevent ingress of dirt and corrosion of internal surfaces during storage and shipment prior to use.

C. Design and Construction

1. Materials: A request by the supplier for material substitution shall be accompanied by complete information including corrected thickness and shall state the complete ASME (or ASTM) designation including any applicable grade, type, quality or finish such as “ASME SA-515-GR55.” In cases where the material has no standard designation, complete description of chemical and mechanical properties shall be submitted and it shall be the responsibility of the fabricator to obtain ASME code approval.

The fabricator shall state in his request whether or not ASME code...
2. Marking and Stamping: The vessel shall be stamped on the thickest portion of the head. The stamping shall include the following:

   a. ASME “U” Stamp
   b. National Board Number
   c. All requirements of the ASME UPV Code Section VIII, Div. 1, UG-115 through UG-119 and Appendix 22.
   d. The head and shell thickness
   e. The words “For CNG”
   f. The volumetric capacity in standard cubic feet natural gas when filled to the MAWP

3. Each pressure vessel shall have a unique serial number stamped on the vessel for the purpose of identification, material traceability and test records. Each pressure vessel shall be stencil marked “CNG Only” with at least one inch high black letters on each side of the vessel. Each side of the vessel shall be stencil marked “FLAMMABLE” in at least four inch high red letters.

4. Each vessel shall be constructed at ground level to allow for a second vessel to be mounted above the ground level vessel.

D. Workmanship

1. The supplier shall furnish for approval, a list of all subcontractors or suppliers who fabricate, weld or stress relieve all or any part of the vessel or skid assembly.

2. Vessel Forging: The pressure vessels shall be fabricated in accordance with ASME BPV Code Section VIII, Division 1, Appendix 22. The inside and outside surfaces shall be free of arc burns and deleterious gouges, grooves, scratches and dents. The repair of any such defect shall be subject to the acceptance of Purchaser and at the fabricator’s expense. In such cases, the proposed procedure shall be submitted to the Engineer for written acceptance prior to being used.

3. Skid Welding: Any skid assembly shall be welded in accordance with AWS D1.1.

E. Documentation

1. Fabrication tolerances shall be shown on a drawing submitted for review and approval to Purchaser. Where nondestructive testing is required, appropriate symbols as specified in AWS A2.2 shall be shown on fabrication drawings at the part or area concerned.

The contractor shall supply the following documentation for the assemblies ordered by the Purchaser purchase order:
a. Preliminary/final certified pressure vessel fabrication drawing  
b. Preliminary/final certified rack assembly drawing (if applicable)  
c. Preliminary/final certified bill of materials  
d. Vessel delivery schedule

2.4 DISPENSING SYSTEMS

A. Design and Performance Criteria

1. Fast-Fill Dispenser

a. One (1) dispenser shall be provided for the CNG fueling station; the dispenser shall be a two (2) hose unit similar in appearance to gasoline dispensers.  
b. The dispenser shall be controlled by the fuel management system (card reader). The fuel management control system authorizes the dispensers to dispense natural gas from the hoses. As gas is dispensed, the gas quantity is measured by a mass flow meter, converted to equivalent gallons of gasoline, and displayed by the dispenser head. The fast-fill dispensers shall be listed for retail sale of CNG in Alabama by the Alabama Weights and Measures Office.  
c. The fast-fill dispenser shall have two (2) hose assemblies, with both assemblies having a 3,600 psig Type 1, NGV-1 nozzle. An in-line, break-away valve shall be installed on each hose assembly in the event of a vehicle pull-away.  
d. The dispenser shall be designed and qualified for 5,000 psig even though the requirement for temperature compensation is 4,500 psig for a delivery pressure of 3,600 psig at 70 F. Dispensers shall meet Class I, Division I NEC Code.  
e. The display head shall have electronic digital display showing Gasoline Gallon Equivalent (GGE), dollars per unit and total sale.  
f. The dispenser shall include battery backup totalizer and be compatible with the Owner’s existing fuel management system.  
g. Each of the two (2) dispenser hoses shall be capable of dispensing a maximum of 1,200 scf of natural gas per minute per hose of 3,600 psi at 70 Degrees F. The fast-fill dispenser shall have one CNG 50 meter for each hose.  
h. The dispenser will display and record fuel delivery in equivalent gallons of gasoline. The dispenser shall track a running total of fuel dispensed and display this information by means of a totalizer remote readout. All hardware and software needed to obtain totalizer information shall also be supplied by the contractor.  
i. The dispenser shall be equipped internally with liquid filled gauge or LCD readout showing fill pressure. Dispenser shall be equipped with emergency shut off valves and hose retractors. Hose retractors shall
detach when fully extended, but not within the normal length of hose extension.

j. An LCD display head shall display the equivalent gallons dispensed, cost per gallon, and total sale amount. The display shall be readable from the front and rear of the dispenser. The front display will be for one hose, the rear display will be for the other hose. Indication of the percent of fuel delivered to the vehicle shall be mounted in the dispenser, visible from the front and rear. The readout shall be liquid crystal. The display shall re-set after each use.

k. The dispenser shall comply with the Americans with Disabilities Act (ADA), National Conference of Weights and Measures (NCWM), and with applicable codes and standards.

l. The nozzle vent line shall vent gas directly to atmosphere through a 1-inch 316 stainless steel 0.134 wall tube through the roof of the canopy. The vent line shall extend to 3-feet above the top extent of the canopy and be topped with a vent cap. (See plans)

m. Tilt/vibration Switch: A means shall be provided to ensure that minimal gas is released from the dispenser or its CNG supply lines should the dispenser be accidentally knocked off its mounting. This shall be accomplished using a tilt/vibration switch. Should the dispenser be knocked over (more than 5 degrees out of plumb) the tilt/vibration switch will activate the ESD system, thereby shutting down the flow of gas to the dispenser.

n. The flow of gas to the vehicle shall continue until the dispenser electronic control system signals a complete fill or is manually stopped. The shut-off fill pressure shall be electronically ambient and heat of compression temperature-compensated at a fixed reference temperature of 70 unrestricted CNG flow until the shutoff pressure is approached. CNG flow shall be throttled as the shut-off pressure is approached.

o. The dispenser enclosure shall be self-supporting and weatherproof. The appearance shall be that of a public-access gasoline station dispenser. The enclosure shall include meter, display and appropriate valving and controls. Instructions for dispenser operations shall be located on the face of the dispenser.

p. One inline coalescing gas filter shall be connected to each dispenser inlet line (3 per dispenser) and shall capture aerosol and solid particles greater than 0.6 microns and 0.2 microns. Each filter shall have a design pressure not less than 5,000 psig. Filter element replacement shall be performed without removing the connection piping or tubing. Filters shall be Parker Finite J4 or approved equal with Parker or equivalent drain kits (ball valve and needle valve combination). Filters shall be installed with ¾" compression fittings.

q. Air purge: Units that require air purge will not be allowed.

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q. Air purge: Units that require air purge will not be allowed.

2. Controls

Sequencing/Priority-fill operations as follows:

a. Sequencing of fuel flow-through fast-fill dispensers shall be drawn from low bank, mid bank and high bank, respectively. In the event that high bank storage pressure is inadequate to complete a fill, the compressor output shall be routed directly to the dispenser.

b. Each fast-fill hose shall be independently sequenced so as to optimize filling of two vehicles of differing on-board vehicle fuel storage pressures. Sequencing valves shall be electronically operated.

c. Fill pressure shall be electronically temperature compensated to achieve a settled tank pressure of 3,600 psi at 70 degrees F, except that fill pressure shall not exceed 4,500 psi at any time.
d. Compressor priority panel – separate from compressor package.

e. Compressor start/stop pressure signal shall be sensed from the high bank pressure, but user switchable to low or mid bank input.

f. Compressor start/stop pressures shall be independently user adjustable between 500 to 4,500 psi.

3. System

a. The Dispensing System shall be complete with all equipment piped and wired for automatic and unattended operation. All accessories necessary for testing and routine maintenance must be included.

b. Tubing shall be stainless steel and designed for 5,500 psig maximum allowable working pressure (MAWP) between the priority valve panel and fast fill dispensers, and between the compressor and storage vessels as shown on the plans.

c. The dispenser system shall be equipped with an electronically temperature compensated system which will shut off gas flow to the vehicle when the compensated pressure in the vehicle’s on-board fuel system reaches 3,600 psig at 70ºF.

d. Flow from each fast-fill hose shall be metered independently using a meter with an accuracy of + or - 0.5% by mass only.

2.5 STATION CONTROL SYSTEM

A. A programmable logic controller (PLC) shall be provided to control the entire station operation, including but not limited to: dryer, compressor, dispensers, priority and sequential valves, high pressure storage, electronic ambient and heat of compression temperature compensators, time clock and emergency shutdown system. An operator interface display shall be provided to indicate the cause and condition of each shutdown and to annunciate the status of shutdowns. All set points shall be modifiable at a local input-output display panel. Provide 20% spare input and output points. The PLC shall be capable of servicing the station as designed and to accommodate expansion to three compressors and four 2-hose fast-fill dispensers. Priority Control Logic is as follows:

a. Priority Valve Panel – The station shall be equipped with a one-inch priority valve panel. The panel shall be enclosed with a free-standing weatherproof cabinet with access doors where shown on the plans and shall conform to all provisions of the Fire Code and NFPA 52.

b. Priority operation description:

Compressor priority panel will regulate the flow of compressed fuel in accordance with the following priority:

Priority 1 - fast-fill dispenser;
Priority 2 - high bank storage;
Priority 3 - mid bank storage;
Priority 4 - low bank storage; and

c. Fill Scenario. When a call for fast-fill is activated through the fuel management system (card reader), the cascade storage shall be accessed first (sequencing through low, mid and high bank storage). If available high bank storage cannot complete the fill, then the station control system shall start the compressor and direct compressor discharge gas to the dispenser. The compressor shall continue to run to meet any additional fast-filling demands in coordination with the cascade storage system. If there are none, the compressor shall replenish storage. In addition, if storage pressures have dropped below the adjustable set pressure after meeting direct vehicle filling demands, then the station control system shall start the compressor and the priority control system shall direct the compressor to replenish storage.

With both new compressors installed, the station controls will operate compressors in lead-lag and alternating start configuration to satisfy all fast-fill and storage replenishment requirements.

B. Instrumentation

a. Design and Performance Criteria

General: All instrument components interfacing with natural gas shall be made of material compatible with specified odorized natural gas. Specifically the material shall be 316 stainless steel; no copper metal or alloys containing more than 70% copper shall be used in natural gas service.

1) Pressure Gauges: All pressure gauges shall conform to the following requirements.

   a) Accuracy, including hysteresis, shall be plus or minus 0.5% of full scale or better.

   b) Rear blowout protection shall be provided.

   c) All gauges shall be waterproof and oil filled.

   d) The dial shall have a minimum diameter of 2 ½ inches.

   e) Gauges shall be able to read a minimum of 30% above MAWP.

2) Temperature Gauges: All temperature gauges shall conform to the following requirements:

   a) Accuracy shall be within plus or minus 1% of the full scale or better.

   b) The dial shall have a minimum diameter of 2 ½ inches.

   c) Gauges shall be able to read a minimum of 50% above maximum working temperature.

C. System Controllers
a. System control shall feature:

1) Compressor Annunciation
2) Suction, Interstage and Discharge Pressures (psig)
3) Suction and Interstage Temperatures (Degrees, Fahrenheit)
4) Compressor Status
5) Date and Time

b. Compressor Shutdowns

1) Low crankcase oil pressure switch gauge
2) Low suction pressure
3) High suction pressure
4) High interstage and discharge temperature set at or below 350°F
5) High crankcase pressure
6) Low cylinder lubrication
7) Emergency shutdown buttons (ESD)
   a) Kill switch (keyed) inside compressor enclosure
   b) Reset momentary contact switch on panel at compressor enclosure
   c) Transducer or thermocouple failure
8) Dryer Annunciation
   a) Moisture monitor power on
   b) Schedule regeneration
   c) Immediate regeneration
9) Dispenser Annunciation
   a) Storage bank pressure (psig)
   b) Ambient temperature (Fahrenheit)
   c) Starting fill pressure
   d) Running fill pressure (psig) and flow rate (GGE/min)
   e) Ending fill pressure (psig) and flow rate
   f) Amount dispensed (GGE)
10) Dispenser Shutdowns

a) Excess flow rate
b) Excess fill amount
c) Transducer failure
d) Thermocouple failure
e) Emergency shutdown

Note:

a) All inputs to be wired fail-safe (circuit to open on fault condition).
b) A minimum of three (3) additional fault shutdowns (per compressor) with annunciation are to be supplied and wired to the terminal strip in the Motor Control Center (MCC) for future use.
c) Controls are to be organized in a "first out" sequence. LCD readout to be provided for each compressor indicating type and cause of each shutdown.

D. Alarms

Provide a red flashing beacon on top of the MSP. Provide, acknowledge, and reset buttons for the beacon.

E. Combination Motor Starters

a. Provide 3-phase, 480-volt, full-voltage, non-reversing motor starters (Class 8998) with horsepower ratings as shown on the drawings. Provide melting alloy overload relays. The internal wiring shall meet the control circuit interlocks and functionality described within this specification.

b. Provide 3-phase, 480-volt, solid-state, reduced-voltage starters with integral bypass contactor. Provide current ratings as shown on the drawings. Interlock solid state starters with an auxiliary contact from the automatic transfer switch to shut down the motor prior to transfer and restart the motor after transfer.

c. Circuit breakers for combination motor starters shall be adjustable magnetic-only motor circuit protectors.

d. Fault current rating of the combination starters shall be equal to or greater than the ratings shown on the drawings.

I. Auxiliary Power and Controls
2.6 VALVING

A. Design and Performance Criteria (also see Section 400525)

1. Suction valves shall be carbon steel body with stainless steel trim. All other valves shall be made of stainless steel.

2. Pressure Safety Valves (PSV) or otherwise called Pressure Relief Valves (PRV) shall have Viton seals.

3. Welded ball valves shall be three-piece designs.

4. Compressor suction line shall have a spring return actuated three-piece fire rated ball valve (API 607).

5. All level operated valves must be equipped with locking kits capable of securing the valve in either an open or closed position.

6. Needle valves shall be stainless steel.

7. Bleed valves shall be stainless steel.

2.7 PIPING TUBING

A. Design and Performance Criteria (also see Section 154809)

1. Compressed natural gas Piping and Appurtenances – See applicable specification in Division 40.Gas Piping
   a. Gas piping design, fabrication, inspection, and testing shall be in accordance with ANSI B31.3.
   b. Cast iron piping shall not be used in this contract.
   c. Threaded piping connections may be used on 1 ½ inch nominal pipe size and smaller for piping systems with a maximum operating pressure no greater than 150 psig. Otherwise, such piping shall be socket or butt welded.
   d. Size of the natural gas line from the Alagasco meter to the compressor shall be as shown on the plans.

2. Tubing - See applicable specification 15 48 09

2.8 EMERGENCY SHUT DOWN (ESD) SYSTEM

A. The new station ESDs shall be installed such that if an ESD is activated, the entire station will be shut down. It will take someone to physically reset the ESD for any flow of fuel to dispensers to restart.
B. The ESD system shall operate on 120 VAC and shall be designed to be activated by one of the ESD push buttons.

C. Push-buttons shall be red momentary contact mushroom buttons and shall be protected with a hinged cover to prevent accidental activation.

D. ESD Push buttons are to be provided where shown on the plans.

E. Provide one (1) keyed reset momentary contact switch on the MSP.

F. When the ESD system is activated, the system shall perform as follows:

1. All power is removed from any motor contactors and the companion shut-down driver appurtenant to all fuel CNG dispensers.

2. The power is removed from all solenoid valves, and hence the following valves close automatically:
   a) Compressor suction valve
   b) Compressor discharge valve
   c) Dispenser line valve
   d) Discharge valve at each storage vessel in the priority valve panel.

3. Compressor blow-down valve (unloader) opens automatically.

4. The system status panel shall indicate that an ESD button was pressed. The cause(s) of activation has to be resolved before the system can be reset.

G. A flashing beacon warning device mounted on the MSP will be activated when an ESD button is pushed or the compressor faults out due to malfunction.

H. The device will be turned off when a keyed momentary contact switch is activated.

I. Provide adequate labeling of the Emergency Shut Down system so that system operating personnel can readily identify the ESD components.

J. The ESD system shall not allow the station to resume operation without a manual reset and the cause(s) of activation returned to normal.

K. The ESD system shall also have a provision for the operator to reset the system after isolating the problem identified by the ESD, so that the station can resume safely operating while the problem identified is being addressed.

2.9 COMPRESSOR SKID

Compressor Skids shall each be a one (1) piece welded steel bolt-down frame. Skids shall be equipped with lifting lugs. Skids shall be installed level and on a minimum of 1” of non-shrink dry pack, mortar or epoxy grout and anchored to a concrete pad foundation. The Contractor shall submit drawings, calculations of skid including foundation for approval.

2.10 FUEL MANAGEMENT SYSTEM
A. The fuel management system for fueling of gas and diesel will be independent of the CNG fueling fuel management system. For the CNG facilities, the new fast-fill CNG dispensers shall be electronically controlled / monitored with the new fuel management system as herein specified.

B. Card Access Device Design and Performance Criteria:

1. General: The card access device shall be compatible with the Owner's accounting system provider. Card access device shall be compliant with the California Division of Measurement Standards (CDMS).

2. Modem Access: Installation of card access device shall include modem access capability for the purpose of downloading transaction and usage deformation by remote computer. The card access device shall be hard wired to the District's data panel and said work shall require direct coordination with the District IT Department.

3. Telephone service: Provide a dedicated telephone line and service for the modem at the card access device. This service shall be distinct from the telephone service for the modem at the control panel.

4. Installation: Final termination, hook-ups of terminal wiring and initialization of the terminal shall be performed by Vendor personnel. Installation of host-computer (provided by Owner), software and related user training shall be performed by Vendor personnel.

2.11 ALARM/CONTROL FEATURE

A. Each compressor system skid will be equipped with a PLC controller that monitors several alarm conditions. At a minimum, these conditions will include:

1. high inlet pressure
2. low inlet pressure
3. ESD shutdown
4. high final stage discharge temperature
5. low oil level (crank case and cylinder)
6. drive motor failure to start
7. power failure
8. dryer requiring regeneration
9. compressor safety fault
10. dryer malfunction
11. high/low oil temperature
12. high compressor vibration
13. high pressure in blowdown recovery tank
14. excessive motor starts
15. other conditions as appropriate

B. The alarm/control feature will be a combination web based/telephone based unit equipped with an auto dialer with the following capabilities:

1. Call out to a given phone number or list of numbers when there is an alarm condition.
2. The ability for someone to access the modem and determine the cause of shutdown.
3. The ability for someone to restart the station remotely, provided the shutdown was not for emergency reasons, such as an ESD shutdown or a compressor safety fault.
4. The ability for someone to access and query system functions

The alarm/control feature will also include a flashing beacon that will be activated during alarm conditions set by the Owner.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Contractor shall install compressor skids, dispensers, valve panels, and other equipment as shown on the plans and as approved by the Owner. Contractor is responsible for adjusting slab thickness or reinforcement modifications as required. Slab thickness and reinforcing as shown on the plans are minimum requirements.

3.2 TESTING

A. Shop Tests

1. All testing at the manufacturer/packager assembly facility shall be coordinated with the Engineer a minimum of seven (7) days prior to intended test date. Tests shall include, as a minimum, the items listed below. Copies of all test reports and other documentation indicated below shall be forwarded to the Engineer a minimum of two (2) business days prior to shipment of the unit, (original and five (5) copies of each report).

2. The Owner reserves the right to inspect the Contractor’s/ manufacturer’s/ packager’s facility at any time during this contract without prior notice.

3. Pressure Testing – General

a. All gas piping shall be pressure tested pneumatically. Shop reports must be signed by the Contractor’s test engineer or his/her designate and must include, as a minimum:

1) Spool Number
2) Spool Description
3) Safety Relief Valve (SRV) setting
4) Test Pressure
5) Test Duration
6) Test Date
7) Signature of testing Technician

b. Prior to performing tests, all SRV's and filter cartridges shall be removed from the system. Subsequent to the pressure tests, the SRV's and filter cartridges shall be reinstalled.

4. Pneumatic Testing: Pneumatic testing shall be done at 1.1 times the SRV setting for thirty (30) minutes minimum. Pneumatic tests should be performed with inert gas. Pipes should be removed or isolated to prevent test gas from entering the compressor or other piping spools. Pre-testing to approximately 60 psig is recommended, to locate major deficiencies. Subsequent pressure increases should be made gradually to prevent “shocking” of the pipe system. At the end of the half hour test an inspection of all connections (welded, threaded, compression and flanged) with Swagelok, Snoop (or approved equivalent) leak detector, shall be performed.

5. Functional Test: The manufacturer/packager shall perform the following functional tests. Tests shall be performed on natural gas.

a. Controls operation including compressor startup, normal safety shutdowns and system annunciation.

b. Compressor operation parameters (temperatures, pressures and vibration levels).

c. Operation of all subsystems including priority-fill, sequencing, emergency shut-down and remote alarms.

d. As per item b) with prolonged continuous operations of one (1) hour or more. This operation to be repeated until a minimum two (2) hours of full load operation has elapsed.

B. Field Test

1. Contractor shall submit from the manufacturer/packager the method of startup and testing to the Engineer for approval.

2. After the installation is complete, the Contractor shall thoroughly clean all tubing to manufacturer's/packager's requirements by blowing out with 4,000 psi of Nitrogen gas at required durations. The Contractor shall then repeat all leak and functional tests in the field. These tests shall comply with code requirements to the complete satisfaction of the Fire Marshall Representative and the Owner. The Contractor shall give the Engineer at least three (3) business days advance notice so that the Engineer may coordinate with the Fire Department Representative for witnessing the tests.
3. The Contractor shall provide all materials, equipment, instrumentation and labor for the tests. The Contractor must secure permission from the District to use natural gas and electricity available at the site for the tests.

4. The field test procedure shall include a demonstration of compressor capacity. It is suggested that this test be conducted by timing the natural gas throughout at the fueling station gas meter during measured time intervals.

5. Prior to introducing utility supplied natural gas into the new equipment, contractor is to purge new service and assure installation of startup screen and all filters to prevent grit, construction debris and other contaminants from entering into the fueling system.

6. Safety precautions shall be exercised at all times. Pressure shall be introduced slowly in increments not to exceed 500 psig at 15 minute intervals without written authorization by the Engineer. At each interval all connections shall be checked for leaks.

7. After all connections are proved sealed, record pressure (design plus 20%) and allow setting for one hour. This is the standing pressure test. After one hour compare test pressure to recorded pressure. If pressures are the same, bleed off gas in a controlled and safe manner. If the test pressure is lower than the recorded pressure, find and repair the leak and repeat standing pressure test.

8. Startup testing shall be witnessed by the Owner’s design engineering consultant one time at no cost to the contractor. If additional startup visits are required due to reasons within the Contractor’s control, Contractor shall pay the hourly rate and expenses of the engineering consultant for all subsequent startup site visits. Contractor is therefore advised to perform a trial startup in advance of the actual startup.

3.3 PAINTING

A. The CNG equipment and appurtenant facilities shall be painted according to the following requirements:

1. All surfaces except factory painted with finished coats shall be cleaned of oil, dirt, and corrosion with a cleaning solution approved by the paint manufacturer. A prime coat of oxide primer shall be applied the same day as the cleaning process. A minimum of two (2) coats of industrial alkyd enamel paint shall be applied over the primer, in accordance with the paint manufacturer's specifications.

2. Subsequent to the paint fully hardening, all lamacoid labels shall be mounted.

3. Colors shall be as follows (skid components only):
   a. Suction Gas Piping: Silver (heat resistant)
   b. Gas Vent Piping: Bright Yellow Gas/Heat
   c. Detector Conduit: Red
B. Marking

1. Contractor shall mark each exterior stainless steel tube immediately outside each compressor, valve panel, access pit (fast fill dispensers) and where tubing connects to storage vessels in accordance with the following schedule:
   a. HIGH BANK
   b. MID BANK
   c. LOW BANK
   d. (DISPENSER) VENT
   e. (DISPENSER) HIGH BANK
   f. (DISPENSER) MID BANK
   g. (DISPENSER) LOW BANK
   h. Storage Vessel Marking: Contractor shall mark the top of each vessel where fill tubes are connected, using 1” high black stenciled letters “HIGH”, “MID”, “LOW” to coordinate accurately with each storage bank and tubing configuration.

3.4 TRAINING

A. General: At least 15 calendar days prior to station commissioning, the Contractor shall provide a minimum of sixteen (16) hours of on-site classroom and field training to Owner personnel covering the operation and maintenance of the station components.

B. Instruction: The instruction shall be presented by manufacturer’s representative of the CNG equipment and shall be certified by the manufacturer to provide such instruction. Prior to providing instruction, the Contractor shall submit résumé’s of the instructor(s) for review and approval by the Engineer.

C. Course Materials: Prior to providing instruction, Contractor shall submit the following for review and approval by the Engineer:
   1. Program of instruction of classroom and field training
   2. Training course content (hard copy printout)
   3. Course handouts
   4. Diagrammatic layout of equipment installed
   5. Equipment user’s manual
   6. Operations and maintenance manuals shall be provided for all equipment.

D. Course Content: The training shall cover operator-level instruction on the following areas for this particular station.
E. Classroom Training

1. Introduction to Compressed Natural Gas.

2. Health and safety issues related to natural gas and precautions to be taken around installed equipment.

3. Overview of the recommended operations and maintenance requirements.

4. Major Components of the CNG Station
   a. Described individually and how they integrate into the station
   b. Identified physically in the field
   c. Operator’s checks and services

5. System Components to Include the Following:
   a. Power and control panel
   b. Gas dryer
   c. Compressor and accessories
   d. Electric motor
   e. Priority/time-fill control systems
   f. Card reader
   g. Dispensers (including sequencing operation)
   h. Storage vessels and appurtenances

6. Maintenance Activities
   a. Types of maintenance (daily, weekly, monthly, and hourly for compressor)
   b. Monitoring system operations
   c. Managing maintenance activities
   d. Routine inspections (provide handouts)
   e. Maintenance records (provide handouts)

7. Safety Procedures and Guidelines

8. NGV Facility Safety

9. Business Plan Modification
10. Alarm Procedures
   a. Conditions
   b. Features provided
   c. Actions to be taken

11. Fueling Operations
   a. Routine
   b. Emergency

12. Monitoring and Control of System Functions
   a. Locally
   b. Remotely by modem and by telephone

13. Parts and Outside Service
   a. Show how to use previously provided parts list and how to order parts
   b. Make recommendations regarding spare parts that should be kept in stock
   c. Identify local supplier of parts; name, address, phone and fax
   d. Identify local service representative; name, address, phone and fax.

14. Log Book
   a. Provide a log book with all appropriate charts and instructions to facilitate all necessary maintenance activities on CNG station components.
   b. Field Training
      1. Training procedures shall have been favorably reviewed and approved by the Owner prior to starting field training.
      2. Field training shall be administered on-site using the delivered system in real time situations. Field training shall not start until the Operation Testing has been completed and approved by the Owner and the corresponding Operation and Maintenance Manuals have been submitted and approved.
      3. The “Training Plan” shall be conducted by a qualified supplier person(s), who has conducted similar training for the type of system supplied.
      4. Acceptable Operation and Maintenance Manuals shall be on-site and available when training sessions are implemented.
      5. Field training shall be held after any necessary classroom training for the equipment has been completed.

END OF SECTION 15 45 09
PART 1 - GENERAL

1.1 This section of the specifications, together with any special conditions and the construction drawings, cover the work of fabricating, installing, and testing the piping systems required for this project. The contractor shall be responsible for understanding the intent of the construction drawings and providing a complete working system. Any omissions or discrepancies among the drawings, specifications, and other contract provisions shall be brought to the attention of the engineer for clarification prior to bidding.

A. Piping systems covered by these specifications include all underground and aboveground piping, including vents and all stainless steel pressure tubing.

B. Construction and installation shall conform to the following codes and standards as adopted or amended by the authorities having jurisdiction.

   ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)
   B31.3 - PROCESS PIPING
   B16.5 - STEEL PIPE FITTING AND FLANGES
   ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)
   NFPA (NATIONAL FIRE PROTECTION ASSOCIATION) 52 – VEHICULAR GASEOUS FUEL SYSTEMS CODE

C. The contractor shall inspect the site for, and verify the locations of any existing substructures and underground utilities, and shall not rely on these plans or drawings alone. The contractor shall take all measures necessary to protect existing underground utilities and substructures. The contractor shall be responsible for any damage during construction, irrespective of whether or not the damaged utility was shown on the drawings.

D. The contractor shall notify the project manager of any damage to any existing underground wet or dry utilities, or to any conduits damaged during trenching, and shall repair them immediately according to the standards of the agency having jurisdiction over them.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

PART 2 - MATERIALS

2.1 GENERAL

A. Stainless steel pressure tubing shall be seamless, bright-annealed, type 316 material tube, manufactured and tested according to ASTM A269. Tubes shall be cold-finished, free of scratches, and clearly marked with name, production heat, tube size and working pressure. In addition, underground stainless steel tubing will be produced with minimum 2.5% molybdenum for improved corrosion resistance. Straight length tubing shall be individually capped for cleanliness. Upon request, the tube supplier shall furnish EN10204 3.1 certificates documenting compliance with this specification.

B. Dimensions: Tubing shall be furnished with minimum wall thickness no less than required to operate with a maximum allowable working pressure (MAWP) of 5,500 psig between the priority panel and storage vessels and 5,000 psig (MAWP) between the priority panel and fast fill
dispenser, time fill dispenser or compressor. See drawings for locations of tubing:

<table>
<thead>
<tr>
<th>TUBE WALL THICKNESS (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside Diameter</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>1/2</td>
</tr>
<tr>
<td>1/2</td>
</tr>
<tr>
<td>3/4</td>
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<tr>
<td>3/4</td>
</tr>
<tr>
<td>3/4</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

C. Tubing manufacturer shall be ISO 9001-certified and have over 30 years of experience manufacturing tubing. Supplier shall also be compliant with other industry standards, including, but not limited to, Pressure Equipment Directive (PED). Tubing manufacturer shall be PED-certified in accordance with the requirements outlined in Pressure Equipment Directive 97/23/EC and the Pressure Equipment Regulations 1999, UK Statutory Instrument 1999 No. 2001 and 2002 No. 1267.

D. Tube fittings shall be type 316 stainless steel with a MAWP of not less than 5,500 psig. Each fitting used on the job will be certified to 5,500 psig per ASME B31.3 code calculations by the manufacturer. The actual calculations and formulæ may be requested. The products shall be supported with manufacturing, engineering and parts storage in North America. All swaged fittings furnished by the contractor shall be products of a single manufacturer. Zero clearance fittings or pipe – U-Bends must be used where actuated ball valves, safety relief valves, check valves and like, need to be removed for servicing. Zero clearance fittings must be verified to meet design pressure of system. Where compression-style fittings will not meet pressure requirements of the installation, socket-welded fittings shall be used.

E. Ball valves: high flow, 316 stainless steel body and trim, with packing and seals suitable for compressed natural gas service approved to NGV 4.6 current edition. 5,500 psig rating per ASME B31.3. Code calculations by the manufacturer. Ball valves should have integral tube fitting ends to connect directly to tubing.

F. Needle valves: 316 stainless steel body and trim, with packing and seals suitable for compressed natural gas service approved to NGV 4.6 current edition. 5,500 psig rating per ASME B 31.3. Code calculations by the manufacturer. Needle valves should have integral tube fitting ends to connect directly to tubing.

G. Check valves: 316 stainless steel body and trim, high flow, 1 psi cracking pressure with packing seals suitable for compressed natural gas service. 5,500 psig rating per ASME B 31.3. Code calculations by the manufacturer. Check valves should have integral tube fitting ends to connect directly to tubing.

H. Sleeve (for underground tubing) shall be HDPE pipe, sized as shown on the drawings.

PART 3 – EXECUTION

3.1 TEST

A. Tubing shall be hydrostatically or pneumatically tested to one hundred ten percent (110%) of the
3.2 PREPARATION FOR DELIVERY

A. All valves, pre-fabricated piping, flanges, etc. Shall be protected during storage, transit, and erection with plywood covers 1/2” thick and secured with bolts for closure, or equal. Shop fabricated sections shall not be left with open ends exposed to atmosphere during storage, transit, or erection. Suitable caps shall be provided on all mechanical connections.

B. Temporary supports shall be provided and installed during erection to avoid over-stressing piping or equipment to which piping is connected.

3.3 CERTIFICATION

A. The manufacturer or vendor shall be prepared to certify that the tubing conforms to the requirements of this specification.

3.4 ACCEPTANCE INSPECTION

A. Owner may make inspections that are necessary to determine conformance with this specification. Quality acceptance sampling will be performed in accordance with ANSI Z1.4, by using General level I in Table I and an appropriate Acceptance Quality Level as given in Table III-A. When the sample inspected or the performance tests indicate that items do not meet this specification, Owner will then, at its option, reject either the defective items or the entire lot.

B. If a field installed item fails to meet this specification, the unused portion of the lot is subject to further acceptance testing and possible rejection.

3.5 INSTALLATION

A. Stainless steel tubing shall be installed where shown on the plans in strict accordance with manufacturer’s requirements. Furnish and install weather resistant non-metallic spacers on tubing where multiple tubes are in a single conduit to reduce chafing between tubes. Where tubing is supported by Unistrut or other owner-approved metallic bracing, provide weather resistant non-metallic interfacing between metallic fastener and tubing.

3.6 APPROVED TUBING SUPPORT AND FASTENING TECHNIQUES

A. Pipe and tubing shall be adequately supported per UPC and ASME requirements to prevent bending, sagging and excessive vibration or damage to threads or flanges. When placing pipe in supports, care shall be exercised so as not to jerk pipe or impose any stresses that may kink or put a permanent bend or stress in pipe or crack a thread.

B. As a minimum, clamps shall be placed no greater than 60 inches apart and 12 inches from both sides of any bends. Where requirements of any codes or manufacturer are more stringent, that clamping interval shall apply. Pipe and tubing shall not be used to support external devices. Clamps and fasteners shall be adequate for application intended.

C. Clamps and fasteners shall be secured by mechanical means (e.g., welded, bolt with lock washer). Use of adhesives and self-tapping screws shall be subject to Engineer’s approval. Use of plastic saddle, clamp type tubing support systems is required for tubing and piping.

D. Clamp spacing shall be as per governing code or clamp manufacturer’s specifications, whichever is more stringent.
E. Interconnecting tubing and piping shall be installed as required by installation and manufacturer's drawings, as indicated in Specifications and as required to give a fully operational station.

1. Tubing shall be installed with expansion offsets and —U bends as required to allow for differential heaving/settlement of equipment pads and trench and movement due to temperature/mechanical forces.
2. All above ground tubing/piping shall be laid out/configured and connected in a manner that allows each section to be removed without disassembly of adjacent piping, tubing or equipment.
3. Ream, clean, and remove burrs inside and outside of tubing before making up joints, adding valves, fittings or any kind of connection to tubing.
4. Prior to connecting fittings or valves to tubing (in particular coiled tubing), conform to manufacturer's requirements for truing or re-rounding tubing. Contractor is responsible to assure that all tubing connections are properly sealed. Re-rounding is a requirement of the contract.

3.7 WELDING

A. Welding procedures shall be in accordance with ANSI B31.3-2008, "Process Piping, Chapter V, "Fabrication, Assembly, and Erection"

B. The contractor shall submit welding procedure specifications (WPS) to the engineer for approval, prior to starting work. Each wps shall be identified with the contractor's name and identification number. Welding shall not commence until the procedure is approved.

C. Each welder must provide a complete procedure qualification record (PQR) signed by an authorized officer of the testing laboratory or deputy welding inspector and the contractor's authorized representative. Previous welding certification (active certification within the previous six (6) months) may be submitted for approval.

D. Weld tests shall be performed per ANSI B31.3, and approved by the engineer.

   1. Not less than 5% of all butt welds by each welder performing work at the site shall be randomly selected and radiographed.
   2. Radiographs shall be evaluated by a certified welding inspector. The welding inspector's written report of their evaluation shall be submitted to the project manager before the welds are buried.

3.8 FIELD TEST

A. After the installation is complete, the Contractor shall thoroughly clean all tubing to manufacturer's requirements by blowing out with 4,000 psi of Nitrogen gas at required durations. The Contractor shall then repeat all leak and functional tests in the field. These tests shall comply with code requirements to the complete satisfaction of the Fire Department representative and Owner. The Contractor shall give the Owner at least three (3) business days advance notice so that the Owner may coordinate with the Fire Marshall Representative for witnessing the tests.

END OF SECTION 15 48 09
PART 1 - GENERAL

1.1 SCOPE

A. The electrical work commences with the point of electrical service where shown on the Drawings and includes furnishing all material and labor for a complete electrical installation.

B. The requirements of Division 01 apply to all work hereunder. The General and Special Conditions are a part of this Division of the Specifications and all provisions contained therein which affect this work are as binding as though incorporated herein.

1.2 DEFINITIONS

A. Provide: Furnish, install, and connect.

B. Product Data: Catalog cuts and descriptive literature.

C. Shop Drawings: Factory prepared specific to the installation.

D. Low Voltage: 0-600 volts.

E. High Voltage: Above 600 volts.

F. Indicated: Shown on the Drawings.

G. Noted: Indicated or specified elsewhere.

1.3 MATERIAL NOT FURNISHED

A. Unless otherwise noted, the following are furnished and installed under other Divisions
   1. Motors.
   3. Electric heating and air conditioning equipment.
   4. Building energy management systems.
   5. Electrical heat tracing.
   6. Pilot and control devices for the above equipment.

B. Power wiring and equipment connections for the above items are included in this Division. Also included in this Division is control wiring to the extent shown on the Electrical Drawings; other control wiring is furnished under the applicable Mechanical Division.

1.4 LOCAL CONDITIONS

A. Power will be supplied by Alabama Power Company overhead distribution system. Verify and comply with all power company requirements for metering and transformer connections. Make necessary arrangements with Alabama Power Company for temporary construction power service requirements.

B. Verify and comply with all requirements of the local telephone company concerning the complete
telephone system and internet service.

1.5 QUALITY ASSURANCE

A. Provide the complete electrical installation in accordance with the National Electrical Code (NFPA 70), Life Safety Code (NFPA 101), and in accordance with applicable local codes. Obtain all necessary permits and have all work inspected by appropriate authorities.

B. All products shall be designed, manufactured, and tested in accordance with industry standards. Where applicable, products shall be labeled or listed by third party certification agencies.

C. Industry Standards: Standards organizations and their abbreviations, as used herein, are as follows: Applicable date for industry standards is that in effect on the date of advertisement of the Project.

4. Institute of Electrical and Electronics Engineers (IEEE).
5. Insulated Cable Engineers Association (ICEA).
8. Underwriters Laboratories, Inc. (UL).

1.6 SUBMITTALS

A. Make all submittals in accordance with the requirements of Division 01. Approval drawings consist of shop drawings, product data and other information as noted in the individual equipment sections. Except as noted, submittal information is for approval and equipment may not be installed until submittals have been returned with stamped approval.

B. Information required "for reference" such as product samples, similar unit test reports and time current curves is for the purpose of determining the suitability of a product, selecting breaker settings, etc. This information is to be submitted at the same time as approval data; however, this information will not be returned and stamped approval is not required prior to installation.

C. Except as noted, installation instructions are not required to be submitted. However, it is the Contractor's responsibility to obtain installation information from the manufacturer for all equipment prior to installing the equipment.

1.7 RECORD DRAWINGS

A. Furnish record drawings in accordance with the requirements of Division 01. Record drawings consist of submittal data as listed above, operation and maintenance data, and as-built drawings. Record drawings are to reflect the final installation, including any changes during approval, manufacturing tests, and installation.

B. In addition to other required sets, furnish one set of operation and maintenance data for all apparatus requiring service. This set is to be bound in hardback, 3-ring binder(s) and shall include:

1. Title page with project name; installing contractor's name, address and telephone number; date of installation and warranty period.
2. Index sheet.
3. Complete manufacturer's operation and maintenance data with tabs (corresponding to the index) separating each item or system. Include the name, address, and phone number of the
nearest sales and service organization for each item.

C. As-Built Drawings: Furnish one set of prints maintained at the job site at all times with all changes during construction marked thereon. Include on the as-built drawings sufficient dimensions to permit location of underground conduits.

D. Submit the results of any tests required in the individual equipment sections.

1.8 ARC FLASH STUDY

A. Description: Submit an arc flash study to facilitate compliance with NFPA 70E, Handbook for Electrical Safety in the Workplace. Arc Flash Study shall be performed using software specifically for the purpose and all calculations shall comply with IEEE 1584.

B. Documentation: Provide an Arc Flash analysis summary including as a minimum the following information:
   1. Equipment name.
   2. Equipment voltage.
   3. Available fault current (3 phase bolted).
   4. Arcing fault current.
   5. Protective device operating time.
   6. Arc flash boundary (in.).
   7. Working distance (in.).
   8. Incident Energy (cal/cm^2).
   9. Protective clothing category.

C. Provide arc flash warning nameplates for each individual equipment item. Nameplates shall include the wording "WARNING – Arc Flash Hazard. Protective Equipment Required". Nameplate shall also include the analysis data as listed above, settings (where applicable) of the equipment main protective device and a description of protective clothing required.

D. Scope: Study shall include all electrical distribution equipment from the service entrance equipment down to and including branch circuit panelboards.

E. Study Data and Submittal Requirements: Fault current and equipment data are as specified above under "Coordination Study"; Arc Flash Study shall be included with or submitted concurrently with the coordination study.

1.9 DELIVERY, STORAGE AND HANDLING

A. Ship products to the job site in their original packaging. Receive and store products in a suitable manner to prevent damage or deterioration. Keep equipment upright at all times.

B. Investigate the spaces through which equipment must pass to reach its final destination. Coordinate with the manufacturer to arrange delivery at the proper stage of construction and to provide shipping splits where necessary.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Provide only new products of the Manufacturer's latest design.
2.2 SUBSTITUTIONS

A. Where the words "equal to" follow or precede the listed acceptable manufacturers, equal products of other manufacturers are acceptable and request for substitution may be made during submittal stage.

B. Where the words "or equal" follow the listed acceptable manufacturers, products of other manufacturers must be submitted and approved prior to the Bid, in accordance with the Instructions to Bidders of the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The complete installation is to be accomplished by skilled electrical tradesmen, with certified or suitably qualified individuals performing all special systems installation and testing. All workmanship shall be of the highest quality, sub-standard work will be rejected.

B. Schedule the work and cooperate with all trades to avoid delays, interferences, and unnecessary work. If any conflicts occur necessitating departures from the Drawings and Specifications, details of departures and reasons therefore shall be submitted immediately for the Engineer's consideration.

C. Prior to final inspection, clean all dirt, mud and construction debris from all boxes, cabinets, manholes and equipment enclosures.

3.2 CERTIFICATION AND TESTS

A. Prior to request for final review, test all systems and repair or replace all defective work. Submit, with request for final review, written certification that all electrical systems are complete and operational.

B. At the time of final review of electrical work, demonstrate the operation of electrical systems. Furnish labor, apparatus and equipment for systems' demonstration.

C. After final review and acceptance, turn over to the Owner all keys for electrical equipment locks. Present to the Owner or the Owner's designated representative, demonstrations and oral instructions for proper operation and maintenance of the electrical equipment and systems.

END OF SECTION 26 00 00
PART 1 - GENERAL

1.1 SCOPE:

A. This Section includes underground power distribution requirements typical for a facility with underground distribution.

   1. Underground duct banks
   2. Manholes.

1.2 SUBMITTALS

A. Submit product data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Precast Manholes: Equal to Shaw or DeKalb Concrete Products.

B. Manhole Frames and Covers: Equal to Neenah.

2.2 PRECAST MANHOLES

A. Dimensions: As indicated.

B. Concrete: 4,500 psi, suitable for H-20 loading.

PART 3 – EXECUTION

3.1 EXCAVATION

A. Perform excavation in accordance with applicable OSHA requirements, including suitable bracing and shoring where required.

B. Excavation includes all excavation of trenches and pits, no matter what the substance encountered, and disposal of excess material.

NOTE: Reference Civil Sections for earthwork where available.

C. Perform trench excavation by open cut. The top portion of the trench may be excavated with vertical or sloping sides to any width within the construction easement which will not cause unnecessary damage to adjoining structures, roadways, pavements, utilities, trees, or private property.

D. Backfill the first 18-inches with select material consisting of finely selected earth, stone dust, or sand. Place in 6-inch layers and compact with proper hand tools. Remaining backfill, if necessary, may be with general excavated material so long as the material consists of not more than 1/3
broken rock with no single rock weighing over 50 pounds.

3.2 BEDDING OF MANHOLES

A. Excavate manholes a minimum of 12-inches below the base elevation then bring the bed to the proper elevation with compacted stone or gravel, 3/4-inch and less in size. Thoroughly compact the bed by tamping or slicing with a flatbed shovel.

3.3 UNDERGROUND DUCT BANK INSTALLATION

A. Install top of duct bank minimum 18-inches below finished grade with plastic warning tape 12-inches below finished grade.

B. Terminate conduit in end bell at manhole entries.

C. Stagger conduit joints in concrete encasement 6-inches minimum.

D. Provide minimum 3-inch concrete cover at bottom, top, and sides of duct bank. Use suitable separators and chairs installed not greater than four feet on center to provide conduit spacing as indicated. Securely anchor conduit to prevent movement during concrete placement.

E. Construct duct banks with 3,000 psi red concrete. Provide two No. 4 steel reinforcing bars as indicated.

F. Where duct bank passes beneath footings or slabs resting on grade excavate to provide a minimum of 6-inches clearance between the conduits and the structure. Backfill to the base of the structure with concrete.

END OF SECTION 26 03 75
PART 1 - GENERAL

1.1 SCOPE

A. Panelboards.

1.2 SUBMITTALS

A. Submit Shop Drawings.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Equipment shall be manufactured by General Electric, Siemens, Square D, or Eaton.

2.2 PANELBOARDS

A. Panelboards: NEMA PB-1; UL 67.

B. Rating: Voltage and ampere ratings are shown on the Drawings. Unless otherwise indicated interrupting ratings (RMS symmetrical) are 14,000 amps for 480 volt panelboards and 10,000 amps for 240 and 208 volt panelboards.

C. Boxes: Code gauge galvanized steel; sized to accommodate devices indicated and afford wire bending space in accordance with NEC requirements.

D. Fronts: Surface or flush as indicated, door-in-door construction, finished in light grey enamel over a rust inhibitor. Furnish flush lock for fronts less than 48-inches high and vault type handle with three point catch for fronts 48-inches and higher. Key all locks alike.

E. Bus: Copper, arranged for bolt-on circuit breakers. Furnish insulated neutral bus and ground bus with main lug bonded to the box. Neutral buss shall be rated 200% main bus.

F. Circuit Breakers: NEMA AB-1; molded case type, thermal-magnetic trip with internal common trip on multi-pole breakers. Provide breaker fully rated for interrupting ratings noted; series ratings are not acceptable.

G. Provide engraved nameplates giving the voltage rating and panel designation as indicated. Provide a UL service entrance label for panelboards used as service entrance equipment.

H. Surge Protection: Where indicated provide transient voltage surge suppressor, UL listed in accordance with UL 1449 (2nd Edition); suitable for medium exposure level ANSI/IEEE C62.41 Cat. C3 environments; total surge current shall not be less than 80 kA per phase or 40 kA per mode in accordance with NEMA LS-1. Provide surge suppressor with standard overcurrent protection (no fuses), integral disconnect and diagnostic indicating lights. Suppressor shall be installed either in the panelboard gutter unless space does not permit or panelboard UL label is voided – in which case furnish loose for field installation adjacent (less than five feet) to the panelboard. Suppressor shall be connected on the load side of the main disconnect device, as close as possible to the phase/neutral/ground conductors per manufacturer's recommendations.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install boxes so they are rigidly supported and correctly aligned. Select mounting height so that operating handles are not higher than 6 feet 6-inches or lower than 24-inches above the floor.

B. For flush mounted panels provide a 3/4-inch empty raceway for each three unused spaces and spare poles. Terminate in a junction box located above the ceiling or other approved accessible location for future extension.

C. Prior to energizing panelboards clean out construction dirt and debris. Paint any scratches on the trims or dead front barriers. Meggar each phase to phase and ground to insure that no short circuits exist.

D. Adjust panel barriers so that no openings occur between them and the panel front. Provide filler plates and plugs as necessary to maintain dead front integrity.

E. Type directory cards with circuit loads and/or area served. Note spare circuits in pencil.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

END OF SECTION 26 04 70
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency’s Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 – PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers

1. Okonite.
2. Alpha Wire.
3. Belden Inc.
5. General Cable Technologies Corporation.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.
D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for multiconductor cable Type TC with ground wire.

E. VFD Cable:
   1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
   2. Type TC-ER with oversized cross-linked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil resistant outer PVC jacket.

2.2 CONNECTORS AND SPLICES

A. Manufacturers:
   1. AFC Cable Systems, Inc.
   2. Gardner Bender.
   4. Ideal Industries, Inc.
   5. Ilsco; a branch of Bardes Corporation.
   6. NSi Industries LLC.
   7. O-Z/Gedney; a brand of the EGS Electrical Group.
   8. 3M; Electrical Markets Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 – EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper

B. Branch Circuits: Copper

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway
C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway

E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

3.3 GENERAL WIRING METHODS

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

C. Identification: All conductors shall be identified throughout the electrical system. For control and signal conductors use wire markers at all terminals and connections. Color code power circuit conductors as follows:

<table>
<thead>
<tr>
<th>Phase</th>
<th>120/208 Volt System</th>
<th>277/480 Volt System</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Black</td>
<td>Brown</td>
</tr>
<tr>
<td>B</td>
<td>Red</td>
<td>Orange</td>
</tr>
<tr>
<td>C</td>
<td>Blue</td>
<td>Yellow</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
<td>Grey</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
<td>Green</td>
</tr>
</tbody>
</table>

D. For conductors larger than #6 AWG color coding may be accomplished with 1-inch wide colored tape applied at each end of the conductor or at points where conductor is accessible so as to be visible inside the enclosure.

E. Neatly train and lace wiring inside boxes, equipment and panelboards. Support to prevent conductor movement under fault conditions.

F. Provide separate pull and junction boxes to keep analog signal separate from control and power wiring.

G. Pull all conductors into a raceway at the same time. Thoroughly swab raceway system before installing conductors. Use wire pulling lubricant for all pulls. Do not exceed the manufacturer's pulling tension.

H. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

3.4 INSTALLATION IN MANHOLES

A. Rack all cables; straight thru pulls are not acceptable.
B. Secure cables to rack supports with tie wraps to prevent motion under fault conditions.

C. Provide a minimum of 6 feet slack for all high cables. Do not splice cables without approval by the Engineer.

3.5 WIRING CONNECTIONS AND TERMINATIONS

A. Make connections to circuit breakers; disconnect switches, panel mains, etc. with solderless lugs.

B. Use mechanical connectors for low voltage splices, taps, fixture and motor connections. Exception: Square thread helical spring plastic cap (wire nut) type connectors are acceptable for solid conductor splices and taps. Provide adapters as required for terminations of multiple conductors.

C. Use insulated throat, spade type crimp on connectors for strap screw device terminals. Exception: Receptacle back wiring provisions may be used for terminating solid conductors.

D. Where possible use connectors with integral, insulating covers. Otherwise tape uninsulated conductors and connectors to 150 percent of the insulation value of conductor.

E. Thoroughly clean wires before installing lugs and connectors.

F. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

G. 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.

H. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.6 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connection.

B. Torque test conductor connections and terminations to manufacturers recommended values.

C. Continuity Tests: Ring all conductors for continuity and replace any open conductors.

D. Low Voltage Ground Fault Tests: Meggar all feeder circuits for grounds. Compile and submit a list of meggar readings. Replace all conductors measuring less than 2 megohms to ground.

E. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

1. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3
AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies

3.7 TEST AND INSPECTION REPORTS

A. Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

B. Cables will be considered defective if they do not pass tests and inspections.

1. Results that comply with requirements.
2. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19
SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. Power system grounding.
B. Instrumentation system grounding.
C. Electrical equipment, fencing, raceway grounding and bonding.

1.2 SYSTEM DESCRIPTION

A. The system consists of ground grids for building grounding; ground clusters for supplemental electrodes; and connections thereto of structures, equipment and electrical systems as described below and as indicated on the drawings.
B. This Section is intended to supplement the requirements of the NEC, particularly Article 250, and to differentiate among options allowed by the NEC. This Section is not intended to reiterate explicit requirements of the NEC.
C. Within this Section the following definitions apply.

1. Ground Grid: A horizontal loop, electrically and mechanically continuous; routed approximately three feet inside the building perimeter. Where any building dimension exceeds 100 feet provide cross ties spaced not farther than 50 feet apart connected to the perimeter loop and to each other at all points of intersection to form a grid.
2. Ground Cluster: An assembly of three or more driven ground rods; spaced not closer than 8 feet apart; each rod connected to the others in a closed delta configuration; and providing a resistance to ground of not more than 10 ohms.
3. Connect or Bond: For underground or otherwise inaccessible locations - a permanent connection made by exothermic welding, brazing, or similar process. For exposed and accessible locations - a connection made with clamps, bolts or similar fittings approved for the purpose.
4. Ground Ring: A horizontal loop of bare copper; electrically and mechanically continuous; routed exposed on the inside of a building or area approximately five feet above the finished floor, with elevation changes as necessary to avoid doors, windows and other obstructions. The ground ring is connected to all structural steel columns which it intersects and to the ground grid at intervals not exceeding 50 feet.

1.3 SUBMITTALS

A. Submit product data.
B. Indicate layout of ground grid and routing of grounding electrode conductors.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bare Conductors: ASTM B-8; stranded; hard drawn copper. Size unless otherwise noted is #4/0 AWG.
B. Ground Rods: UL 425H; 5/8-inch x 8 feet; high strength steel core with metallically bonded copper jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Except as noted, use insulated ground conductors only where installed in a raceway. Use bare conductors for the ground grid, ground rod connections, and bonding of buildings, structures etc. Where a bare conductor is installed in a raceway use only non-metallic raceways; do not install bare conductors in metallic raceways.

B. Either embed the ground grid in the concrete building foundation 2 to 4-inches from the bottom or bury the grid three feet deep in the earth. For each 100 feet or fraction thereof of ground grid conductor provide connections to earth by one of the following.

1. Where deep column footings (more than eight feet below grade) are used provide a vertical tap from the grid to the bottom of the footing.

2. Where only shallow footings are available connect the ground grid to a driven ground rod.

C. Drive ground rods so the top is 3 to 6-inches below finished grade. If rock is encountered then rods may be driven at an angle or grounding plates, as approved by the Engineer, may be used.

D. Construct ground clusters as follows: Start with three driven ground rods and measure the resistance to ground of each rod. If the parallel combination exceeds 10 ohms then add sections and drive the rods deeper, or drive additional rods until the specified value is obtained. Connect each rod to every other rod in the cluster. Exception: not more than three additional rods or sections (six total) are required for any one cluster.

E. Where bare conductors emerge from concrete encasement, provide a 4-inch length of Schedule 40 PVC conduit set in the concrete to protect the conductor.

3.2 SERVICE ENTRANCE EQUIPMENT

A. Bond service entrance equipment ground bus to the ground grid with a No. 4/0 conductor as indicated.

B. Provide one ground cluster outside the building at the closest practical location to the service entrance equipment and bond to ground bus as indicated.

C. If a metallic cold water pipe is available for a grounding electrode make connection on the street side and bond around the water meter.

D. Prior to energizing the system remove the neutral link and meggar the system neutral. Repair any grounds then replace the neutral link.

3.3 BUILDINGS AND CANOPY

A. Bond all steel building columns to the ground grid.

B. Provide outside access to the ground grid every 100 feet (two locations minimum) or as indicated by means of a test well. Note locations on the as-built drawings.
3.4 SEPARATELY DERIVED SYSTEMS

A. Ground transformer enclosures and, where solidly grounded systems are indicated, the secondary neutral to one of the following.
   1. The ground grid where transformer is located on the bottom floor.
   2. A ground ring.
   3. The building steel on Canopy.
   4. Other electrode as permitted by NEC if none of the above are available.

B. Ground generator frame and neutral to the ground grid.

3.5 UNDERGROUND DISTRIBUTION SYSTEMS

A. Route a bare conductor through each duct bank. Connect to building ground grid, equipment frame or ground pad as applicable.

B. Provide a driven ground rod at each electrical manhole. Connect to duct bank ground conductor accessible in the manhole.

C. Provide two ground clusters at opposite corners of pad transformers. Connect to transformer secondary compartment grounding lug. Bond primary and secondary ground lugs and duct bank grounding conductor.

3.6 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Notify the Owner's representative at least one week in advance that the ground grid for the building is ready for inspection. Obtain written notice to proceed before filling trenches, pouring slabs, or otherwise covering the work.

C. Compile and submit a list of ground resistance measurements for each ground rod in ground clusters. Measure and submit resistance to ground of service equipment ground bus.

D. Make resistance to ground measurements in normal, dry weather conditions not less than 24 hours after rainfall. Make measurements using the fall of potential method per IEEE Standard No. 142.

END OF SECTION 26 05 26
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.
B. IMC: Intermediate metal conduit.
C. GRS: Galvanized rigid steel conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.
   3. Trapeze hangers. Include Product Data for components.
   4. Steel slotted channel systems. Include Product Data for components.
   5. Nonmetallic slotted channel systems. Equipment supports.
B. Comply with NFPA 70.

1.6 COORDINATION
A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. Fabco Plastics Wholesale Limited.
   d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers:
      1. Hilti Inc.
      2. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3. MKT Fastening, LLC.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers:
      1. Cooper B-Line, Inc.; a division of Cooper Industries.
      2. Empire Tool and Manufacturing Co., Inc.
      3. Hilti Inc.
      4. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5. MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.


2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and GRS as scheduled in NECA 1, where it’s Table 1 lists maximum spacing less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

   1. Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, or GRS may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   1. To New Concrete: Bolt to concrete inserts.
   2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   3. To Existing Concrete: Expansion anchor fasteners.
   4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, and Spring-tension clamps.
   6. To Light Steel: Sheet metal screws.
   7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
8. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 26 05 29
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Nonmetal wireways and auxiliary gutters.
   5. Surface raceways.
   7. Handholes and boxes for exterior underground cabling.

B. Related Requirements
   1. Section 260375 "Underground Power Distribution" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. GRS: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING AND FITTINGS

A. Manufacturers:
   1. AFC Cable Systems, Inc.
   3. Anamet Electrical, Inc.
   4. Electri-Flex Company.
   5. O-Z/Gedney; a brand of EGS Electrical Group.
   6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
   7. Republic Conduit.
   8. Robroy Industries.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRS: Comply with ANSI C80.1 and UL 6.
D. ARC: Comply with ANSI C80.5 and UL 6A
E. IMC: Comply with ANSI C80.6 and UL 1242.
F. EMT: Comply with ANSI C80.3 and UL 797.
G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 36
H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel or die cast.
   b. Type: Setscrew or compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, or GRS: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING AND FITTINGS

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and
C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. RTNC: Comply with UL 1684A and NEMA TC 14.

G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

H. Fittings for LFNC: Comply with UL 514B.

I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers:
   1. Cooper B-Line, Inc.
   2. Hoffman; a Pentair company.
   4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 12 unless otherwise indicated, and sized according to NFPA 70.

   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type flanged-and-gasketed unless otherwise indicated.

   E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

   1. Adalet.
   2. Cooper Technologies Company; Cooper Crouse-Hinds.
   3. EGS/Appleton Electric.
   5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
9. RACO; a Hubbell Company.
10. Robroy Industries.
11. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
12. Thomas & Betts Corporation.
13. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Metal Floor Boxes:
   1. Material: Cast metal.
   2. Type: Fully adjustable.
   3. Shape: Rectangular.
   4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep as required.

K. Gangable boxes as required.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer’s standard enamel.
   2. Interior Panels: Steel; all sides finished with manufacturer’s standard enamel.

M. Cabinets:
   1. NEMA 250, Type 12 painted-steel box with removable interior panel and removable front, finished inside and out with manufacturer’s standard enamel or as indicated.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. 3-point handle lockable.
   4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
7. Sizes and types as indicated

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: GRS or IMC.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
   1. Boxes and Enclosures: NEMA 250, Type 4X.
   2. Exposed, Not Subject to Physical Damage: GRS
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT or GRS.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   5. Damp or Wet Locations: GRS
   6. Boxes and Enclosures: NEMA 250, Type 12, except use NEMA 250, Type 4X stainless steel in wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. EMT: Use setscrew or compression, steel cast-metal fittings. Comply with NEMA FB 2.10.
   4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for
hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from PVC to GRS or IMC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
Q. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

S. Comply with manufacturer's written instructions for solvent welding PVC and fittings.

T. Expansion-Joint Fittings:
1. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

V. Mount boxes at heights required. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by
3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33
SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Identification of power and control cables.
   2. Identification for conductors.
   4. Warning labels and signs.
   5. Instruction signs.
   7. Miscellaneous identification products.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE


B. Comply with NFPA 70.


D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted 3-mil thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical, communications and utility ductbanks.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE

2.3 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:
   1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:
   1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
   2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES"

2.4 INSTRUCTION SIGNS AND EQUIPMENT IDENTIFICATION LABELS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.5 CABLE TIES

A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
   1. Minimum Width: 3/16 inch
   2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi
   3. Temperature Range: Minus 40 to plus 185 deg F.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

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 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

A. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

B. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

C. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted with the conductor designation.

   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Limit use of underground-line warning tape to direct-buried cables.
   2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.

G. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

H. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Outdoor Equipment: Engraved, laminated acrylic 4 inches high.
      b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

   2. Equipment to Be Labeled:
      a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved laminated acrylic or melamine label.
      b. Enclosures and electrical cabinets.
      c. Access doors and panels for concealed electrical items.
      d. Switchboards.
      e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards.
      f. System boxes and enclosures.
      g. Enclosed switches.
      h. Enclosed circuit breakers.
      i. Push-button stations.
      j. Power transfer equipment.
      k. Contactors.
      l. Power-generating units.
      m. Monitoring and control equipment.

END OF SECTION 26 05 53
PART 1 - GENERAL

1.1 SCOPE

A. Service Entrance Rated Automatic Transfer Switch - Low Voltage, Distribution Switchboard with mold case circuit breakers as specified hear in and as indicated on the drawings.

1.2 REFERENCES

A. The Service entrance transfer switch shall be UL 891 listed and labeled and UL 1008 listed

B. The low voltage switchboards and protection devices in this specification are designed and manufactured according to latest revision of the following standards (unless otherwise noted).

1. ANSI 61
2. ANSI/NEMA PB 2, Deadfront Distribution Switchboards
3. ANSI/NEMA PB 2.1, General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
4. ANSI/NFPA 70, National Electrical Code.
5. NEMA AB 1, Molded Case Circuit Breakers and Molded Case Switches.
6. NEMA KS 1, Fused and Non - fused Switches.
7. UL 489, Molded Case Circuit Breakers.
8. UL 891, Dead Front Switchboards.
9. UL 98, Enclosed and Dead Front Switches.
10. UL 1066, Low Voltage Power Circuit Breakers.

1.3 DEFINITIONS

A. Front-Connected only shall be as defined by UL 891 standard which requires that all line and load connections for phase, neutral, and ground conductors can be made and maintained from the front of the switchboard without access to the rear.

B. Front-Accessible shall be as defined by UL 891 standard which is an enclosure in which all bus and device connections are accessible from the front. If necessary, a limited number of devices shall be permitted to be removed to achieve this accessibility.

1.4 SYSTEM DESCRIPTION

A. The Transfer Switch and Distribution Switchboard shall be a factory assembled integral unit and be suitable for 480Y/277 volts, 60 Hertz, 3 phase, 4-wire, solidly grounded wye.

B. The Assembly arrangement shall have front connected and rear aligned.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Transfer Switch and Distribution Switchboard shall withstand the effects of earthquake motions determined according to 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. High seismic loading as defined in IEEE Std 693-1997, with 1.33 amplification factor.
3. IBC-2006, Sds = 1.05g, Ss = 158%, Ip = 1.5, for all z/h greater than 0 and Sds = 1.67g, Ss = 250%, Ip = 1.5, for z/h equal to 0 in accordance with ICC-ES-AC156.

1.6 SUBMITTALS

A. Provide factory prepared drawings and evaluation in accordance with general requirements of Division 01.
1. Shop Drawings shall include, Front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral and ground; switchboard instrument details; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings and equipment short circuit ratings.

1.7 INSTALLATION, OPERATION AND MAINTENANCE DATA

A. Manufacturer shall provide installation, operation and maintenance procedures to owner in accordance with general requirements.

1.8 DELIVERY, STORAGE AND HANDLING

A. Store, protect, and handle products in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals.
B. Ship each section in individual shipping splits for ease of handling. Each section shall be mounted on shipping skids and wrapped for protection.
C. Contractor shall inspect and report concealed damage to carrier within 48 hours.
D. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.
E. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish. Lift only by manufacturers recommended procedures.

1.9 PRODUCT CONDITIONS SITE ENVIRONMENTAL CONDITIONS

A. Follow (standards) service conditions before, during and after switchboard installation.
B. Low voltage switchboards shall be located in well - ventilated areas, free from excess humidity, dust and dirt and away from hazardous materials. Ambient temperature of area will be between minus 30 and plus 40 degrees C. Indoor locations shall be protected to prevent moisture from entering enclosure.

1.10 WARRANTY

A. Manufacturer warrants equipment to be free from defects in materials and workmanship for 1 year from date of installation or 18 months from date of purchase, whichever occurs first.

1.11 FIELD MEASUREMENTS

A. Contractor shall make all necessary field measurements to verify that equipment shall fit in allocated space in full compliance with minimum required clearances specified in National Electrical Code.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General Electric Company.
B. Square D.
C. Eaton Electrical.
D. Siemens.

2.2 SERVICE ENTRANCE AUTOMATIC TRANSFER ASSEMBLY

A. Transfer switch: System consists of a double throw, electrically operated switch to automatically transfer and re-transfer load to and from a standby power source. The switch assembly shall be controlled by a microprocessor controller.

B. When voltage on any phase drops below 85 percent of normal for a time period of three seconds, a set of engine starting contacts close. Transfer occurs when voltage and frequency on the emergency source have reached 95 percent of normal.

C. Re-transfer to normal occurs when the normal source has reached 95 percent of normal voltage for a period of 20 minutes. However, should the emergency source fail during the 20 minute timing period, re-transfer shall occur immediately.

D. After re-transfer the engine start contacts shall remain closed for a five minute cool down period.

E. The transfer switch assembly controls shall include:
   1. Programmable test switch.
   2. Built-in diagnostics with LCD.
   3. Event Log tracking at least 99 events.
   4. Fully programmable time delay functions. To include delay start, delay retransfer, delay cool down.
   5. Programmable exerciser clock.
   6. Four NO & NC auxiliary contacts.
   7. Three phase voltage imbalance monitor.

F. Main Circuit Breaker: Molded Case Circuit Breakers: NEMA AB-1; FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

G. Surge Protection: Provide transient voltage surge suppressor, UL listed in accordance with UL 1449 (2nd Edition); suitable for high exposure level ANSI/IEEE C62.41 Cat. C3 environments; total surge current shall not be less than 240 kA per phase or 120 kA per mode in accordance with NEMA LS-1. Provide surge suppressor with standard overcurrent protection, integral disconnect and diagnostic indicating lights. Suppressor shall be installed in the switchboard on the load side of the main disconnect device, as close as possible to the phase/neutral/ground conductors per manufacturer's recommendations.

H. Instruments and Sensors
   1. Current Transformers: ANSI C57.13; 5 ampere secondary, bar or window type, with single secondary winding and secondary shorting device, primary/secondary ratio as required,
burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
2. Potential Transformers: ANSI C57.13; 120 volt single secondary, disconnecting type with integral fuse mountings, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
3. Circuit Monitor: Microprocessor based unit for measuring multiphase variables including amps, volts, VARS, watts, volt-amps, power factor, frequency, demand values and harmonic distortion indication. Communications: ModBus RTU protocol; digital and analog inputs and outputs; RS232 port on front; RS485 ports on rear.

2.3 SWITCHBOARD CONSTRUCTION

A. Switchboard: NEMA 3R, non-walk in factory-assembled; dead front; metal-enclosed; front accessible; self-supporting switchboard assembly conforming to NEMA PB-2; complete from incoming line terminals to load-side terminations.

B. Switchboard Electrical Ratings and Configurations as indicated.

C. Distribution Section Devices: Panel mounted.

D. Bus: Copper sized in accordance with NEMA PB-2. Provide a copper ground bus through the length of the switchboard.

E. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

F. Molded Case Circuit Breakers: NEMA AB-1; FS W-C-375; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install automatic transfer switch and switchboard assembly in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB-2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.2 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage and grounding.

B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1,000 volts, and minimum acceptable value for insulation resistance is 2 megohms.

C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.

D. Touch up scratched or marred surfaces to match original finish verify field measurements are as shown on Drawings.

E. Verify that required utilities are available, in proper location and ready for use.

3.3 TEST REPORTS
A. Adjust voltage and transfer time settings to the values listed above in Article 1.03.

B. Functionally test the completed installation by tripping the utility source main breaker. The Engineer reserves the right to witness this test and 10 days’ notice shall be provided.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

D. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
   2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
      a. Check for electrical continuity of circuits and for short circuits.
      b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
      c. Verify that manual transfer warnings are properly placed.
      d. Perform manual transfer operation.
   5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
      a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
      b. Simulate loss of phase-to-ground voltage for each phase of normal source.
      c. Verify pickup and dropout voltages by data readout or inspection of control settings.
      d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
      e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
      f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
      g. Verify grounding connections and locations and ratings of sensors.

E. Testing Agency's Tests and Inspections:
   1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
   3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages
and procedure recommended by manufacturer. Comply with manufacturer’s specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
h. Verify grounding connections and locations and ratings of sensors.

F. Coordinate tests with tests of generator and run them concurrently.

G. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

H. Remove and replace malfunctioning units and retest as specified above.

I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 13
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Isolated-ground receptacles.
   3. Weather-resistant receptacles.
   4. Snap switches and wall-box dimmers.
   5. Wall-switch and exterior occupancy sensors.
   6. Communications outlets.
   7. Pendant cord-connector devices.
   8. Cord and plug sets.
   9. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 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.

1.4 SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.

2.3 PENDANT CORD-CONNECTOR DEVICES A.

   Description:
   1. Matching, locking-type plug and receptacle body connector.
   2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
   4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.4 CORD AND PLUG SETS

   A. Description:
      1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
      2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

2.5 TOGGLE SWITCHES

   A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

   B. Switches, 120/277 V, 20 A:

2.6 RECEPTACLES

   A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

   B. Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
      1. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units"
C. GFCI, Non-Feed-Through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

D. Telephone Outlet:
   1. Products:
      a. Cooper; 3560-6.
      b. Leviton; 40649.
   2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

E. Combination TV and Telephone Outlet:
   1. Products:
      a. Cooper; 3562.
      b. Leviton; 40159.
   2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category. Comply with UL 1863.

2.7 WALL-BOX DIMMERS
A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
B. Control: Continuously adjustable slider toggle switch; with single-pole or three-way switching. Comply with UL 1472.
C. LED Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.8 WALL PLATES
A. Single and combination types shall match corresponding wiring devices.
B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant die-cast aluminum cover.

2.9 FLOOR SERVICE FITTINGS
A. Type: Modular, flush-type, flap-type, dual-service units suitable for wiring method used.
B. Compartments: Barrier separates power from voice and data communication cabling.
C. Service Plate: Round, with satin finish.
D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
E. Voice and Data Communication Outlet: Blank cover with brushed cable opening.
2.10 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
   1. Hubbell Incorporated; Wiring Device-Kellems.
   2. Pass & Seymour/Legrand.
   3. Square D/Schneider Electric.
   4. Thomas & Betts Corporation.
   5. Wiremold/Legrand.

B. Description:
   1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
   2. Comply with UL 514 scrub water exclusion requirements.
   3. Service-Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.
   4. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.
   5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   6. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.

2.11 FINISHES

A. Device Color:
   1. Wiring Devices Ivory unless otherwise indicated or required by NFPA 70 or device listing.
   2. Isolated-Ground Receptacles: Orange

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
   1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
   1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid
scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtailed.

4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtailed for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION
A. Comply with Section 260553 "Identification for Electrical Systems".

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 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 unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

B. Wiring device will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 27 26
SECTION 26 28 16  
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers’ technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   1. Enclosure types and details for types NEMA 250, Type 12 or 4X as indicated.
   2. Current and voltage ratings.

1.5 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Eaton Electrical
   2. General Electric
   3. Siemens
   4. Square D

2.2 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
B. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.

2.3 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and ground conductors.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.


2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. As Indicated
   2. Indoor, Dry and Clean Locations: NEMA 250, Type 12
   3. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260529 "Hangers and Supports for Electrical Systems".

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.
3.3 IDENTIFICATION

A. Comply with requirements in Section 26195 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

END OF SECTION 26 28 16
SECTION 26 32 13
ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for standby power supply with the following features:
   1. Diesel engine.
   2. Unit-mounted cooling system.
   3. Unit-mounted double wall diesel fuel tank
   4. Unit-mounted control and monitoring.
   5. Sound attenuated outdoor enclosure.

B. Related Sections include the following:
   1. Section 262413, "Distribution Switchboards - Automatic Transfer Switch", including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
   2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
   3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in "Operation and Maintenance Data", specification section include the following:
   1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASME B15.1.

E. Comply with NFPA 37.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110 requirements. I. Comply with UL 2200.

J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator systems shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 15 to plus 40 deg C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 3200 feet

1.7 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of completion.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture
PART 2 - PRODUCTS

2.1 MANUFACTURES

A. Manufacturers:
   1. Caterpillar; Engine Div.
   2. Onan/Cummins Power Generation

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
   1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:
   1. Power Output Ratings: As indicated
   2. Output Connections: As indicated.
   3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:
   1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
   2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
   3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
   4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
   5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
   6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
   7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
   8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: No. 2 Diesel
B. Rated Engine Speed: 1800 rpm.

C. Construction: Heavy duty industrial type; water cooled; compression ignition diesel engine. Engine shall be 4-cycle, solid injection, vertical in-line or V-type, 12 cylinders maximum. Provide single piece, cast iron block fitted with removable wet cylinder liners of close-grained alloy cast iron; single piece drop forge steel crankshaft; precision insert, steel backed tri-metal bearings; forged connecting rods; cast pistons with positive pressure oil cooling.

D. Lubrication System: The following items are mounted on engine or skid:
1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Coolant Jacket Heater: 208V, single phase Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Solid state isochronous type with steady state speed regulation of 0.5 percent and transient speed regulation of three cycles maximum from no load to full load with two second maximum recovery to steady state.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
   a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and no collapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 18 dB at 500 Hz.
2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 95 dBA or less.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and “blocked filter” indicator.

K. Starting System: 24V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 “Project Conditions” Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified.
4. Battery: Adequate capacity within ambient temperature range specified in Part 1 “Project Conditions” Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 “Project Conditions” Article. Include accessories required to support and fasten batteries in place.
8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
   a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 SUB-BASE FUEL TANK

A. Comply with NFPA 30 and with UL 142.

B. Tank design shall duel wall, secondary containment, heavy construction 0.24-inch steel plate, side channels 0.16-inch sheet steel, rear and right side stub-up access. Welded steel containment basin (minimum of 110% of primary tank capacity. Interior tank surface shall be coated with a solvent-based thin film to prevent rust. Locate tank fill nozzle as indicated on the drawings.
C. Capacity: Fuel for 24 hours continuous operation, 200 gallon minimum.

D. Electronic Leak Detection System.

E. Fuel Level switch with alarm and shutdown.

F. Tank design shall provide capacity for thermal expansion of fuel. Features include the following:
   1. Direct reading fuel level indicator.
   2. 4-inch lockable flip top fill cap.
   3. Compatible with sound attenuated enclosure as described below.

2.5 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
   1. AC voltmeter.
   2. AC ammeter.
   3. AC frequency meter.
   4. DC voltmeter (alternator battery charging).
   5. Engine-coolant temperature gage.
   6. Engine lubricating-oil pressure gage.
   7. Running-time meter.
   9. Generator-voltage adjusting rheostat.
   10. Fuel tank derangement alarm.
   11. Fuel tank high-level shutdown of fuel supply alarm.
   12. Generator overload.

E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
2. Coolant low-temperature alarm.
3. Control switch not in auto position.
4. Battery-charger malfunction alarm.
5. Battery low-voltage alarm.

G. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.

1. Engine high-temperature shutdown.
2. Lube-oil, low-pressure shutdown.
3. Over speed shutdown.
5. Engine high-temperature pre-alarm.
6. Lube-oil, low-pressure pre-alarm.
7. Fuel tank, low-fuel level.
8. Low coolant level.

H. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
   1. Tripping Characteristic: Designed specifically for generator protection.
   2. Trip Rating: Matched to generator rating.
   3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
   4. Mounting: Adjacent to or integrated with control and monitoring panel.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Drip proof.

G. Instrument Transformers: Mounted within generator enclosure.
H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
   1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent
      adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew
   point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Sub transient Reactance: 12 percent, maximum.

2.8 SOUND ATTENUATED ENCLOSURE

A. Description: Vandal-resistant, weatherproof sound attenuated housing, wind resistant up to 100
   mph. Multiple panels shall be lockable and provide adequate access to components requiring
   maintenance. Panels shall be removable by one person without tools. Instruments and control
   shall be mounted within enclosure.

B. Description: Prefabricated or pre-engineered enclosure with the following features:
   1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building
      erected on concrete foundation.
   2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
   3. Space Heater: Thermostatically controlled and sized to prevent condensation.
   4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when
      engine is not running while excluding exterior dust, birds, and rodents.
   5. Lockable double access doors capable of 180-degree swing.
   6. Lube oil and coolant drain pipes to exterior of enclosure and terminate with drain valves.
   7. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation
      while excluding exterior dust, birds, and rodents.
   8. Thermal Insulation: Manufacturer's sound attenuated materials and thickness selected in
      coordination with space heater to maintain winter interior temperature within operating
      limits required by engine-generator-set components.
   9. Muffler Location: Within enclosure.

C. Sound Pressure Levels (Maximum)
   1. 83.3 dBA at 3.3–feet
   2. 72 dBA at 23–feet
   3. 66 dBA at 49.2–feet

D. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components
   within required limits when unit operates at 110 percent of rated load for 2 hours with ambient
   temperature at top of range specified in system service conditions.
   1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable
      louvers prevent entry of rain and snow.

E. Auxiliary Circuit Breaker: NEMA AB-1; molded case type; NEMA 1 unit mounted enclosure; 30
   amp; 3-pole; 10,000 AIC. Breaker shall disconnect 120/208 volt, 3-phase, 4-wire incoming
   power for coolant heater, battery charger, and other auxiliary devices.

F. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to
   illuminate controls and accessible interior. Arrange for external electrical connection.
1. AC lighting system and connection point for operation when remote source is available.

G. Convenience Outlets: Factory wired GFCI. Arrange for external electrical connection.

2.9 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
   1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch-thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
   2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.10 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
   1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
   2. Full load run.
   3. Maximum power.
   4. Voltage regulation.
   5. Transient and steady-state governing.
   7. Safety shutdown.
   8. Provide 14 days’ advance notice of tests and opportunity for observation of tests by Owner's representative.
   9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment
instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 26548 "Vibration and Seismic Controls for Electrical Systems."

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low - Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according Section 26195 "Identification for Electrical Systems".

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

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.

C. Load Test: Provide full load test utilizing portable load bank, for four hours minimum. Provide fuel for test.

D. Record in 20 minute intervals during four hour test:

1. Kilowatts
2. Amps
3. Voltage
4. Coolant temperature
5. Oil pressure
6. Frequency

E. Test alarm and shutdown circuits by simulating conditions.

F. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection.
2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to
those specified here including, but not limited to, single-step full-load pickup test.

3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.


7. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations and compare measured levels with required values.

G. Coordinate tests with tests for transfer switches and run them concurrently.

H. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

I. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

J. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

K. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

L. Infrared Scanning: After Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
   1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
   2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.
END OF SECTION 26 32 13
SECTION 26 41 13
LIGHTING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide lightning protection system consisting of lightning points mounted on canopy roof,
   interconnecting cable, ground drops and ground grid.

B. Provide ground drops as indicated, in 1-inch PVC conduit with cable supports to ground grid.

1.3 ACTION SUBMITTALS

A. Submit plan drawing for review depicting all on the required components for the Lightning
   Protection System. The drawings shall include plan drawings and mounting details. B.
   Product Data: For each type of product indicated.

C. Shop Drawings: For air terminals and mounting accessories.
   1. Layout of the lightning protection system, along with details of the components to be used in
      the installation.
   2. Include indications for use of raceway, data on how concealment requirements will be
      met, and calculations required by NFPA 780 for bonding of grounded and isolated metal
      bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer. Include data on listing
   or certification by UL.

B. Certification, signed by Contractor, that roof adhesive is approved by manufacturer of roofing
   material.

C. Field quality-control reports.

D. Comply with recommendations in NFPA 780, Annex D, "Inspection and Maintenance of
   Lightning Protection Systems," for maintenance of the lightning protection system.

E. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding
   features, including the following:
   1. Ground rods.
   2. Ground loop conductor.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Certified by UL, trained and approved for installation of units required
   for this Project.
B. System Certificate:
   1. UL Master Label.
   2. LPS System Certificate.
   3. UL Master Label Recertification.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

1.6 COORDINATION

A. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

B. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96 and NFPA 780.
   1. Manufacturers:
      a. East Coast Lightning Equipment Inc.
      b. ERICO International Corporation.
      c. Harger.
      d. Heary Bros. Lightning Protection Co. Inc.
      e. Independent Protection Co.
      f. Preferred Lightning Protection.
      g. Robbins Lightning, Inc.
      h. Thompson Lightning Protection, Inc.

B. Air Terminals: 18-inch solid copper, pin type, 1/2-inch diameter above 75 feet above finished grade (AFG) and 3/8-inch diameter below 75 feet AFG.

C. Lightning Cable: Braided copper, 28 strand 14 gauge for vertical risers and all horizontal rings above 75 feet AFG, and 29 strand 17 gauge for horizontal rings below 75 feet AFG.

D. Ground Grid: 5/8-inch by 10 feet copperweld ground rods with two-bolt cast bronze clamps having a minimum length of 1-1/2-inch and employing stainless steel screw caps.

E. Cable fasteners shall be substantial in construction, electrolytically compatible with the conductor and mounting surface and shall be spaced according to UL 96 and NFPA Code requirements.

F. Bonding devices, cable splicers and miscellaneous connectors shall be of cast bronze with bolt pressure connections to cable. Cast or stamped crimp fittings are not acceptable.

G. All miscellaneous bolts, nuts and screws shall be brass, bronze, or stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.
B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.

C. Conceal the following conductors:
   1. System conductors.
   2. Down conductors.
   3. Interior conductors.
   4. Conductors within normal view of exterior locations at grade within 200 feet of building.

D. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components. Use exothermic-welded connections in underground portions of the system.

E. Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.
   1. Exception: In single-ply membrane roofing, exothermic-welded connections may be used only below the roof level.

F. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer’s written instructions.

G. Down lead cables shall not be brought directly through the roof. Thru-roof connectors with solid rods or conduit through boot flashing shall be utilized for this purpose.

H. Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.
   1. Bond ground terminals to the ground loop.
   2. Bond grounded building systems to the ground loop conductor within 12 feet of grade level.

I. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot intervals.

3.2 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
B. UL Inspection: Meet requirements to obtain a UL Master Label for system.

C. LPI System Inspection: Meet requirements to obtain an LPI System Certificate.

END OF SECTION 26 41 13
SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Exterior luminaires with lamps and ballasts.
   2. Poles and accessories.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.
B. CRI: Color-rendering index.
C. HID: High-intensity discharge.
D. LED: Light Emitting Diode
E. LER: Luminaire efficacy rating.
F. Luminaire: Complete lighting fixture, including ballast housing if provided.
G. Pole: Luminaire support structure, including tower used for large area illumination.
H. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
B. Live Load: Single load of 500 lbf, distributed as stated in AASHTO LTS-4-M.
C. Ice Load: Load of 3 lbf/sq. ft. applied as stated in AASHTO LTS-4-M Ice Load Map.
D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
   1. Basic wind speed for calculating wind load for poles is 150 mph

1.5 ACTION SUBMITTALS

A. 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. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Luminaires Photometric Data Testing Laboratory Qualifications: Provided by manufacturers’ laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaires Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

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.


E. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: As scheduled on the drawings or approved equal.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
   1. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during
relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

E. Exposed Hardware Material: Stainless steel.

F. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

G. 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.

H. Ballast Characteristics:
   1. Power Factor: 90 percent, minimum.
   2. Sound Rating: Class A.
   3. Total Harmonic Distortion Rating: Less than 10 percent.
   6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

2.3 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:
   1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
   2. Minimum Starting Temperature: Minus 22 deg F.
   3. Normal Ambient Operating Temperature: 104 deg F.
   4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.

2.4 HID LAMPS

A. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65 and CCT color temperature 3000 or 4000 K.

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65 and CCT color temperature 4000 K.

2.5 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Luminaire Attachment Provisions: Comply with luminaire manufacturers’ mounting requirements. Use fasteners and mounting bolts unless otherwise indicated.

B. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
   1. Materials: Shall not cause galvanic action at contact points.
after fabrication unless otherwise indicated.

3. Anchor-Bolt Template: Plywood or steel.

C. Hand hole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

2.6 POLES

A. Poles: As Scheduled

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.
   1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements as specified in Section "Cast-in-Place Concrete."

3.3 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems" and as indicated.
   1. Install grounding electrode for each pole unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
   1. Verify operation of photoelectric controls.
END OF SECTION 26 56 00
SECTION 27 01 00
GENERAL INSTRUMENTATION AND CONTROLS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General Instrumentation and Controls requirements shall be provided in accordance with the requirements specified under this section, the Detailed Specifications and the Contract Drawings.

B. The Contractor shall provide all labor, materials and equipment required to perform the work as specified in the General and Detailed Specifications and shown on the Contract Drawings. The work shall also include the following:

1. Inserts and other instrument or electrical items which shall be installed embedded in concrete, or built into walls, partitions, ceilings or control panels constructed by other Prime Contractors. Also, tie-ins to existing control panels in the same or different locations.

2. Installation procedures and schedules under other contracts shall be reviewed and coordinated with other Prime Contractors regarding the installation of electrical items, equipment, instruments, panels, supports, and conduit that must be installed.

3. Keep informed of the construction so the Instrumentation and Controls work shall be installed within such time periods as to not delay the work of the other Prime Contractors.

4. Notify other Prime Contractors in advance of the installation, scope, and duration of the planned instrumentation and controls work, so they shall have sufficient time for coordination and installation of interrelated items that are included in their contracts and that must be installed in conjunction with the work included under this Contract.

C. The following index of this Specification is presented for convenience:

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D. General Specification 260100 – Electrical
1.2 REFERENCES
   A. Variable frequency drives shall comply with the latest applicable provisions and recommendations of the following:
      1. NFPA 70 National Electrical Code.
      2. NFPA 70E Electrical Safety at the Work Place.
      3. NEMA National Electrical Manufactures Association
      4. UL Underwriters Laboratories Inc.

1.3 SUBMITTALS
   A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article 4 - Contractor’s Working Drawings, Design and Shop Drawings; and as specified under Division 1 of the Detailed Specifications.

   B. Working Drawings
      1. Point-to-point wiring diagrams, loop drawings, tie-in drawings, and, wiring and conduit schedules.
      2. Qualifications of proposed wiring coordinator who shall prepare the point-to-point field wiring diagrams for the wiring of the various types of field instruments.

   C. Reports: Demonstration of equipment report shall be submitted.

1.4 QUALITY ASSURANCE
   A. General:
      1. All instrumentation, controls, equipment, and devices provided under each contract, shall be properly connected and interconnected with other equipment and devices so as to render the installations complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Specifications or shown on the Contract Drawings.
      2. Similar or multiples of the same products shall be by the same manufacturer for uniformity on the Contract.
      3. Electrical components and equipment shall be new and shall bear the label of UL, or other nationally recognized, independent testing laboratory, wherever standards have been established and label service regularly applies.
      4. Where execution of the work under this Contract requires certain systems and equipment to be modified, the Contractor shall perform the work with due regard to maintenance of operations and construction staging in accordance with the Detailed Specifications.
      5. The modification work shall be coordinated in advance with the plant superintendent and existing conditions. Contractor shall field determine and make such investigations as required.
to determine the functionality of each circuit and identify circuit terminations as required for the modifications intended to ensure the proper interface of all components for a complete functional system.

6. The Contractor shall retain the services of a wiring coordinator, to prepare the loop drawings, Tie-in Drawings, and point-to-point field wiring diagrams. The wiring coordinator shall have experience in the development and use of the diagrams of the type specified and shall have served in a similar role on a project of similar size and complexity.

B. Area Classifications:

1. Materials and equipment for all indoor and outdoor areas shall conform to the area hazardous classifications shown on the Contract Drawings or stated in the Detailed Specifications.

2. Materials and equipment for all outdoor areas shall conform to corrosive requirements, unless shown otherwise stated on the Contract Drawings or stated in the Detailed Specifications.

3. The locations and requirements shall be in accordance with the following:

   a. Instruments, equipment, materials and incidentals installed in corrosive areas shall meet NEC and NEMA requirements for corrosive locations. Enclosures (i.e. panels) installed in corrosive locations shall meet NEMA 4X requirements and material compatibility requirements.

   b. Instruments, equipment, materials and incidentals installed in hazardous locations shall meet NEC requirements for the Class and Division designated. Enclosures installed in hazardous locations shall be provided with stainless steel hardware and watertight or gas tight gaskets.

   c. Materials, equipment and incidentals installed in dusty locations shall meet NEC and NEMA 12 requirements.

PART 2 - PRODUCTS

2.1 LOOP WIRING DIAGRAMS

A. The Contractor shall provide Instrument Loop Wiring Drawings and Loop Wiring Diagrams for all control loops. Loop wiring diagrams shall include all instrumentation and all equipment, including equipment provided by other Prime Contractors.

B. The diagrams shall be developed for hook-up and interlocks of equipment and all required instruments, inputs and outputs, and to document terminations. The Loop Wiring Drawings shall be prepared based upon vendor drawings, existing control loops, P & ID, sequences of operation, shop drawings of related Contracts, working drawings and inspections as necessary to complete the drawings. The diagrams shall include:

   1. External wiring for each instrument, piece of equipment, panel, auto valve and other devices to perform control, monitoring, or the acquisition of data. The diagrams shall include control, status, signal and power wiring. Power diagrams shall include connections to instruments, equipment, switchgear, motor control centers, panel boards, panels and field devices.

   2. Numbered terminal block and fuse block identification for each wire termination.

   3. Identification of the assigned wire numbers and color coding for all interconnections.

   4. Identification of all wiring by the conduit tag in which the wire is installed.

   5. Terminal, junction, and pull boxes through which wiring is routed.

   6. Identification of instruments, equipment, panels, terminal strips, input/output modules, and all
other terminations with functional name and number to which wiring is to be connected.

2.2 SHOP FINISHES

A. Electrical, instrumentation, and related equipment shall be shop painted and compatible with intended environment.

B. Exposed ferrous metal surfaces except aluminum, bronze, brass and stainless steel components shall be cleaned with a commercial blast and primed with one coat of rust inhibitive primer.

C. Manufactured assemblies such as control panels, substations, motor control centers, panel boards and motor controllers shall be shop painted.

D. Other equipment shall be painted with the manufacturer’s best grade finish paint system compatible with the finish coatings.

PART 3 - EXECUTION

3.1 MAINTENANCE OF OPERATIONS

A. Where execution of the work under this Contract requires certain equipment to be taken out of service, the Contractor shall perform the work with due regard to maintenance of operations and construction staging in accordance with the Detailed Specifications.

B. The Contractor shall schedule the work in advance with the Engineer so as not to affect proper plant operations. When the work is scheduled, the Engineer shall be notified 48 hours prior to proceeding with the work to allow time for the plant superintendent to perform load switching and alternation of equipment.
C. To the maximum extent possible at the end of the workday, all equipment shall be back in place and ready for its normal service use should a plant emergency arise. In addition, should an emergency condition occur during execution of the work, at the request of the plant engineer, the equipment shall be placed back in service immediately and turned over to plant personnel.

D. In the event of accidental shutdown of plant equipment the Contractor shall notify plant personnel immediately to allow for an orderly restart of affected equipment.

3.2 DEMONSTRATION OF EQUIPMENT

A. The Contractor shall demonstrate, in the presence of the Engineer, that all instrumentation loops, perform their desired functions in a safe and orderly fashion. And, that control systems, electrical systems and electrically operated equipment operates as specified, designed and as required.

B. The Contractor shall coordinate the demonstration of the electrical systems which are part of other Contracts with the other Prime Contractors.

C. The demonstration of control loops and equipment shall include the following:
   1. All power circuits shall be operated to verify proper connection to equipment. Mechanical key-interlocks for circuit breakers shall be operated to verify their proper operation. All control loops shall be powered-up and tested to verify their operation.
   2. Emergency power systems shall be activated to verify their automatic start-up, proper operation while running and proper energized state and cool-down upon availability of regular normal power.
   3. All pushbuttons, indicating lights and similar devices shall be operated to verify proper connection and function. All devices, such as pressure and flow switches and similar devices shall be operated to verify that shut-downs and control sequences operate as required.
   4. The Contractor, with coordination of the other Prime Contractors, shall operate the systems to verify wiring and adjust the controls, as required, to achieve proper operation. This shall include wiring, timing, switching functions, auto-valve modulation, equipment start and stop, and date reporting and acquisition.

D. The Contractor shall provide a Check-Out Log of all equipment. The Log shall include complete information on time, schedule, tasks performed, persons involved, problems found and corrected, and all other pertinent information.

3.3 RESTORATION

A. The Contractor shall field paint after installation marred or scratched surfaces. All scratches, abrasions and other damage to instrumentation, control, panels and equipment shall be touch-up painted.

END OF SECTION 27 01 00
PART 1 SYSTEM DESCRIPTION

1.1 WORK INCLUDED

A. The Contractor shall be responsible for providing all labor, materials, equipment, and
incidentals necessary to perform and coordinate the check-out, start-up, commissioning, and
field testing of all and every component of the Control System.

B. The Contractor shall retain the services of the System Integrator to supervise and/or perform
check-out and start-up of all system components. As part of these services, the System
Integrator shall include for those equipment items not manufactured by him the services of an
authorized manufacturer's representative to check the equipment installation and place the
equipment in operation. The manufacturer's representative shall be thoroughly
knowledgeable about the installation and O&M of the equipment.

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1.2 REFERENCES

A. General electrical requirements shall comply with the latest applicable provisions and
recommendations of the following:

1. NFPA 70, National Electrical Code.
2. NFPA 70E, Electrical Safety at the Work Place
3. NEMA, National Electrical Manufacturers Association.
4. UL, Underwriters Laboratories Incorporated.
1.3 SUBMITTALS

A. Within 120 days of the effective date of the Notice to Proceed, the Contractor shall submit his plan for training. Included in the plan shall be course outlines and schedules.

B. Contractor shall submit the following information for each training course as described below, a minimum of two months in advance of any scheduled training:
   1. A detailed outline of the topics to be covered including expected duration of each topic.
   2. The name(s) and qualifications of the person(s) proposed to conduct the training.
   3. A list of all O&M Manuals, supplies, etc. to be provided to the training course attendees.

1.4 ON SITE TRAINING

A. Primary Sensors/Transducers and Field Instruments: Provide on-site O&M training by qualified representatives of the System Integrator and the equipment manufacturers prior to placing the equipment in continuous operation. Training shall be provided by the System Integrator and equipment manufacturer's representatives for a minimum of two (2) hours for each type of instrument provided.

B. Training shall accomplish the following:
   1. Provide instruction covering use and operation of the equipment to perform the intended functions.
   2. Provide instruction covering procedures for routine, preventive, and troubleshooting maintenance including equipment calibration.
   3. Explain procedures for placing the equipment in and out of operation and explain necessary actions and precautions to be taken regarding the overall Control System.

C. Control Panels: Provide on-site O&M training by the System Integrator and the equipment manufacturer's representatives prior to placing the control panels in continuous operation. Training shall be provided for a minimum of eight hours for each control panel.
   1. Training shall accomplish the following:
      a. Provide instruction covering the use and operation of the control panels and all items contained on or within the control panels.
      b. Provide instruction covering procedures for routine, preventive, and troubleshooting maintenance including device calibration.
      c. Describe the control panel's operational and functional capabilities.

D. Training following two months of regular system operations:
   1. The System Integrator shall provide three (3) days of O&M training covering all system equipment provided.
2. The training course shall be a refresher course covering the PLC control system and operator interface computer stations. The training course format and content shall be as specified above.

1.5 SYSTEM CHECKOUT AND START-UP:

A. The Contractor under the supervision of the System Integrator, and other instrument suppliers as applicable, shall perform the following:
   1. Check and approve the installation of all instrumentation components and all cable and wiring connections between the various systems prior to placing the various processes and equipment into operation.
   2. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes. Provide all test equipment necessary to perform the testing during system checkout and start-up.

B. Contractor and System Integrator shall be responsible for initial operation of the Control System and shall make any required changes, adjustment or replacements for operation, monitoring, and control of the various processes and equipment necessary to perform the functions intended.

C. Contractor shall furnish to the Engineer certified calibration reports for field instruments and control devices specified.

D. The Calibration Certificate forms shall be prepared and furnished by the Contractor. All calibration data pertinent to the individual instruments shall be provided on the calibration certificates.
   1. Each calibration certificate shall be signed and dated by an authorized representative of Contractor. Three copies of each completed certificate shall be submitted to Engineer. Receipt of any calibration certificate shall in no way imply acceptance of any work or instrument calibration.

E. Contractor shall furnish to Engineer two copies of an Installation Inspection Report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both Contractor and the System Integrator.

1.6 COMMISSIONING:

A. Following the checkout and initial operation, Contractor, under the supervision of the System Integrator, shall perform a complete system test in the presence of the Engineer to verify that all equipment and software is operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational.

B. Contractor shall submit to the Engineer a schedule and protocol for Commissioning, including a proposed start date, at least three weeks in advance. Commissioning can only begin when the following work was completed:
   1. All instruments and control panels are installed and wired.
2. O&M Manuals and a schedule for training are approved.
3. All spare parts are on site and accepted.

C. Commissioning shall include, as a minimum, the following checks:

1. All wiring shall be checked at each termination point for correct wire size, type, color, termination and wire number.
2. All instruments and devices shall be checked to verify compliance with the specifications and approved Shop Drawings. The calibration of analog devices shall be verified including the zero and span.
3. Analog wiring shall be checked for correct polarity and ground continuity at each termination point in the loop.
4. All analog loops shall be verified at each termination point at 0, 10, 25, 50, 75%, 90 and 100 percent signal levels.

D. Provide the following documentation for use during the Commissioning effort. This documentation is in addition to that included in the General and Detailed Specifications:

1. Complete panel schematic and internal point-to-point wiring interconnection diagrams.
2. Complete electrical control schematics in accordance with JIC standards.
3. Complete panel layout drawings as detailed.
4. Complete field wiring interconnection diagrams.
5. Complete instrument loop diagrams.
6. Complete Calibration Certificates for all field and panel devices which require adjustment or calibration.

E. Provide one set of Commissioning documentation for the Owner's personnel, one set for the Engineer's use, one set for field use, and the required number of sets for the Contractor's use.

F. The drawings corrected and modified during Commissioning shall form the basis for the "As-Built" record drawing requirement as specified in Division 1.

G. All Input / Output hardware and software shall be thoroughly tested to verify proper operation as an integrated system. System testing shall include, as a minimum, the following:

1. All digital inputs shall be activated at the field element to verify proper response to the status change on graphic displays, reports, and in automatic control algorithms.
2. All analog inputs shall be tested at the field transmitter over a full range to verify proper response on graphic displays, reports, and in automatic control algorithms.
3. All digital and analog outputs shall be forced to verify proper control operation.
4. Communications, including PLC / DCS data highway, computer local area network, remote I/O, and serial communications shall be tested between all components, including existing equipment.
5. Alarm displays and printing shall be tested for all analog and digital alarm points.
6. All automatic control algorithms shall be completely tested over various ranges and input conditions to verify proper operation. Graphic displays shall be observed to verify proper response to automatic control operations.

7. All historical data collection, trending, computation, totalization and reporting functions shall be checked and tested to confirm proper operation and accuracy of the data.

H. Any defects or problems found during the Commissioning effort or field test shall be corrected by the Contractor and then retested to demonstrate proper operation.

I. Provide Operational Availability Demonstration (OAD) following the testing and demonstration of all system functions for continuous 48 hours. The OAD specified below shall not begin until the all Facility I&C system proven bug free for continuous 48 hours and Owner and Engineer agree that the OAD can begin.

1.7 OPERATIONAL AVAILABILITY DEMONSTRATION:

A. Operational Availability Demonstration (OAD) shall begin following completion of field testing, Commissioning, and the 48 hour proving run as specified above and shall continue until a time frame has been achieved, wherein, the system (both hardware and software) availability meets or exceeds 99.7 percent for 60 consecutive days and no system failures have occurred which result in starting the OAD over again. During the OAD the system shall be available to plant operating personnel for use in normal operation of the Facility.

B. For the purpose of the OAD, the system will be defined as consisting of the following systems and components:

1. All Graphic displays
2. PLC/DCS Data Highway communications system and computer local area network
3. All PLC/DCS system components including processors, communications modules, and I/O modules.
4. Single Loop Controllers
5. Local Area Control Panels (LCP)
6. Primary Sensors/Transducers and Field Instruments
7. Analytical Instruments

C. The conditions listed below shall constitute system failures which are considered critical to the operability and maintainability of the system. The OAD shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 60 consecutive day OAD shall begin.

1. Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.
2. Recurrent type hardware or software problems, if the same type of problem occurs three times or more.
3. Software problem causing a PLC processor to halt.
D. The following conditions shall constitute a system failure in determining the system availability based as specified below:

1. Failure of any of the PCP components
2. Loss of communications with devices on the data highway or local area network.
3. Failure of one or more I/O components.
4. Single Loop Controllers
5. Primary Sensors/Transducers and Field Instruments.

E. Time to repair shall be the period between the time that the Contractor is notified of a system failure and the time that the system has been restored to proper operation in terms of hours, minus an allowance for the following dead times which shall not be counted as part of the time to repair period.

F. All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by the Contractor at no additional cost to the Owner. If parts are obtained from the required plant spare parts inventory, they shall be replaced to provide a full complement of parts as specified.

G. Malfunction/Repair Reporting Form shall be completed by the plant personnel and/or Engineer to document failures, to record Contractor notification, arrival and repair times and Contractor repair actions. Format of the form shall be developed by the Contractor and approved by the Engineer prior to the start of the Field Test.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 27 02 00
SECTION 27 07 60  
LABELING, TAGGING AND IDENTIFICATION OF  
CONTROL PANELS, AUTO VALVES, AND FIELD INSTRUMENTS

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Requirements for providing labeling, tagging, and identification. Labeling, tagging and identification shall be provided in accordance with the requirements specified under this section, the Detailed Specifications and the Contract Drawings.

B. The labeling and identification shall be provided for the identification of equipment, control panels, junction boxes, termination panels, auto valves, field instruments and control and power cables and conduit. The work shall include providing all tags, labels, signs, nameplates, markers and signs for all panels, instruments and equipment furnished under this Contract.

C. The following index of this specification is included for convenience:

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1.2  RELATED SPECIFICATIONS

A. General Specification 15076- Piping and Equipment Identification
B. General Specification 16121- Electric Wire and Cable
C. General Specification 16131- Electric Conduit System

1.3 REFERENCES

A. Labeling and identification shall comply with the latest applicable provisions and recommendations of the following:
   1. NFPA 70 - National Electrical Code.
   2. OSHA - Occupational Safety and Health Act.
   3. Plant operational practices and safety procedures.

1.4 SUBMITTALS

A. Contractor shall submit working drawings, shop drawings, tag and label lists, and material specifications for the approval of the Engineer.

B. Working Drawings:
   1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.
   2. Submit signs, nameplates and other labeling and identification devices proposed for use with specifications and other data required to demonstrate compliance with the specified requirements.

1.5 QUALITY ASSURANCE

A. All labeling and identification signs and name plates shall be provided in accordance with the Electrical Code and OSHA.

1.6 DELIVERY, STORAGE AND HANDLING

A. The labeling and identification devices shall be delivered, stored and handled in accordance with the Detailed Specifications and the manufacturer’s recommendations.

PART 2 PRODUCTS

2.1 INSTRUMENT AND VALVE TAGS

A. All field instruments and valves, except small (i.e. ½” and smaller) instrument isolation valves, are to have tags.
B. Tags are to be made of lamacoid, stainless steel, or other permanent type material.
   1. Block lettering of a size called-out on the drawings, or mentioned elsewhere in these specifications or the contract specifications.
   2. Stainless steel tags are to have etched, raised, or stamped lettering.

2.2 EQUIPMENT NAMEPLATES

A. Equipment nameplates shall be provided in addition to the manufacturer(s) nameplate, to identify the equipment number and the items function and the equipment to which it serves.

B. Equipment nameplates shall be provided.

C. Equipment nameplates shall be laminated plastic with black letters on a white background. Nameplates for equipment identification shall have 1/2-inch high letter engravings. Nameplates for pilot device identification shall have 1/4-inch high letter engravings.

D. Nameplates for control panels, terminal panels, and control equipment cabinets shall have the following information:
   1. Panel assigned name and tag or I.D. number.
   2. Tag number or I.D. name and/or number.

E. Pull boxes, junction boxes and control stations shall have a nameplate identifying the equipment name and number.

F. Valve tags shall be fastened to the valves with stainless steel wire or stainless steel screws.

G. All control and indicating devices shall have individual nameplates identifying device function.

H. Nameplate mounting screws shall be 3/16 inch diameter, round-head, stainless steel self-tapping type. Adhesives shall not be used.

2.3 CONDUIT MARKERS AND TAGS

A. Conduit markers and tags shall be provided for the identification of the electric conduit system.

B. Conduit markers and tags shall be in accordance with General Specification 16131 - Electric Conduit System.

2.4 CABLE AND WIRE MARKERS

A. Cable and wire markers shall be provided for the identification of the electric wire and cable.
B. Cable and wire markers shall be in accordance with General Specification 16121 - Electric Wire and Cable.

PART 3 EXECUTION

3.1 INSTALLATION

A. All signs, nameplates and tags shall be installed neatly, properly and as recommended by the manufacturers.

B. Provide nameplate on front of panels to identify equipment. Nameplates shall be engraved, three-layer, laminated plastic with black letters on white background. Attach nameplates to front of NEMA 12 panels with sheet metal screws or rivets. Attach nameplates to NEMA 4X panels with two-part epoxy glue.

C. Control, signal and status wire and cable shall be identified by a unique number. The numbering system shall reflect the actual identification used in the work and shall be documented on the point-to-point wiring diagrams.

END OF SECTION 27 07 60
SECTION 27 10 00
CONTROL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for providing Control Panels. Control Panels shall be provided in accordance with the requirements specified under this section and the Contract Drawings.

1.2 SUBMITTALS

A. The Contractor shall furnish the following items from the System Manufacturer for approval prior to fabrication:

1. Layout drawings of the front of the panel showing mounting dimensions for all instruments and associated hardware.

2. Color sample illustrations on the Graphic Operator Screens: This shall include a graphic screen depicting fully functional details for each system indicated on the P&ID drawings

3. Assembly drawings shall include:
a. Details of panel fabrication including outline dimensions and locations of rear of panel mounted equipment.

b. Wiring layout.

c. Wiring and tubing interconnection diagrams.

4. Electrical wiring and termination drawings.

5. Complete bill of materials describing all panel components, including manufacturer and complete model numbers for all components.

6. Provide catalog cut sheets for all panel components.

1.3 RECORD DRAWINGS

A. Submit shop drawings as listed under Article 1.03 above plus operation and maintenance information.

1.4 DELIVERY, STORAGE AND HANDLING

A. Wrap the completed panel in polyethylene plastic and crate in a wooden shipping crate with sufficient packing to avoid damage in shipment.

B. Support the base of the shipping crate with the cross members of sufficient strength and clearance to allow movement of the entire crated panel by fork lift truck.

1.5 SPARE PARTS

A. Provide a copy of the software program of the graphic operator interface touch screen panel. The program shall be of a CD disk.

PART 2 PRODUCTS

2.1 ENCLOSURE

A. Provide wall mounted, stanchion mounted, free standing, or walk-in enclosures as scheduled.

B. Provide NEMA 12 enclosures for control panels located indoors and NEMA 3R for outdoor locations (except walk-in) unless otherwise noted.

C. In all NEMA 3R enclosures, provide a thermostat controlled space heater and corrosion inhibitor blocks. Provide NEMA 4X rated devices on front of enclosure or mount devices on interior panel and provide door mounted tempered glass or polycarbonate viewing window.

D. Free standing enclosures are a minimum of 20-inches deep.
E. NEMA 12 and general purpose steel enclosures shall be fabricated from a minimum 14 gauge steel, unless noted otherwise, with all seams ground smooth, all corners rounded, and all flat surfaces smooth with no ripples, dimples, or surface imperfections and no screws, bolts, or nuts visible from outside. Provide panel stiffeners as required to provide a rigid, non-bowling surface. Thoroughly clean and degrease the steel shell before painting. Apply one coat of a rust inhibiting primer and two coats of air dry enamel or acrylic with flattening agent to produce a smooth semi gloss finish. Colors are to be chosen by the Engineer.

F. Install a continuous hinged front access door. For free standing enclosure, furnish a three point latch. A single point latch is acceptable for wall mounted enclosures. Wire door mounted instruments and controls to stationary components with suitable flexible connections and protection where wiring crosses the hinge. Provide double or multiple doors as required for stability and smooth mechanical operation.

G. Terminate all tubing and electrical connections at the bottom of the panel to bulkhead fittings and terminal strips, with all external connections properly identified for field connections.

H. For panels with 120 VAC power supply, provide appropriately sized circuit breaker, single pole, 22,000 AIC, mounted in the rear of the panel to disconnect power. Mount an engraved nameplate (white letters, red background) to read "WARNING -This panel energized by foreign control power sources. Equipment will be live with panel disconnect in either on or off position."

I. Internal panel sub-feeds of 120 VAC power shall be divided into separate circuits protected by properly sized circuit breakers or fuses. The following separate circuit divisions shall be provided:
   1. Panel light(s) and panel fans (where used).
   2. Each receptacle.
   3. Power to the panel UPS (where supplied).
   4. Thermostatically controlled heaters (where supplied).
   5. Each power supply (including 24-volt power supplies, power supplies for PLCs, power supplies for fiber optic transceivers, etc.).
   6. 120-volt power to field mounted instruments (each instrument shall be provided with a separate circuit).

J. Uninterruptible Power Supply (UPS) units shall be provided to power control panels as scheduled below. As a minimum the UPS shall be equal to Best Power type 610. The UPS unit shall be located within the enclosure.

K. Provide copper ground bus bar(s) in the rear of the panel. All bus bars shall be bonded together.

M. Provide two non-isolated grounding lugs in the rear of the enclosure.

N. Provide 20 percent spare, contiguous panel/subpanel mounting area to accommodate future panel expansion, unless noted otherwise.
O. The System Manufacturer shall investigate the space allocated for control panels on the accompanying drawings and inform the Engineer of any potential problems.

P. If indicated in the control panel schedule, control panels shall be provided with a drip shield, heat shield, and/or digital display covers.

1. A 304 SS drip shield shall be provided to prevent ice buildup on the panel door, door hinges and front of panel mounted devices. Minimum overhang shall be 1-inch on the front and sides of the panel.

2. 304 SS heat shields shall be provided to prevent excess heat inside the panel. Shields shall be provided for the top, front, back and both sides of the panel. Shields shall be mounted to provide one-inch air space between the shield and the panel. Each shield shall have the same height and width as the panel side being protected. Cutouts shall be provided for access to front of panel-mounted devices.

3. A black polycarbonate cover shall be installed to cover the entire display area of each front-of-panel mounted instrument containing digital displays (LCD, LED, etc.). The cover shall prevent sunlight from shining on any portion of the display area, which shall prolong the life of the display. The cover shall be hinged on top to permit personnel to swing the cover up to view the display. All mounting hardware shall be 304 stainless steel and shall be installed in such a manner to maintain the NEMA rating of the enclosure.

Q. All indicator lights shall be LED push-to-test transformer type. In cases where it is not practical to use push-to-test indicator lights (Engineer’s approval required), then a lamp test circuit with a lamp test pushbutton mounted on the front-of-panel shall be provided. Pressing the lamp test pushbutton shall illuminate all indicator lights without interrupting control circuits.

<table>
<thead>
<tr>
<th>Lamp Colors</th>
<th>Lamp Functions</th>
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</thead>
<tbody>
<tr>
<td>Red</td>
<td>Running, Open</td>
</tr>
<tr>
<td>Green</td>
<td>Stopped, Off, Closed</td>
</tr>
<tr>
<td>Amber</td>
<td>Alarm</td>
</tr>
</tbody>
</table>

R. Provide one 120 VAC duplex receptacle and fluorescent light(s) as scheduled. Incandescent lights may be used where panel size prohibits the use of fluorescent lights. Provide one standard on-off light switch for the lights. Receptacles and lights shall be provided with a separate circuit breaker and shall be fed from the 120 VAC power supply to the panel. Receptacles and lights shall not be fed from uninterruptible power supplies.

S. All PLC discrete outputs shall have interposing relays installed in the control panel.

2.2 PANEL VIEW GRAPHIC OPERATOR INTERFACE

A. Provide MCP panel with a graphic operator interface touch screen panel. The touch screen shall allow the plant personnel to graphically view the system process and to adjust process control set points. The graphic screen shall depict each process as a system and as an individual piece of equipment. The graphic system shall follow the pattern as indicated on the P&ID drawings. The touch screen shall be password protected. The panel shall include the following:

1. Keypad-40, Keypad/Touch, Touch Color Active Matrix TFT, with a 15-inch display, (8.3 x 6.2 inch viewing area)

2. Resolution 1024 x 768, 18-bit Color Graphic
3. Battery-backup real time clock, timestamp critical data.


B. Acceptable Manufacture: Rockwell – Automation, Panel View Plus CE 1500 or approved equal.

2.3 WIRING

A. Install a minimum of #16 AWG copper stranded, 600 volt, extra flexible type for all control wiring 50 volts and above, and a minimum of #18 AWG twisted, shielded pair for analog signal conductors. All wiring shall be MTW type. Color code wires as follows:

1. Ground: Green
2. Neutral: White
3. Line Conductor (150 volts or less to ground): Black
4. Control (150 volts AC or less): Red
5. Control (150 volts DC or less): Blue
6. Interlock control circuits supplied from external power source: Yellow or pink
7. Signal, Shielded and Special Cables: Identify with wire markers

B. Mark all wires with approved wire markers at all terminations. Clearly mark all terminal blocks with typewritten or ink markings. Label all devices mounted on the steel sub panel. All instrument and control devices (current switches, MiniCAS II relay modules, etc.) located inside control panels shall have engraved lascosid nametag affixed on or near the device and shall bear the tag number and service description. Label all devices mounted on the panel front with engraved lascosid nameplates, fastened with screws, of colors chosen by the Engineer.

C. Neatly bundle and secure all wiring with plastic ties. Route back-panel wiring in slotted plastic wire ways with snap on covers.

D. Terminal blocks shall be provided for all field wiring connections to the panel. This includes shield terminals for shielded cables. Terminal blocks may be mounted horizontally or vertically and shall be easily accessed from panel door(s). Terminal blocks shall be DIN rail mounted, screw clamp, feed through type with 600 volt minimum rating. A minimum of 20 percent extra terminals shall be provided on the terminal blocks. Each terminal shall be clearly and permanently marked. Provide fused terminal blocks for all 120 VAC discrete inputs and outputs. All terminal blocks shall be suitably sized for #12 AWG (minimum) stranded wire. All terminal blocks shall be grouped apart, depending upon type of signal per Paragraph E. below.

E. AC or DC power wiring shall not run in any raceway with any type of instrument wiring. Wiring is to be divided into categories and shall be carried in separate raceways. The minimum acceptable groupings are:

1. 120 VAC, 60 Hz AC power wiring and chart drive power wiring
2. DC power to electronic instruments (does not include loop powered instruments), contact closure input and output wiring.
3. All wiring carrying pulsed information.
4. Standard range analog DC signals, thermocouple and up to 200 mV DC signals.

F. It is the responsibility of the System Manufacturer to provide appropriate protection against transients and surges for all field wiring, interfacing with the control panels. This protection equipment shall reside in the appropriate control panel. All instrument analog signal wiring, data transmission wiring, and 120 VAC power supply wiring shall be protected against lightning spikes, and other transient surges at all control panel termination points. All control power wiring, AC control power wiring, I/O cabinet discrete input wiring and discrete output wiring which is routed outside of buildings shall be protected against lightning spikes, and other transient surges at all control panel termination points. Lightning and surge devices shall protect the system from induced surges in analog, discrete and control circuitry and power supply lines. The protective devices shall not interfere with the normal operation of the panel hardware and shall be designed not to have a maximum clamping voltage in excess of what the protected device is capable of withstanding. Protection devices for all internally mounted power supplies shall be installed on individual 120 VAC supply wiring. Each surge/lightning protector shall be independently grounded to the panel ground bus. Protector mounting rail shall not be used to ground the protector.

G. The System Manufacturer shall provide required hardware and labor for termination of new signals in existing termination cabinets where required. This hardware and workmanship shall match existing work with respect to method, materials and workmanship.

H. All control panels furnished under this Section shall carry a UL label which certifies the control panel meets the requirements of UL-508A (latest revision).

2.4 ALARM HORH AND STROBE

A. Provide the MCP panel with an audible horn and an alarm strobe. The panel shall include an acknowledge and silence push-buttons.

2.5 DRAWINGS

A. Panel Construction Drawings
1. Shop Drawings and Catalog Cuts: Provide detailed shop drawings and catalog cuts for all panels, instrument racks and enclosures. Drawings shall show the location of all front panel and internal sub-panel mounted devices to scale and shall include a panel legend and bill of materials. Layout drawings shall show all major dimensions as well as elevations, in inches from the base up, of all rows of components.
2. The panel legend shall list and identify all front of panel devices by their assigned tag numbers, all nameplate inscriptions, service legends, and annunciator inscriptions. Tag number shall be as listed in the Specifications and Drawings.
3. The bill of materials shall include all devices including those mounted within the panel that are not listed in the panel legend, and shall include the device tag number, description, manufacturer, and complete model number.

B. Panel Wiring Diagram

1. Programming capabilities shall include the ability to alert the programmer to provide complete terminal identification of all external primary elements, panels and junction boxes that interface directly to the panel wiring being shown. Polarity of analog signals shall be shown at each terminal.

2. All external wiring that the electrical contractor must provide and wire shall be shown as a dashed line. Special cables that are provided with the instrument shall be clearly identified.

3. Panel wiring diagrams shall identify wire numbers and types, terminal numbers, and tag numbers. Wiring diagrams shall show all circuits individually; no common diagrams will be allowed.

4. Provide panel power wiring diagrams for all panels. The diagrams shall include the grounding requirements.

2.6 CONTROL PANEL SCHEDULE

<table>
<thead>
<tr>
<th>PANEL NO.</th>
<th>MOUNTING TYPE*</th>
<th>ENCLOSURE RATING</th>
<th>LIGHT/RECEPTACLE</th>
<th>UPS</th>
<th>COMMENTS</th>
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<tr>
<td>Main Control Panel</td>
<td>Free Standing</td>
<td>NEMA 3R</td>
<td>Yes/Yes</td>
<td>Yes</td>
<td></td>
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<tr>
<td>LCP Compressor</td>
<td>Skid Mounted</td>
<td>NEMA 3R*</td>
<td>Yes/Yes</td>
<td>Yes</td>
<td>Supplied by Compressor</td>
</tr>
<tr>
<td>LCP Compressor</td>
<td>Skid Mounted</td>
<td>NEMA 3R*</td>
<td>Yes/Yes</td>
<td>Yes</td>
<td>Supplied by compressor</td>
</tr>
<tr>
<td>LCP Dryer</td>
<td>Skid Mounted</td>
<td>NEMA 3R*</td>
<td>Yes/Yes</td>
<td>Yes</td>
<td>Supplied by dryer</td>
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<tr>
<td>LCP Dispenser</td>
<td>Skid Mounted</td>
<td>NEMA 3R*</td>
<td>Yes/Yes</td>
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<td>Supplied by dispenser</td>
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<td>LCP Dispenser</td>
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<td>NEMA 3R*</td>
<td>Yes/Yes</td>
<td>Yes</td>
<td>Supplied by dispenser</td>
</tr>
</tbody>
</table>

* If enclosure is located in a hazardous classified area the enclosure will be rated for outdoor use and be rated for use in the classified area in which it is located.
PART 3 EXECUTION

3.1 TESTING AND CALIBRATION

A. Thoroughly shop test the completed panel. Confirm that all lamps burn. Remove, box and label all parts that may come loose or detached in shipment, so that after installation, they may be easily replaced.

B. Perform preliminary calibrations in the fabricator's shop, and final calibrations at start-up by qualified personnel.

END OF SECTION 27 10 00
SECTION 27 12 10
INSTRUMENTATION AND CONTROLS WIRES AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for providing instrument signal cables, control wires, and fiber optic cables; Instrument signal cables, control wires and fiber optic cables shall be provided in accordance with the requirements specified under this Specification, the Specifications and the Contract Drawings.

B. The instrument signal cables, control wires and fiber optic cables are to be shall include all accessories and terminations.

1.2 REFERENCES

A. Electric wires and cables shall comply with the latest applicable provisions and recommendations of the following:
   1. NFPA 70 - National Electrical Code.
   3. All fiber optical cables shall be constructed in accordance with EIA-455

1.3 SUBMITTALS

A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer.

B. Catalog Data: Catalog data on fiber-optic cable, termination devices, patch panels, Breakout enclosures splice kits, pigtails, and fan-outs where applicable. Product Data sheets shall include the manufacturer's name and catalog number for each Item, the manufacturer's descriptive literature, catalog cuts, and any power supply requirements.

C. Working Drawings:
   1. Prior to equipment submission, a list of proposed manufacturers shall be submitted with the products they produce proposed for the contract.
   2. Manufacturer's Literature, specifications and engineering data for the electric wires and cables and accessories. Including:
      a) Minimum bending radius, in inches.
      b) Minimum pulling temperatures at which cable may be pulled without damage.
      c) Maximum pulling tensions which may be applied to the cable without damage.
      d) materials and methods which Contractor proposes to use.
      e) Manufacturer's recommended pulling lubricants.
D. Reports:
1. Shop and field test reports shall be submitted.
2. Acceptance testing report shall be submitted.

1.4 QUALITY ASSURANCE

A. General:
1. All cables and wires shall be made by an approved manufacturer, and in their construction shall be employed the most improved commercial materials and processes of manufacture.
2. Only electrical wiring manufactured under high standards of production and meeting the approval of the Engineer shall be used. Friction tape shall have been tested in accordance with ASTM D69.
3. Fiber Optic Cable manufacture shall be ISO9001 certified and registered.

B. Field Tests:
1. Electric wires and cables shall be field tested. Field testing for 600 volt and below wires and cables shall be in accordance with the requirements specified under Article 3.04.
2. Every field wire is to be checked for continuity, and the results logged.

C. Wire numbers shall be used to identify and track installation and testing.
3. Fiber Optic Cables: A transmission test shall be performed with the use of a 1310 and 1550 nm stabilized light sources and 1310 nm/1550 nm power meters for SMF. This test shall be conducted in both directions on each fiber of each cable.

1.5 DELIVERY, STORAGE AND HANDLING

A. Electric wires and cables shall be delivered, stored and handled in accordance with the Specifications and the manufacturer’s instructions.

PART 2 PRODUCTS

2.1 300 VOLT INSULATED CABLE

A. 300 volt insulated cable shall be used for all instrumentation and communication circuits. The size and quantity of 300 volt insulated cable shall be as indicated in the conduit and cable schedule.

B. Instrumentation cable shall be in accordance with the following:
1. Conductors shall be stranded, tinned coated copper, No. 16 AWG minimum size. All conductors shall be polyethylene insulated and twisted in pairs with an aluminum-mylar shield overlapped.
2. The cable shall include an outer jacket. Jacketing shall be neoprene, chlorosulfonated polyethylene (hylapon), chlorinated polyethylene or flame retardant 105 degree C polyvinyl chloride.
3. Instrumentation cable shall be by Okonite Company, Belden Company or equal to be
C. Communication and Fire Alarm Cable shall be in accordance with the following:
   1. Conductors shall be stranded, tinned coated copper, No. 18 AWG minimum size for fire alarm cable and No. 24 AWG for communication cable. Insulation shall be polyethylene. Where specifically shown on the Contract Drawings or stated in the Specifications, communication system conductors shall be twisted shielded cable.
   2. The cable shall include an outer jacket. Jacketing shall be neoprene, chlorosulfonated polyethylene (hypalon), chlorinated polyethylene or flame retardant 105 degrees C or polyvinyl chloride.
   3. Fire Alarm Cable shall be UL listed, made of Teflon and approved by the New York City Building Department, Materials and Equipment Acceptance Division.
   4. Communication and Fire Alarm Cable shall be by Cablec Continental Company, Belden Company with Beldfoil shielding or equal to be approved by the Engineer.

2.2 600 VOLT INSULATED WIRE AND CABLE

A. 600 volt insulated wire and cable shall be used for all 600 volt and below power, lighting, control and alarm circuits. The size and quantity of 600 volt insulated wire and cable shall be as indicated in the conduit and cable schedule.

B. Security system cables shall be 600 Volt insulated. Minimum size conductors for the security system shall be No.22 AWG. Where specifically shown on the Contract Drawings or stated in the Specifications, security system shall use twisted shielded cable or coaxial type cable.
   1. Conductors shall be soft or annealed tinned coated copper with concentric-lay Class B round stranding in accordance with the current ASTM Standard B 8 and B 33.
   2. The cable insulation system shall include two separate shield layers and the primary insulation.
   3. Conductor Shield: The conductor shield shall consist of an Aluminum/Polyester tape overlapped to provide 100% coverage.
   4. Cable shall be Series 83 as manufactured by Ideal Industries. Connectors shall also be by Thomas and Betts, Burndy or equal approved by the Engineer.

2.3 FIBER OPTIC CABLE

A. Optical Fiber Characteristics:
   1. All fibers in the cable must be usable fibers and meet required specifications.
   2. Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be matched clad design.
   3. Provide multimode and/or single mode, optical glass fiber compatible with LED or laser based transmission systems as specified herein.

B. The multimode fiber utilized in the optical fiber cable shall meet EIA/TIA-492AAAB, "Detail Specification for 50-μm Core Diameter/125-μm Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers."

C. Acceptable Manufactures
   1. Corning Cable Systems Corp.
   2. CommScope
3. Belden Cable

D. Geometry
1. Core Diameter (μm) 50.0 ± 3.0
2. Core Non-Circularity ≤ 5%
3. Cladding Diameter (μm) 125.0 ± 2.0
4. Cladding Non-Circularity ≤ 1.0%
5. Core-to-Cladding Concentricity (μm) ≤ 1.5
6. Coating Diameter (μm) 245 ± 5
7. Colored Fiber Nominal Diameter (μm) 253 – 259

E. Optical
1. Cabled Fiber Attenuation (dB/km): 850 nm - ≤ 3.5, 1300 nm - ≤ 1.5
2. Point discontinuity (dB): 850 nm - ≤ 0.2, 1300 nm - ≤ 0.2
3. Cabled Effective Modal Bandwidth1) (MHz•km): 850 nm > 510
4. IEEE 802.3 GbE Distance (m): 1000BASE-SX Window (850 nm) 1000BASE-LX Window (1300 nm) up to 600
5. OFL Bandwidth (MHz•km) 850 nm - > 500, 1300 nm - > 500
6. Numerical Aperture 0.200 ± 0.015

F. Riser Cables
1. Riser cables up to 24 fibers: In cables with more than one fiber, the fibers shall be stranded around a dielectric member and surrounded by layered aramid yarns. The aramid yarns shall serve as the tensile strength member of the cable. A ripcord may be applied between the aramid yarns and the outer jacket to facilitate jacket removal. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection.

2. Riser cables with more than 24 fibers: The buffered fibers shall be grouped into six fiber subunits. In each subunit, the individual fibers shall be stranded around a dielectric central member and surrounded by layered aramid yarns. A ripcord shall be incorporated in the subunit design to facilitate access to the individual fibers. The subunit jacket shall be extruded over the aramid yarns for additional physical and environmental protection. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the units for physical and environmental protection.

G. Cable Identification
1. The individual fibers shall be color coded for identification. The optical fiber color coding shall be in accordance with EIA/TIA-598, “Color Coding of Fiber Optic Cables.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color coded buffered fibers shall not adhere to one another. When fibers are grouped into individual units, each unit shall be numbered in the unit jacket for identification. The number shall be repeated at regular intervals.

2. The outer cable jacket shall be marked with the manufacturer’s name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential
H. Fiber Cable Terminations

1. General
   a. Patch panels shall be suitable for panel mounting, comprised of internal mounting plate, cable holders, slack cable take up/organizer blocks, patch block with connectors, and ground lugs. Panels shall be NEMA 4X, 316 stainless steel construction for outdoors; and NEMA 12, 316 stainless steel or fiberglass for indoor use. Patch panels shall be suitable for multimode and single mode systems operation at 800 and 1300 nanometers. Patch panels shall be suitable for ST or LC connectors. The patch panels shall be sized to handle the number of fibers as required. All fibers shall be terminated in the patch panel.

2.4 SHOP TESTS

A. Certified Shop Tests:
   1. Shop testing shall be performed on the wire and cable at the manufacturer's plant prior to shipment. Shop test shall be in accordance with the latest revisions of ICEA and UL and shall demonstrate that the wire and cable tested conforms to the requirements specified.
   2. The Contractor shall provide a shop test report. The report shall identify the tests performed and the results obtained.
   3. All low voltage wire and cable shall be shop tested in accordance with the requirements of Underwriters’ Laboratories.

PART 3 EXECUTION

3.1 GENERAL

A. All cables and wires shall be installed within the raceways as shown on the Contract Drawings. They shall be carefully handled so as to avoid twists or kinks in the conductors or damage to the insulation.

B. The Contractor shall ensure that the manufacturer’s recommended cable bending radii and pulling are not exceeded and that the number of conductors permitted in a conduit are in accordance with the latest applicable section of the City of New York Electrical Code.

C. No splicing of instrument wiring shall be permitted. Instrument wiring shall be extended by use of field termination boxes employing labeled terminal strips. Shield continuity shall be maintained. Ultimate shield termination (ground) shall be at one end only.

3.2 INSTALLATION OF WIRING

A. Cables shall be installed complete with proper terminations at both ends. For each motor circuit, Contractor shall ensure proper phase sequence and motor rotation.

B. Wire and cable contained within a single conduit shall be pulled simultaneously using insulating pulling compounds containing no mineral oil.
C. Pulling tension on medium voltage cables shall be continuously monitored using a calibrated Dynamometer type device, having a calibration label within six months of its use.

D. Cables shall be installed with maximum slack at all terminal points, boxes, handholes and manholes.

3.3 CONDUCTOR IDENTIFICATION

A. Each wire shall be labeled at each termination points and all splice locations. Carry individual conductor or circuit identification throughout, with circuit numbers or other identification stamped on terminal boards when provided or the cable so it is visible around the cable's circumference.

B. Each wire shall be identified in junction boxes, cabinets, and terminal boxes. Where no termination is made, use a plastic-coated, self-adhesive, wire marker. Where termination is made, use a plastic, pre-printed sleeve wire marker. Paper, self-adhesive wire markers shall not be used.

3.4 FIELD TESTING

1. Shielded instrumentation cable shields shall be tested with an ohmmeter for continuity along the full length of the cable and for shield continuity to ground.

2. Connect Shielded instrumentation cables shall be connected to a calibrated 4-20 milliamp DC signal transmitter and receiver. Test at 4, 12, and 20 milliamp transmitter settings.

3. New cable failing the test shall be replaced and retested.

4. Provide all material, equipment, and labor to test and integrate the fiber optic cables. Installation shall comply with EIA/TIA Standards 568 and 569. Fiber optic cables shall be continuous from component to component. Intermediate fiber splices shall not be allowed.

5. The Contractor shall provide an acceptance testing report. The report shall be in accordance with NETA, ATS Acceptance Testing Specification.

END OF SECTION 27 12 10
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for providing Programmable Logic Controllers. Programmable Logic Controllers shall be provided in accordance with the requirements specified under this section and the Contract Drawings.

1.2 RELATED SPECIFICATIONS

A. None

1.3 REFERENCES

A. Programmable Logic Controllers shall comply with the latest applicable provisions and recommendations of the following:

1. NFPA 70 - National Electrical Code.
2. NFPA 70E - Electrical Safety at the Work Place.
3. NEMA - National Electrical Manufacturers Association
4. UL - Underwriters Laboratories Inc.

1.4 SYSTEM DESCRIPTION

A. This Section covers the technical requirements for programmable logic controllers (PLC) that will receive discrete and analog inputs, and through the use of an internal ladder logic program, control output relay operations and perform data handling functions.

B. The capabilities of the individual PLC's shall be as required to perform the control functions associated with the particular control panel or system.

C. The System Manufacturer shall determine the actual amount of memory and I/O requirements necessary for each new and existing control panel to function as specified or shown on the Drawings. Each processor shall have 50 percent spare memory capacity (not less than 1K). Where rack type PLCs are used in new control panels, each rack shall have a minimum of 10 percent spare I/O points per type (but not less than four discrete inputs, four discrete outputs, two analog inputs and two analog outputs) and a minimum of 25 percent spare slots (not less than two). The above is true for existing control panels, however, when available space within an existing control panel prohibits the inclusion of spares, the requirement shall be waived.

1.5 SUBMITTALS
A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Engineer in accordance with the requirements of the General Conditions, Article 4 - Contractor's Working Drawings, Design and Shop Drawings; and as specified under Division 1 of the Detailed Specifications.

B. Working Drawings:
   1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.
   2. Manufacturer's technical information which shall include:
      a. Dimensional information and construction details of enclosures. Enclosure details shall consist of exterior and interior front door with nameplate legends, interior door front and rear views and terminal block layout.
      b. Technical specifications.
      c. Catalog cuts.
   3. Description of shop and field testing methods and procedures, and apparatus with calibration dates shall be submitted. Testing methods and procedures shall be submitted at least 45 days in advance prior to conformation of witness testing dates and actual testing.
   4. Qualifications of proposed service firm who will perform the service and maintenance agreement. Five recent references with phone numbers shall be submitted.

C. Operation and maintenance manuals shall be submitted in accordance with the Detailed Specifications.

1.6 QUALITY ASSURANCE

A. General:
   1. Programmable Logic Controllers shall be designed, built and tested in accordance with the latest applicable editions of ANSI/IEEE, NEMA, UL, and NFPA. The Programmable Logic Controllers shall be UL or ETL listed.
   2. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the U.S. National Institute of Standards and Technology.

B. Field Tests:
   1. The Programmable Logic Controllers shall be field tested. Field testing shall be performed in accordance with the requirements specified under article 3.02.
   2. Retain the services of the Programmable Logic Controllers manufacturer for field service. Field service shall be in accordance with the requirements specified under Article 3.03.

1.7 DELIVERY, STORAGE AND HANDLING
A. Programmable Logic Controllers equipment shall be delivered, stored and handled in accordance with the Detailed Specifications, the manufacturer's instructions and the following:

1. Programmable Logic Controllers equipment shall be inspected for shipping damage or loose parts when received. Evidence of water which may have entered equipment during transit shall be checked.

2. Programmable Logic Controllers equipment shall be stored in a clean, dry location in which a uniform temperature is maintained. Equipment shall be protected with coverings and air circulation shall be maintained.

3. Where dampness or condensation may be encountered, heaters shall be provided for equipment to prevent moisture damage.

1.8 SPARE PARTS

A. The Contractor shall furnish and deliver to the Engineer a list of recommended spare parts for the Programmable Logic Controllers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Programmable Logic Controllers shall be manufactured by Allen-Bradley or approved equal. B. Program development software shall be as distributed by the PLC manufacturer.

2.2 GENERAL REQUIREMENTS

A. All components in the PLC system shall be the product of a company who regularly manufactures and services this type of equipment. Wherever possible, all assemblies and sub-assemblies performing similar functions in separate controllers purchased under this Section shall be interchangeable.

B. Components: In compliance with normally recognized industry standards and regularly sold to heavy industry installations. All connecting cables shall be constructed so as to withstand, without damage, all normal use and handling.

C. The PLC system shall be of a modular design with a plug-in processing unit, input/output frames or assemblies, and plug-in peripherals. All necessary cables shall be included.

D. Mark all major assemblies, sub-assemblies, circuit cards, and devices with the manufacturer's part or identification number.

E. All components of the PLC system shall be capable of continuous operation at temperatures of 0-60 degrees C, and humidity levels of 5-95 percent.

F. Electrical supply voltage to the individual controllers shall be 115 VAC ± 10 percent, 48-63 Hz. Controller system power supplies shall have circuit breakers or fuses for overload protection.
G. Each controller, including output devices, shall orderly shut down and alarm in the event of a disruption of program execution or scan, a loss of logic power, loss of communication between controller essential devices, or a memory error. A failure of one controller shall not disrupt operation of other controllers in the system.

2.3 CENTRAL PROCESSING UNIT (CPU)

A. The CPU shall contain the following memory

1. System Memory: Electrically Erasable Non-Volatile type (EEPROM) or Lithium battery-backed RAM with minimum retention time of 2 years under worst case conditions.

2. Application Memory: Lithium battery-backed RAM with minimum retention time of 2 years under worst case conditions, or RAM with EEPROM or Nonvolatile Random Access Memory (NOVRAM) backup modules.

B. The program memory shall be capable of being expanded in the field by card exchange.

C. At least 1,024 internal storage registers shall be available for data storage. These registers shall be independent of and in addition to program storage memory.

D. Provisions shall be made for the processor to check all logic words for parity when read from memory. A parity error shall cause an immediate shutdown with alarm and visual indication.

E. Nominal memory scan time shall be no longer than 4 milli-seconds per 1K of ladder logic memory. Only the portion of memory being used shall be scanned, and the memory shall be automatically repositioned up or down when contacts and rungs are added or deleted. Service each input on every scan.

F. The system shall have the capability of servicing the I/O at any point in the user program as many times as desired during a scan. Provide the capability of not servicing the I/O during a scan if the user so chooses.

G. Software or key locking arrangement at the CPU shall prevent memory modification by unauthorized personnel.

H. The processor unit shall be expandable to a minimum of 4,000 I/O points. Any number of normally open or normally closed contacts shall then be available from these references for use in the program. Any internal coil shall be capable of assuming a relay, latch relay, one-shot, timer, or counter function.

I. The system software timers and counters shall be capable of the following:

1. Timers shall have a selectable time base of 0.01, 0.1 and 1.0 second, or 0.1 minutes. Each timer shall be capable of the maximum time preset.

2. Both up-counters and down-counters shall be available. Each counter shall be capable of a fixed preset of at least 0-999 and at least a register preset of 0-65535.

3. Presets shall be from internal constants and internal storage registers. Timers and counters shall have the capability of being reprogrammed from the keyboard, as specified below, at anytime without halting system operation.
4. Timers and counters shall be capable of causing an output relay operation, and display of the time or count through programming software.

5. Timers and counters shall be capable of using the same contact for enable and reset functions.

J. The system shall have math capability available.

1. Math functions shall be a minimum of four digit (0-9999) addition, subtraction, multiplication, division, equality, greater than, and less than. In addition, signed addition and subtraction, and floating point addition and subtraction shall be available.

2. Include capability to handle data in lists or tables. These lists shall be a minimum of 16 bits wide, with capability of a length of 255. Include a sort function with a sort capability of 192 items, and the ability to generate FIFO and LIFO stacks.

3. The system shall have matrix logic capability up to 16 x 255. Matrix logic functions shall include AND, OR, XOR, and Compare.

4. The numerical data for a math function, data list, or matrix shall be input from timers, counters, keyboard entry, and other math functions, data lists, or matrices.

5. The system shall be capable of using the results from math functions, data handling functions, and matrix functions for presets to timers and counters, and for operating system outputs and CRT displays.

K. The status of latch relays and one-shots, and all data from timers, counters, and math functions shall be retained during any power outage as specified above.

L. The system shall have the capability to conditionally skip execution of all or part of the user program.

M. The system shall be capable of performing a minimum of 16 sub-routines. These sub-routines shall be called up by a programmed instruction at any time during the main body user program.

N. The system shall have a minimum of 16 priority interrupt inputs which will cause an immediate jump to the associated sub-routine of the main body user program.

2.4 INPUT/OUTPUT (I/O) DEVICES

A. Discrete Inputs/Outputs:

1. Discrete inputs shall be available in 24 and 115 VDC/DC. Discrete outputs shall be available in 24 VDC and 115 VAC.

2. Discrete inputs shall be guaranteed if at least 78 percent of nominal voltage is present. Discrete inputs shall be guaranteed off if 20 percent or less of the nominal voltage is present.

3. Minimum isolation between input/output and logic voltage shall be 1,500 V RMS per NEMA standards via optoisolation.

4. The AC discrete outputs shall be rated at 20 amps inrush, 2 amps continuous. DC discrete outputs shall have a 2 amp rating. All outputs shall have 3 amp
normal fuse protection.

5. Each discrete input and output shall have an LED or other visible indication of on/off status.

B. ANALOG INPUTS/OUTPUTS:

1. Analog inputs shall be available in 4-20 ma, 1-5 Vdc, and 0-10 Vdc. Analog outputs shall be available in 4-20 ma, 0-10 Vdc, and -10 to +10 Vdc.

2. All of the above inputs and outputs shall have at least 11 bit resolution with an accuracy of ± 1 percent over the rated temperature range.

3. Minimum isolation between input/output and logic voltage shall be 1500 Vdc per NEMA standards via optoisolation.

4. All analog inputs interfacing with 120 VAC or 24 VDC (non-loop) powered devices shall be provided with isolated analog input modules.

5. All analog outputs shall be isolated.

C. Frames or racks for mounting all types of inputs and outputs shall be interchangeable, and inputs and outputs shall be interchangeable within the same frame.

D. All PLC terminal blocks shall be 300 V minimum NEMA rated, and accommodate no fewer than two #14 gauge wires.

E. Marker strips shall be attached adjacent to the field wiring and the status indicating lights to allow easy identification of inputs and outputs by the user. These markers shall not change when devices are replaced during repair or maintenance. Color code marker strips according to voltage.

F. Field wiring shall not have to be removed in order to replace an I/O device during repair or maintenance.

2.5 DATA PROCESSING

A. The controller system shall have the ability to perform the following data processing functions without significantly slowing down or interrupting the logic processing:

1. The controller system shall be capable of storing, displaying, and printing messages containing numerical information, including information from timers, counters, math functions, and analog functions. These messages shall contain the full range of alphanumeric characters and shall be capable of assuming user required formats. A minimum storage capacity of 64,000 characters in addition to program memory and storage registers shall be available for these messages.

2. Provide proportional, integral, derivative (PID) fixed point control with ability to solve 32 PID loops with a repetition rate of one second.

3. The controller system shall have data storage capability which will allow the storage of recipes or other information in a structured file system. The file system shall be accessible from the user program.
2.6 PROGRAM DEVELOPMENT SOFTWARE

A. Programming capabilities shall include the ability to alert the programmer to errors in order to prevent not closing logic circuits, entering non-allowable addresses or missing addresses.

B. Programming field for each rung shall be 70 elements minimum. Program changes shall be allowed element by element such as adding, deleting, or reversing (NO to NC) contacts without replacing an entire rung. It shall be possible to delete or insert entire rungs inside the program.

C. A search feature shall allow the operator to call up any contact or coil in the program by reference. The search feature shall be provided by a special pushbutton on the keyboard.

D. The controller system shall allow an operator to override inputs and outputs on or off from the development software. The override function shall be provided by a special pushbutton on the keyboard.

E. The programming device shall have "off-line", "on-line", and "monitor" modes of operation, controlled by password to provide an additional tier of security.

1. Normal programming shall be in the "off-line" mode. The PC shall not need to be connected to the control system for "off-line" programming.

2. In the "on-line" mode, the programming device shall be connected to the control system, and two-way communications shall exist between individual CPU's and the programming device. "On-line" programming shall include the ability to make program edits, upload data and download data while the CPU is running. The status of contacts and coils in the ladder logic program shall be displayed on the PC. The PC shall be able to display the current values of timers, counters, and internal registers, and the operator shall be able to modify these values through the development software while in the program display mode.

3. In the "monitor" mode the programming device shall be connected to the control system, and disabled communication shall exist from the CPU to the programming device. The programming device shall be able to read from but not write to the CPU. The status of contacts, coils, timers, counters, and registers shall be displayed on the PC, but an operator shall not be able to modify them.

2.7 PROGRAM DEVELOPMENT

A. A program development PC is not included in the project. It shall be the responsibility of the System Manufacturer to supply a PC, for their own use, for the development of the PLC program.

PART 3 EXECUTION

3.1 INSTALLATION
A. PLC equipment is to be mounted on the back panel of the local control panels, unless otherwise noted, and incorporated in the panel design by the System Manufacturer.

B. Programmable Logic Controllers equipment shall be installed so that sufficient access and working space is provided for ready and safe operation and maintenance.

C. Programmable Logic Controllers equipment shall be installed on concrete pads at locations shown on the Contract Drawings. Steel channels shall be provided for support of equipment. Equipment shall be secured to mounting surface with anchor bolts of sufficient size and number to secure equipment.

D. Install nameplates for identification of equipment.

3.2 FIELD TESTS

A. After installation, Programmable Logic Controllers shall be field tested for operation and conformance. The Contractor shall perform field tests in accordance with the Detailed Specifications.

B. The Contractor is responsible for furnishing required footage for the data highway to the System Manufacturer. Data highway conductors shall be furnished by the System Manufacturer for installation by the Contractor.

END OF SECTION 27 25 00
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for providing Transmitters, Receivers and Analytical Instruments. Transmitters, Receivers and Analytical Instruments shall be provided in accordance with the requirements specified under this section and the Contract Drawings.

1.2 SYSTEM DESCRIPTION

A. System consists of all field and panel mounted instrumentation devices as noted, complete with all necessary signal converters, isolators, amplifiers, power supplies, and other appurtenances necessary for interfacing with other components.

B. Except as noted, scale all indicators in engineering units.

1.3 SUBMITTALS

A. Submit product data.

PART 2 PRODUCTS

2.1 ALARM LIGHT - STROBE

A. Type: High-intensity strobe warning light

B. Enclosure: Corrosion-resistant, NEMA 4X, suitable for outdoor service

C. Area Classification: As required by schedule

D. Power: 120 VAC

E. Dome Color: Red, blue, or amber, as required by schedule

F. Acceptable Manufacturer: Equal to Federal Signal Corporation (LP3 Series with ½" pipe mount)

G. Schedule

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<th>Tag</th>
<th>Color</th>
<th>Area Classification</th>
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<td>MCP</td>
<td>Red</td>
<td>Non-Hazardous</td>
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2.2 ALARM HORN

A. Type: Electro-mechanical diaphragm
B. Mounting: Flush or ½” threaded conduit
C. Housing: Cast aluminum, NEMA 4X for outdoor locations
D. Diaphragm Material: Stainless steel
E. Grille Material: Die-cast aluminum
F. Power: 120 VAC
G. Sound Intensity: 100 Db at 10 feet
H. Acceptable Manufacturer: Equal to Federal Signal Corporation Model 350 (for Non- Hazardous Areas), Model 31X (for Class I, Division 1 & 2, Group D Areas)
I. Area Classification: As required by schedule
J. Acceptable Manufacturer: Equal to Federal Signal Corporation Model 350 (for Non- Hazardous Areas), Model 31X (for Class I, Division 1 & 2, Group D Areas)
K. Schedule

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<td>MCP</td>
<td>Panel, Outdoors</td>
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</table>

2.3 SURVEILLANCE CAMERA
A. Type: 360° Outdoor dome camera
B. Sensor: 5 Megapixel
C. Angle of View: 180° Hemisphere
D. Lens: 185° 1.6mm/F2.0
E. Power: IEEE802.3af Power over Ethernet (PoE)
F. Port: RJ45 for 100Base-TX
G. Mounting: Pole and Surface
H. Accessories
   1. Mounting brackets as required
   2. Outdoor Sunshield
I. Qty.: 3
J. Manufacture
1. PELCO
2. Approved Equal

2.4 PRESSURE INDICATOR

A. Type: 4 ½” Gage Pressure Indicator

B. Materials:
1. Case: 304 Stainless Steel
2. Window: Shatter Proof Glass
3. Dial: Aluminum White Background, Black Markings
4. Movement: 400 SS
5. Bourdon Tube: 316L SS
6. Socket: 316L SS

C. Process Connection: ½-14 NPT Male

D. Connection Location: Bottom

E. Pressure Range: See Schedule

F. Liquid Filled: Yes - Glycerin

G. Weatherproof Hermetic Seal

H. Acceptable Manufacturers:
1. Ashcroft 45 1009 S L 04 L XSG XLJ
2. US Gauge
3. Approved Equal

I. Schedule

<table>
<thead>
<tr>
<th>Tag</th>
<th>Calibrated Range</th>
<th>Chemical Seal</th>
<th>Pulsation Dampener</th>
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<td>PI-100A</td>
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<tr>
<td>PI-100B</td>
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2.5 PRESSURE TRANSMITTER
A. Type: Gage Pressure Transmitter

B. Materials:
1. Process Connection Wetted Parts: 316L SST
2. Isolating Diaphragm: 316L SST
3. Housing: Aluminum

C. Process Connection: ½-14 NPT Female

D. Transmitter Output: 4-20 mA

E. Pressure Range: See Schedule

F. Sensor Fill Fluid: Silicone

G. Options
1. LCD Display
2. Transient Protection Terminal Block
3. FM Certification Explosion-proof, Dust Ignition-proof

H. Acceptable Manufacturers:
1. Rosemount 3051
2. IGP20, as manufactured by Foxboro Company
3. Model 621T EN as manufactured by ABB
4. Approved Equal

I. Schedule

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<th>Tag</th>
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<th>Calibrated Range</th>
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</tr>
</tbody>
</table>
PART 3  EXECUTION

3.1 INSTALLATION

A. Locate field instruments so they are accessible for maintenance and orient so that indicators are readily visible. Unless otherwise indicated, mount instruments 36 to 60-inches above work surface. Provide 2-inch diameter, 304 stainless steel, Schedule 10 pipe welded to a 10-inch square by 1/4-inch thick stainless steel base plate for support unless wall or other mounting arrangement is indicated. Space instruments at least 1/2-inch off concrete walls by stainless steel channels or phenolic spacers.

B. Provide stainless steel sun screens or shades for all electronic instruments located outdoors.

C. Provide stainless steel identification tags attached with stainless steel wire or screws for all field instruments.

3.2 TESTS AND CALIBRATION

A. Perform continuity and insulation resistance tests on instrumentation conductors in accordance with Electrical Sections.

B. Calibrate each instrument to its published accuracy. Submit calibration sheets including the instrument tag number or name, the date, name of individual performing calibration, procedures and equipment used, and results obtained.

END OF SECTION 27 30 00
SECTION 27 95 00
INSTRUMENT INSTALLATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section includes details of fabrication and installation for certain instrumentation hardware items.

B. The following index of this Specification is presented for convenience:

PART 2 PRODUCTS

2.1 INSTRUMENTATION HARDWARE

A. Refer to Instrument Installation Details drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install and align instruments in accordance with vendor instruction manuals and the attached Installation Details. Locate all field instruments to be accessible for maintenance.

B. Install all field mounted instruments having indicators or recording charts to make the scale or chart visible from the adjacent operating area. Rotate indicating portions of instrumentation where necessary to improve visibility from operating area.

C. Provide sufficient clearances for access and instrument servicing to include dismantling of the instrument.

D. Space instruments at least 1-inch off walls using stainless steel channels.

E. Mount all field instruments securely using manufacturer mounting yoke when furnished, on a pipe stand to ensure a rigid, vibration free installation.

F. Locations of instruments shown on the Drawings are approximate. The Contractor may, at the Contractor's discretion, relocate instruments to more appropriate positions within five feet of the location shown on the Drawings. If the Contractor needs to move a particular instrument more than five feet from its designated location, the Contractor shall obtain prior approval from the Owner.

G. Provide and install any necessary tubing raceways, supports and tie downs. Tubing raceways and supports shall be of stainless steel construction.

H. Install tubing and fittings necessary to assure proper instrument operation in a neat, professional manner. Tubing shall be connected to the field instrument in such a manner as to eliminate stress on the field instrument.

END OF SECTION 27 95 00
SECTION 31 00 00
EARTHWORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary for the following:

1. Site clearing.
2. Earth moving and excavation.
4. Rough and Finish Grading.
5. Backfilling.
7. Compacting.

B. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS


C. American Society for Testing and Materials

2. ASTM D698(2012e1) Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft.)
6. ASTM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil, and Rock by Mass
7. ASTM D2487(2011) Standard Practice for Classification of Soils for Architecting Purposes (Unified Soil Classification System)
8. ASTM D2922-05 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
9. ASTM D2937-2010 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
10. ASTM D3017-05 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Test Reports: Testing laboratory will submit the following reports directly to the Architect and shall copy the Contractor:
   1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and borrow materials.
   2. Verification of each footing subgrade.
   3. In-place density test reports.
   5. Compressive strength or bearing test reports.

B. Maintenance Recommendations of Arborist.

C. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the Work. Change of source requires Design Professional approval.

1.4 QUALITY ASSURANCE

A. Testing Laboratory Services: The Architect will secure and pay for the services of a Testing Agency to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing.

B. Coordinate and schedule in a timely manner with the Testing Agency the following quality control items:
   1. Obtain samples of the structure fill from the borrow site.
   2. Determine particle size, liquid limit, plastic limit, plasticity index and maximum density of each type of soil.
   3. Observe proofrolling.
   4. Perform a sufficient number of field density tests to verify compaction and structural fill.
   5. Verify the foundation bearing capacity.
   6. Verify quantities of material removed and quantities of material placed where Unit Prices are involved.

1.5 PAYMENT

A. Earth Excavation: Removal, reuse, and disposal of earth and other naturally occurring or man-made materials encountered other than materials classified as rock or unnecessary excavation. The cost of earth excavation shall be included in the cost of general construction.
1.6 SITE CONDITIONS

A. Traffic: Do not interfere with or close public ways without permission of governing authorities.

B. Ground water may be encountered during the foundation excavation. Provide a system for controlling the ground water to a level at least 3 feet 0 inches below the lowest point of the excavation.

C. Existing Site Utilities:

1. Advise utility companies of excavation activities before starting excavations. Contractor shall enlist the services of a locating company to locate and identify all underground utilities passing through work area before starting work.
2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Architect immediately for directions. Cooperate with Architect and/or utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Architect and Utility Company.
3. Protect existing utilities indicated to remain.
4. Do not interrupt existing utilities without advance notice to and written approval from the Architect.
5. Repair damaged utilities to satisfaction of utility company, at no additional cost to the Owner.
6. Demolish and completely remove from the site all existing underground utilities indicated on the Contract documents to be removed. Coordinate with utility companies for shut-off of services if lines are active.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For each soil material proposed for use as fill or backfill, whether obtained on or off site, testing laboratory shall classify soil material, develop Proctor curve, and perform any other tests required.

B. Obtain approval of the Architect for each soil material.

C. Topsoil: Friable clay loam surface soil.

D. Satisfactory Topsoil: Fertile agricultural soil, typical for locality, capable of sustaining vigorous plant growth; free of subsoil, rocks larger than 1 inch in diameter, clay, toxic matter, plants, weeds, and roots.

E. Fill Materials: Materials classified as satisfactory.

F. Unsatisfactory Soil Material ASTM D2487-2011:

1. OL (organic clay).
2. OL (organic silt).
3. CH (fat clay).
4. MH (elastic silt).
5. OH (organic clay).
6. OH (organic silt).
7. PT (peat).

G. Backfill: (Defined as - All fill placed 18 inches immediately under slabs on grade). Material for backfill shall be sound and free draining, such as sand, gravel or crushed stone with less than 5% passing the No. 200 sieve. Maximum diameter shall be 1-1/2 inches.

H. Structural fill: (Defined as - All fill under buildings or pavement except where defined as backfill). Material for structural fill shall be silty sand, clay, silty clay, or sandy clay with a plasticity index of less than 30. Maximum particle size shall be less than 6 inches in mass graded areas. The testing agent shall approve all materials used for structural fill.

I. Capillary Water Barrier: Clean, crushed rock or gravel or uncrushed gravel; 100 percent passing a 1-1/2-inch sieve; not more than 20 percent passing a No. 4 sieve, and not less than 5% passing the No. 200 sieve.

J. Aggregate Fill within Tree Drip Line: Clean, crushed rock or gravel or uncrushed gravel; 100 percent passing a 1-1/2-inch sieve; not more than 2 percent passing a No. 4 sieve.

K. Subbase Material: Well-graded, clean, sound, durable particles of crushed stone, crushed blast furnace slag, or crushed gravel, and screenings. Obtain the Architect's approval of source, quality, and gradation. Electric arc furnace slag and reprocessed or crushed concrete shall not be used as subbase material.

L. Filter/Drainage Fabrics:
   1. Contech Construction Products C-40NW.
   4. Amoco Fabrics and Fibers 4545.


PART 3 - EXECUTION

3.1 PREPARATION

A. Stripping Topsoil:
   1. Strip areas to be occupied by buildings, pavements, areas to be filled, and all areas to be impacted by construction activities. Strip topsoil to subsoil depth. Strip only materials that conform to the topsoil specification above.
   2. Stockpile topsoil on site, located where it will not interfere with the work.

B. Re-spr eding Topsoil: Elsewhere in Division 31.

C. Protection: Provide markers indicating limits of work and clear identification of items and areas requiring protection.

D. Provide barricades, warning signs, and warning lights around open excavations as
necessary to prevent injury to persons.

E. The Contractor is solely responsible for determining the potential for injury to persons and damage to property.

1. Where such potential is present, take appropriate protective measures.
2. Protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

F. Do not allow excavation subgrades and soil at foundations to be subjected to freezing temperatures or frost. Provide protective insulating materials as necessary. Should prepared, compacted subgrades be damaged by freezing, remove soil materials to the depth required by the Architect and replace and recompact in conformance with specified requirements.

3.2 EROSION CONTROL

A. To the maximum extent practicable, prevent erosion or displacement of soils and discharge of soil-bearing water runoff to adjacent properties and waterways.

B. Provide erosion control during the entire project in accordance with the “Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas.”

C. See Temporary Erosion and Sediment Control elsewhere in Division 31.

3.3 PROTECTION OF TREES

A. Provide temporary guards to protect trees and vegetation to remain. Place guards so as to prevent all forms of vehicular traffic or parking within drip lines.

1. Do not allow excess foot traffic within drip lines.
2. Do not stockpile construction materials, soil, or aggregates within drip lines.
3. Water trees and other vegetation to remain within limits of the area of construction activities as required to maintain their health during the course of construction operations.

B. Engage a qualified arborist to remove branches or roots to the extent required by this specification or shown on the contract documents.

C. Excavate within drip line of trees only where indicated.

D. Where underground utilities must pass within drip line, hand-dig tunnels to avoid cutting main lateral roots and taproots. Minor roots may be cut only when necessary.

E. Where excavation must occur within drip line, hand excavate to avoid damage to roots. Minimize over-excavation by providing sheeting in lieu of sloped embankments.

1. Reestablish exposed roots in areas to be backfilled where practicable. Extend excavation along major roots to facilitate gradual bending of roots into backfill areas. Cut roots only where roots cannot be reestablished.
2. Where root system is damaged or cut back, prune branches to maintain root/branch balance.
F. Immediately protect exposed roots until reestablishment in backfill. Cover with approved mulching material and keep continuously moist.

G. Maintain existing grade within drip line of trees, unless otherwise indicated.

H. Lowering Grades:

1. Follow recommendations of arborist to achieve required grades and optimize chances of survival for trees. Use hand excavation within drip line.
2. Prune branches as recommended by arborist and provide further maintenance as recommended by arborist until substantial completion.
3. Submit arborist’s written instructions for the Architect’s continued maintenance after substantial completion of the project.

I. Raising Grades:

1. Minor fills less than 6 inches: Place specified topsoil without compacting, and finish grade by hand.
2. Moderate fills, 6 to 12 inches:
   a. Aggregate fill within an 18 inch radius of trunk up to a level approximately 2 inches above finish grade.
   b. Elsewhere within drip line, hand place aggregate fill up to 6 inches below finish grade, then hand place 6 inches of topsoil to finish grade. Slightly over fill to allow for future settlement.
   c. Finish grade by hand without compacting fill.

J. Where cutting is required, cut branches and roots using properly sharpened tools and without breaking members.

K. Promptly repair any damaged trees to prevent death or loss of vigor. Where the Contractor’s operations result in dead or severely damaged trees, remove trees and provide new trees of similar size, except provide 6-inch-caliper trees to replace existing trees over 6 inches caliper. Species as selected by the Architect.

3.4 CLEARING AND GRUBBING

A. Clearing and Grubbing is specified in Section 31 11 00 – Clearing and Grubbing

3.5 DEWATERING

A. Do not allow surface or ground water to flow into or accumulate in excavations.

B. Do not allow water to flow in an uncontrolled fashion across the project site or to erode slopes or to undermine foundations. Do not allow water to be diverted onto adjacent properties. Arrange excavation operations so as to provide continual and effective drainage of excavations.

C. Provide and maintain temporary diversion ditches, dikes, and grading as necessary; do not use trench excavations for this purpose. When required by surface or subsurface water conditions, provide sumps, wellpoints, French drains, pumps, and other control measures necessary to keep excavations free of water. When existence of ground water near or above final excavation level is indicated or suspected, provide control measures...
prior to excavating to water level and maintain water level continuously below working level.

3.6 EXCAVATION

A. General: Excavation includes the removal of any materials necessary to achieve the required subgrade elevations and includes reuse or disposal of such materials.

B. Unnecessary Excavation: The expense of excavation of materials outside of limits indicated or ordered in writing by the Architect and the correction thereof to the satisfaction of the Architect or Testing Agent shall be borne by the Contractor.

1. Unnecessary excavation under footings: Either deepen footings to bear on actual subgrade elevation without changing top elevations or place concrete fill up to required elevation, as required by the Architect or Testing Agent.

2. Unnecessary excavation other than under footings: Either place compacted fill or otherwise correct conditions, as required by the Architect or Testing Agent.

C. Approval of Subgrade: Notify the Architect or Testing Agent when required elevations have been reached.

1. When required by the Architect or Testing Agent due to the unforeseen presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the Architect’s or Testing Agent’s instructions.

2. Payment for unforeseen additional work will be made in accordance with established unit prices or, if none, in accordance with provisions for changes in the work. No payment will be made for correction of subgrades improperly protected against damage from freeze-thaw or accumulation of water, or for correction of otherwise defective subgrades.

D. Excavation Stabilization: Wherever it is possible to slope faces of excavations to achieve stabilization, do so in compliance with requirements of governing authorities. Otherwise, provide shoring and bracing. Design, provide, maintain, and remove shoring and bracing in compliance with requirements of the governing authorities. Remove temporary shoring and bracing when stabilization is no longer required.

E. Excavation for Structures: Excavate beyond footings and foundations so as to allow proper construction and inspection of concrete formwork and other materials. Excavate to the required elevation plus or minus 0.10 foot.

F. Excavation for Footings and Foundations:

1. Delay excavation to final grade and final compaction until just before concrete will be placed.

2. Remove any loose or sloughed material and adjust excavations to conform to required lines, grades, and tolerances and to form a suitable bearing surface. Do not disturb bottom of completed excavations.

3. For pile-supported footings, halt excavations 6 to 12 inches above the bottom of the footing before driving piles. After driving piles continue excavating to required elevations.

G. Excavation for Pavements: Excavate, shape, and compact to the lines, subgrade
elevations, and cross sections indicated. Store soil materials without intermixing. Protect from contamination with other soils or debris.

H. Provide protection for workers within trench areas in accordance with local, State, and Federal Occupational Safety and Health requirements and regulations.

1. Slope, shore, sheet, or brace excavation side walls greater than 5 feet in depth.
2. Provide lateral travel distance to excavation exit ladder or steps maximum 25 feet for trenches minimum 4 feet in depth.

I. Unacceptable Fill Material for Building and Paving Areas: Excavated material containing rock or stone greater than 6 inches in largest dimension.

J. Acceptable Fill Material:
1. Rock or stone less than 6 inches in largest dimension as fill to within 24 inches of surface of proposed subgrade when mixed with suitable material.
2. Rock or stone less than 2 inches in largest dimension mixed with suitable material as fill within the upper 24 inches of proposed subgrade.

3.7 BACKFILLING

A. Preparation: Backfill excavations as soon as practicable. Complete the following operations before backfilling:

1. Inspection and acceptance of below-grade construction.
2. Inspection, testing, and approval of underground utilities.
3. Surveying of underground utilities for record documents.
4. Concrete formwork removal.
   a. Removal of loose material, muck, debris, and trash from excavation.
   b. Installation of temporary or permanent horizontal bracing for structures to receive backfill.

B. Remove temporary shoring and bracing as the work progresses and when its use is no longer necessary.

C. Installation: Place approved soil materials in layers to required elevations. Do not place material on muddy or frozen surfaces or on surfaces containing frost.

D. Installation: Place satisfactory soil materials in layers to required subgrade elevations.

3.8 FILLING

A. Preparation: Verify that area has been stripped of vegetation including roots below grade. Remove and dispose of any unsatisfactory soils.

1. When filling slopes steeper than 1 in 4 rise, plow, step, or break up surfaces to a depth of at least 6 inches to promote bond of new to existing material.
2. Break up existing pavement in areas indicated before filling over.
3. Should density of subgrade to receive fill be less than specified for fill, break up and pulverize subgrade to a depth of at least 6 inches, moisture condition if necessary, and recompact to required density at optimum moisture content.

B. Installation: Place fill materials to required elevations in lifts of required depth. Provide fill materials beneath each area as indicated.
1. Planted areas: Satisfactory soil materials.
2. Paved areas: Subbase material.
3. Exterior steps/ramps: Subbase material.
4. Building slabs: Capillary water barrier material.

3.9 PAVEMENT SUBBASE COURSE PLACEMENT

A. Place lifts such that compaction true to grade and level is accomplished with a minimum of surface disturbance and segregation or degradation of materials. Maintain grade control and cross section by means of line and grade stakes. Maintain moisture content within prescribed limits during placing and compacting.

B. When the total thickness of subbase is less than the maximum lift thickness permitted, place material in a single lift. When the total thickness of subbase is greater than the maximum lift thickness permitted, place materials in two or more lifts of uniform thickness with no lift less than 3 inches in thickness.

C. Place material along the edges of the subbase course so as to maintain compaction of the subbase course. Construct at least a 1-foot width of shoulder simultaneously with each lift of the subbase course.

D. Cut any overbuild to grade. Should top elevation be lower than allowable tolerances, scarify to a depth of 3 inches, add new material, and recompact to bring to grade within required tolerances.

3.10 FILL PLACEMENT

A. Place fill or backfill lifts such that compaction true to grade and level is accomplished with a minimum of surface disturbance and segregation or degradation of materials. Maintain grade control and cross section by means of line and grade stakes. Maintain moisture content within prescribed limits during placing and compacting.

B. Do not place structural fill on subgrade that contains frost, mud or is frozen.

C. After proofrolling, and where required and approved by the Testing Agency, the structural fill shall be placed and compacted in layers of six inch thickness.

D. Do not place backfill on subgrade that contains frost, or is frozen.

3.11 COMPACTION

A. Place materials used in backfilling and filling in layers not exceeding loose depths as follows, unless noted otherwise:

1. Heavy equipment compaction: 8 inches.

B. Place material simultaneously on opposite sides of walls, small structures, utility lines, etc. to avoid displacement or overstressing.

C. In-Place Density Requirements: Compact soil to not less than the values given below, expressed as a percentage of maximum density at optimum moisture content.
1. Fill, embankment, and backfill under structures, building slabs, steps, paved areas, around footings, and in trenches, 98%.
2. Fill, embankment, and backfill under sidewalks, 95%.
3. Fill, embankment, and backfill under grassed areas, 90%.
4. Subgrade under building slabs, steps, and paved areas, top 12 inches, 100%.
5. Subgrade under sidewalks, top 6 inches, 98%.
6. Sewer leach or absorption fields, 90%.

D. Compact structural fill behind walls to provide 95 percent.

E. Moisture Control: During compaction, control moisture of subgrades and subsequent lifts to within tolerances from optimum moisture content as recommended by testing laboratory. Wet surface with water when additional moisture is required. Aerate soil to aid in drying or replace soil when excessive moisture is present.

3.12 GRADING

A. General: Smooth grade to a uniform surface that complies with compaction requirements and required lines, grades, and cross sections and is free from irregular surface changes.

B. Provide a smooth transition between existing adjacent grades and changed grades. Cut out soft spots, fill low spots, and cut down high spots to conform to required surface tolerances.

C. Slope grades to direct water away from structures and to prevent ponding. Finish subgrade to required elevations within the following tolerance:
   1. Unpaved areas: Plus or minus 0.10 foot.
   2. Paved areas: Plus or minus 0.05 foot.
   3. Exterior steps and ramps: Plus or minus 0.05 foot.
   4. Inside building lines: 1/2 inch as measured with a 10-foot straightedge.

3.13 PROOFROLLING

A. After excavation and before any fill placement, fill areas shall be proofrolled with two coverages of a loaded dump truck or scraper.

B. After completion of required compaction and immediately prior to proceeding with subsequent construction, proofroll in the presence of testing laboratory representative.

C. Proof roll using a heavy pneumatic-tired vehicle having four tires abreast, each tire loaded to 30,000 pounds and tire inflated to manufacturer's recommended pressure. Provide 30 coverages of the area to be proof rolled, one coverage being defined as the application of one tire print over the entire area. Maintain optimum moisture content during proof rolling. In areas which show pumping or which are otherwise unsatisfactory, undercut fill material and replace with compacted fill, or stabilize in place, as required by the Architect or Testing Agent.
D. Proofroll areas to receive:
   1. Pavement.
   2. Building slabs on grade.

3.14 FIELD QUALITY CONTROL:

A. Testing Laboratory Services: Provide timely notice to testing laboratory. Do not proceed with construction until testing of each subgrade and lift of fill or backfill has been performed and required inspections and approvals have been obtained.

B. In-Place Density Tests: ASTM D1556-2015 (sand cone method), ASTM D2167-94(2008) (rubber balloon method), or ASTM D2922-05 (nuclear method), as applicable. ASTM D2922-05 shall be used only to test granular base material beneath pavement. When ASTM D2922-05 is used, check and adjust calibration curves using ASTM D1556-2015 only.

C. Foundation Bearing Subgrade: Verify foundation subgrade to determine bearing capacity of each material encountered. Foundation subgrades shall be verified by the Testing Agent retained by the Design Professional.

D. Areas under Slabs and Pavements: Conduct not less than one in-place density test of subgrade and one in-place density test of each compacted fill or backfill layer for every 10,000 square feet of overlying paved area, and one test for every 5,000 square feet of fill placed in building pad areas, but in no case less than three tests per lift.

E. Areas not under Slabs and Pavements: Conduct not less than one in-place density test of each compacted fill or backfill layer for every 20,000 square feet of area but not less than two tests per lift.

F. Foundation Wall Backfill: Conduct not less than two in-place density tests per lift.

G. Trench Backfill: Conduct not less than two in-place density tests per lift per trench.

H. If testing service reports indicate that subgrade or fills are below specified density, scarify or remove and replace to the required depth, recompact, and retest at no cost to the Owner.

3.15 MAINTENANCE

A. Completed Areas: Protect from damage by pedestrian or vehicular traffic, freezing, erosion, and contamination with foreign materials. Repair and re-establish grades to specified tolerances in settled, eroded, or rutted areas.

B. Damaged Areas: Where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction and whether due to subsequent construction operations or weather conditions, restore materials to required conditions: Scarify or remove and replace to the required depth, return to optimum moisture content, and compact materials to the required density before continuing construction.
C. Correction: Should settling occur within the project correction period, remove finished surfacing, add additional approved material, compact material, and reconstruct surfacing. Construct surfacing to match and blend in with adjacent surfacing as nearly as practicable.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Properly dispose of any excess or unsatisfactory topsoil off site.

B. Remove any material not required for use on the project (including unsatisfactory soil, excess satisfactory soil, trash, and debris) and legally dispose of it off the Owner's property.

C. Remove any unsatisfactory soil, trash, debris, and other materials not required for use on the project and legally dispose of it off the Owner's property.

D. On-site burning is not permitted.

END OF SECTION 31 00 00
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, equipment and materials necessary to clear and grub the site to the limits indicated on the Contract Documents.

B. The Contractor shall protect all existing structures, trees, or vegetation indicated on the Contract documents to remain.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 RELATED DOCUMENTS

A. Jefferson County Standards and Specifications, Current Edition


D. Alabama Department of Transportation Standard Specifications for Highway Construction, Current Edition

1.3 SUBMITTALS

Not Applicable

1.4 QUALITY ASSURANCE

A. Obtain required permits and licenses in accordance with requirements of the Federal Clean Water Act (CWA), Water Quality Act (WQA), State laws, and Local laws.

B. Provide temporary erosion control systems as indicated on the Contract documents or as directed by the Architect or Testing Agent to protect adjacent properties and water resources from erosion and sedimentation.

C. Conduct operations and removal of debris with minimum interference to roads, streets, walks, and other adjacent facilities. Do not close or obstruct streets, walks or other facilities without permission from the authorities having jurisdiction.

1.5 DEFINITIONS

A. Clearing - Clearing shall consist of the felling, trimming, and cutting of trees into sections
and the satisfactory disposal of the trees and the other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

C. Grubbing - Grubbing shall consist of the removal and disposal of stumps, roots larger than 1/2 inch in diameter, and matted roots within the limits of work indicated on the plans.

PART 2 - PRODUCTS
Not Applicable

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

1. Locate existing utilities as specified in elsewhere in Project Manual.
2. Verify that survey benchmark and intended elevations for the Work are as indicated and are not located in an area where they may be damaged.
3. Verify that existing plant life and clearing limits are clearly tagged, identified and marked in such a manner as to insure their safety throughout construction operations.

B. Report in writing to the Architect any prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. By beginning Work, the Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Architect.

3.2 PREPARATION

A. Provide temporary erosion control systems as indicated on the Contract documents or as directed by the Architect or Testing Agent to protect project site and adjacent properties and water resources from erosion and sedimentation.

3.3 CLEARING

A. Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing.

B. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint.
C. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

D. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the Work.

3.4 GRUBBING

A. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved.

B. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform to the original adjacent surface of the ground.

3.5 TOPSOIL EXCAVATION

A. Strip topsoil from areas that are indicated to be filled, excavated, landscaped, or re-graded to a depth that prevents contact with underlying subsoil or unsuitable material. Where trees are indicated to remain, stop topsoil stripping sufficient distance from tree to prevent damage to main root system.

B. Cut heavy growths of grass from areas prior to start of stripping. Remove heavy growths of grass along with clearing of other vegetation materials.

C. If the Contractor feels that storage on site will interfere with construction operations, he may elect to haul topsoil off site, protect and haul topsoil back again when needed for topsoiling, all at no additional expense to the Owner.

D. Construct stockpile areas to positively drain surface water.

E. Cover stockpile areas as required to prevent windblown dust.

F. Dispose of unsuitable topsoil off-site as specified, unless directed otherwise by the Architect or Testing Agent.

G. Protect stockpiled topsoil from wetting, erosion and sedimenting by means of tarpaulins and by a perimeter barrier of boards staked in place, or other methods necessary.

H. Topsoil stripped and stockpiled in quantities in excess of needs for new topsoiling shall be either stored or disposed of as directed by Architect or Testing Agent; obtain Architect's or Testing Agent’s decision.

3.6 TREE REMOVAL

A. Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This
work shall include the felling of such trees and the removal of their stumps and roots as specified in section 02 41 00. Trees shall be disposed of as specified in section 02 41 00.

3.7 DISPOSAL OF MATERIALS

A. All cleared material shall become the property of the Contractor and shall be hauled off site immediately and disposed of legally after obtaining necessary permits.

B. Do not burn cleared material on site unless pit burning permits or other necessary permits, have been obtained by the Contractor through all relative governmental agencies.

3.8 TREE PROTECTION

A. Tree protection shall be as shown on the Landscape Plans or as directed by the Architect or Arborist.

3.9 REPAIR FOR DAMAGED TREES:

A. Damaged trees to remain shall be repaired or replaced as directed by the Architect or Arborist.

END OF SECTION 31 11 00
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary for excavating, filling, and backfilling for buildings and utility systems.

B. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS

A. Jefferson County Standards and Specifications, Current Edition

B. City of Birmingham’s Standard Specifications for the Construction of Public Works Projects.

B. American Society for Testing and Materials


2. ASTM D698-07e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft.)


6. ASTM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil, and Rock by Mass

7. ASTM D2487-2011 Standard Practice for Classification of Soils for Architecting Purposes (Unified Soil Classification System)

8. ASTM D2922-05 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

9. ASTM D2937-2010 Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method

10. ASTM D3017-05 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

11. ASTM D4318-2010e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.3 SUBMITTALS

A. Test Reports: Testing agency will submit, within 24 hours of the completion of the test, the
following reports directly to the Design Professional and shall copy the Contractor:

1. Analysis of fill and backfill materials.
2. In-place density test reports.

B. Material Source: Submit name of imported materials suppliers. Provide materials from same source throughout the Work. Change of source requires Architect approval.

1.4 QUALITY ASSURANCE

A. Testing Laboratory Services: The Design Professional will secure and pay for the services of a Testing Agent to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing.

B. Coordinate and schedule in a timely manner with the Testing Agency the following quality control items:

1. Perform the required tests per section 3.31.
2. Verify quantities of material removed and quantities of material placed where Unit Prices are involved.

1.5 SITE CONDITIONS

A. Traffic: Do not interfere with or close public ways without the permission of the governing authorities.

B. Existing Site Utilities:

1. Advise utility companies of excavation activities before starting excavations. Contractor shall enlist the services of a locating company to locate and identify all underground utilities passing through work area before starting work.
2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Design Professional immediately for directions. Cooperate with Design Professional and/or utility companies in keeping respective services and facilities in operation.
3. Protect existing utilities indicated to remain.
4. Do not interrupt existing utilities without advance notice to and written approval from the Design Professional.
5. Repair damaged utilities to satisfaction of utility company, at no additional cost to the Owner.
6. Demolish and completely remove from the site all existing underground utilities indicated on the Contract documents to be removed. Coordinate with utility companies for shut-off of services if lines are active.

1.6 PAYMENT

A. Earth Excavation: Removal, reuse, and disposal of earth and other naturally occurring or man-made materials encountered other than materials classified as rock or unnecessary
excavation. The cost of earth excavation shall be included in the cost of general construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Materials: Satisfactory materials shall be as defined by the Testing Agent in accordance with ASTM D2487-11.

B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory that contains root and other organic matter, frozen material, and stones larger than 3 inches. The Design Professional and Testing Agent shall be notified of any contaminated materials.

C. Cohesionless and Cohesive Materials: Cohesionless and cohesive materials shall be as defined by the Testing Agent in accordance with ASTM D2487-11.

D. Expansive Soils: Expansive soils shall be as defined by the Testing Agent in accordance with ASTM D4318-10.

E. Nonfrost Susceptible Material: Nonfrost susceptible material shall be an uniformly graded, washed sand as defined by the Testing Agent.

F. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

G. Unstable Material: Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

H. Select Granular Material: Select granular material shall consist of well-graded sand, gravel, crushed gravel, or crushed stone composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 1-1/2 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

I. Initial Backfill Material: Initial backfill shall consist of select granular material (See Section 2.1.H for definition of Select Granular Fill) or satisfactory materials free from rocks 2 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 1 inch in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

2.2 CAPILLARY WATER BARRIER

A. Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 1-1/2 inches and no more than
2 percent by weight shall pass the No. 4 size sieve.

2.3 PLASTIC MARKING TAPE

A. Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with a minimum thickness of 0.004 inches.

B. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise.

C. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion.

D. The tape shall be of a type specifically manufactured for marking and locating underground utilities.

E. Tape color shall be as specified below and shall bear a continuous printed inscription that describes the specific utility.

1. Red: Electric
2. Yellow: Gas, Oil, Dangerous Materials
3. Orange: Telephone, Telecommunications, Television
4. Blue: Water Systems
5. Green: Sewer Systems

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Clearing and grubbing is specified in Section 31 11 00 - CLEARING AND GRUBBING.

3.2 TOPSOIL

A. Topsoil shall be stripped to a depth below existing grade as recommended by the Testing Agent within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

A. Earth excavation shall include removal and disposal of material not classified as rock excavation.

B. Rock excavation shall include removal and disposition of material defined as rock in section 1.6.

C. Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility and foundation drainage systems to a point 5 feet beyond the building line of each building and structure, excavation for outside grease interceptors, and all incidental work thereof.

D. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation,
but in no instance closer than 2 feet.

E. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms.

F. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed and replaced with satisfactory material.

G. Satisfactory material removed below the depths indicated, without specific direction of the Design Professional, shall be replaced, at no additional cost to the Owner, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation.

H. Satisfactory material shall be placed and compacted as specified in section 3.21.

I. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Design Professional or Testing Agent.

J. Excavated material not required or not satisfactory for backfill shall be disposed of by direction of the Testing Agent.

3.4 TRENCH EXCAVATION

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical.

B. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in.

C. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content.

D. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter.

E. Where recommended trench widths are exceeded, the Contractor shall utilize redesign, stronger pipe, or special installation procedures. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Owner.

3.5 DRAINAGE

A. Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations.
B. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction.

C. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing.

D. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.6 DEWATERING

A. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction.

B. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made.

C. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material.

D. While the excavation is open, the water level shall be maintained continuously, at a depth below the working level as determined by the Testing Agent.

3.7 SHORING

A. Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities.

B. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

C. All shoring, bracing, and sheeting shall meet the requirements of the Occupational Safety & Health Administration and state and local laws as applicable.

3.8 CLASSIFICATION OF EXCAVATION

A. Common excavation shall consist of all excavation not classified as rock excavation.

B. Rock excavation shall be as defined in section 1.6.

3.9 BLASTING

A. Blasting will not be permitted.

3.10 BORROW

A. Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained from approved sources off site without additional charge to the Owner.
3.11 EXCAVATED MATERIALS

A. Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed.

B. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of at approved locations off site without additional charge to the Owner.

3.12 STOCKPILES

A. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times.

B. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled.

C. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Owner.

3.13 REMOVAL OF UNYIELDING MATERIAL

A. Where unyielding material is encountered in the bottom of the trench, such material shall be removed as directed by the Testing Agent and replaced with suitable materials as provided in section 3.14.

3.14 REPLACEMENT OF UNYIELDING MATERIAL

A. Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material in layers not exceeding 6 inches loose thickness.

3.15 REMOVAL OF UNSTABLE MATERIAL

A. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed by the Testing Agent and replaced to the proper grade with select granular material as provided in section 3.16.

B. When removal of unstable material is required due to the Contractor’s fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

3.16 REPLACEMENT OF UNSTABLE MATERIAL

A. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.
3.17 EXCAVATION FOR APPURtenANCES

A. Excavation for manholes, catch-basins, inlets, or similar structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members.

B. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed by the Testing Agent. Loose disintegrated rock and thin strata shall be removed.

C. Removal of unstable material shall be as specified above.

D. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.18 JACKING, BORING, AND TUNNELING

A. Jacking, Boring, and Tunneling shall be performed where indicated on the Contract documents and shall and in accordance with the standards and specifications of the governing authority having jurisdiction.

B. In situations where utility lines must be installed more than 15 to 20 feet below ground surface, through embankments, under minor roads or parking areas, or where surface conditions make it difficult or impractical to excavate open trenches, utility lines may be installed by jacking, boring, or tunneling as a contractor option.

3.19 TRENCH BOTTOM PREPARATION

A. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe.

B. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing.

C. Stones of 1-1/2 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.20 BEDDING AND INITIAL BACKFILL

A. Bedding shall be of the type and thickness shown on the contract documents.

B. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. Do not place material on muddy or frozen surfaces or on surfaces containing frost.

C. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.
3.21 FILLING AND BACKFILLING

A. Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials.

B. Satisfactory materials shall be placed in horizontal layers not exceeding 8 inches in loose thickness or 6 inches when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified.

C. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris.

D. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors.

E. Backfill shall not be placed in wet or frozen areas.

F. Where pipe is coated or wrapped for protection against corrosion the backfill material, up to an elevation 2 feet above sewer lines and 1 foot above other utility lines, shall be free from stones larger than 1 inch in any dimension.

G. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted.

H. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks.

I. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls.

J. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.

K. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

1. Fill, embankment, and backfill under structures, building slabs, steps, paved areas, around footings, and in trenches, 98%.
2. Fill, embankment, and backfill under sidewalks, 95%.
3. Fill, embankment, and backfill under grassed areas, 90%.
4. Subgrade under building slabs, steps, and paved areas, top 12 inches, 100%.
5. Subgrade under sidewalks, top 6 inches, 98%.

L. Approved compacted subgrades that are disturbed by the Contractor’s operations or adverse
weather shall be scarified and compacted as specified herein to the required density prior to further construction thereon. Recompaction over underground utilities shall be by hand tamping.

3.22 TRENCH BACKFILL

A. The trench shall not be backfilled until all of the following operations have been completed:

1. Inspection, testing, and approval of underground utilities.
2. Surveying of underground utilities for record documents.
4. Removal of loose material, muck, debris, and trash from excavation.
5. Installation of temporary or permanent horizontal bracing for structures to receive backfill.

3.23 BACKFILL FOR APPURTENANCES

A. After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for a minimum of 7 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth.

B. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.24 SUBGRADE PREPARATION

A. Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Testing Agent.

B. The surface shall be scarified to a depth of 6 inches before the fill is started.

C. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material.

D. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

E. Material shall not be placed on surfaces that are muddy, frozen, or contain frost.

F. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted.

G. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

H. Minimum subgrade density shall be as specified in section 3.31.
3.25 FINAL GRADE TO SUPPORT CONCRETE SURFACES

A. Excavation to final grade shall not be made until just before concrete is to be placed.

B. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used.

C. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond.

D. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

3.26 CAPILLARY WATER BARRIER

A. Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.27 GRADING

A. Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.28 SPREADING TOPSOIL

A. Areas outside the building lines from which topsoil has been removed shall be topsoiled.

B. The surface shall be free of materials that would hinder planting or maintenance operations.

C. The subgrade shall be pulverized to a depth of 2 inches by diskng or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, and slopes shown, and left free of surface irregularities.

D. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 100 to 160 pounds per linear foot of roller.

E. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.29 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

A. Gas Distribution System: Trenches shall be excavated to a depth that will provide not less than 18 inches of cover in rock excavation and not less than 24 inches of cover in other excavation unless otherwise required by the authority having jurisdiction. Trenches shall be graded as specified for pipe-laying requirements in Section 23 00 11 FUEL SYSTEMS.
B. Water Lines: Trenches shall be of a depth to provide a minimum cover of 3 feet from the indicated finished grade to the top of the pipe unless otherwise required by the authority having jurisdiction.

C. Electrical Distribution System: Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise required by the authority having jurisdiction.

D. Plastic Marking Tape: Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise required by the authority having jurisdiction.

3.30 PROTECTION

A. Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

3.31 TESTING

A. Testing shall be performed by an approved commercial testing laboratory under the supervision of a licensed professional Testing Agent.

B. Field In-Place Density Tests

1. Field in-place density shall be determined in accordance with ASTM D1556(2015), ASTM D2167-94(2008), or ASTM D2922-05 as appropriate. When ASTM D2922-05 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D2922-05, paragraph ADJUSTING CALIBRATION CURVE. ASTM D2922-05 results in a wet unit weight of soil and when using this method ASTM D6938-10 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938-10. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, and at intervals as directed by the Testing Agent. ASTM D2937-10 shall be used only for soft, fine-grained, cohesive soils.

2. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Testing Agent and Design Professional.

3. In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

C. In-Place Density of Subgrades: Conduct not less than one in-place density test of subgrade for every 2,500 square feet or fraction thereof of overlying paved areas and every 5,000 square feet or fraction thereof in building pad areas.

D. In-Place Density of Fills and Backfills

1. One test per 5,000 square feet or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines.
2. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 6 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 1,000 square feet, or one test for each 250 linear feet of long narrow fills 250 feet or more in length. In any case a minimum of one test shall be performed on all fills.

3. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Owner.

E. Moisture Content

1. In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions.

2. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D2216-10.

F. Optimum Moisture and Laboratory Maximum Density

1. Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values.

2. One representative test per 1500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

G. Displacement of Sewers

1. After other required tests have been performed and the trench backfill compacted to a minimum of 2 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Testing Agent.

2. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe.

3. If, in the judgement of the Inspector, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Owner.

END OF SECTION 31 23 00
1.1 SCOPE OF WORK

A. The contractor shall provide all labor, equipment and materials necessary to construct and maintain all erosion control features as specified on the Contract documents and supplement with additional measures as required by on site conditions during all phases of construction.

B. The contractor shall provide all erosion control measures indicated on the Contract documents and shall reinstall and/or relocate devices as necessary to continue construction without allowing sediment accumulation downstream or on public rights-of-way.

C. Temporary erosion controls include, but are not limited to, grassing, mulching, setting, and watering, and re-seeding on-site surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Architect and Local, State and Federal laws.

D. Temporary sedimentation controls include, but are not limited to, silt fencing, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or controlled.

1.2 REFERENCE DOCUMENTS


E. American Society for Testing and Materials

2. ASTM D4355(2014) Deterioration of Geotextiles from Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus
3. ASTM D4439-14 Standard Terminology for Geotextiles
4. ASTM D4491-99a(2014)e1 Standard Test Methods for Water Permeability of Geotextiles by Permittivity
5. ASTM D4533-15 Standard Test Method for Trapezoid Tearing Strength of Geotextiles
9. ASTM D4873-15 Standard Guide to Identification, Storage, and Handling of Geosynthetic rolls and samples

1.3 SUBMITTALS

A. Submit the brand name(s) and the name(s) of all material suppliers along with a sample of the material(s) to be used.

B. Provide materials from the same source throughout the Work. A change of source requires Architect approval.

C. All seed mixtures and/or hydroseed mixtures with rates of applications and application dates.

D. Provide a copy of all test and inspection reports.

1.4 EROSION AND SEDIMENT CONTROLS

A. Vegetative Measures

1. The vegetative measures to be implemented shall include, but shall not be limited to, temporary seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, erosion control mats, protection of trees, and preservation of mature vegetation. The Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated.

2. Portions of the site where construction activities have temporarily or permanently ceased for fourteen days shall be stabilized with a temporary measure as shown on the Contract documents.

3. Portions of the site where construction activities have temporarily or permanently ceased for twenty-one days shall be stabilized with a permanent measure as shown on the Contract documents.

4. Where the initiation of vegetative measures by the fourteenth day after construction activity temporarily or permanently ceases is precluded by unsuitable conditions caused by the weather, vegetative practices shall be initiated as soon as practicable after conditions become suitable.
B. Structural Practices

Structural practices shall be implemented to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Structural practices shall be implemented in a timely manner during the construction process to minimize erosion and sediment runoff. Structural practices shall include, but shall not be limited to, silt fences, check dams, construction exits, diversion berms, rock filter dams, inlet sediment traps, sediment basins, and storm drain outlet protection. All structural practices are to be installed where shown on the Contract documents or as instructed by the Testing Agent. The details of installation and construction are as shown on the contract documents and in accordance with the Manual for Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas and local municipal standards.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Protect adjacent properties and water resources from erosion and sediment damage throughout Work.

PART 2 - PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

A. Filter Fabric

1. The geotextile shall comply with the requirements of ASTM D4439-14 and shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure.

2. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 to 120 degrees F.

3. The filter fabric shall be as specified in the table below. Type C silt fence shall have woven wire reinforcement.
FILTER FABRIC FOR SILT FENCES

<table>
<thead>
<tr>
<th>FENCE TYPE</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength (lbs. min.) (ASTM D4632-08)</td>
<td>Warp – 120</td>
<td>Warp – 120</td>
<td>Warp – 120</td>
</tr>
<tr>
<td>Elongation (% max.) (ASTM D4632-08)</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Apparent Opening Size (Max. Sieve Size) (ASTM D4751-04)</td>
<td>#30</td>
<td>#30</td>
<td>#30</td>
</tr>
<tr>
<td>Flow Rate (gal/min/sf)</td>
<td>25</td>
<td>25</td>
<td>70</td>
</tr>
<tr>
<td>Ultraviolet Stability (ASTM D4632-08 after 300 hours weathering in accordance with ASTM D ASTM D4533-09)</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Bursting Strength (psi min.)</td>
<td>175</td>
<td>175</td>
<td>175</td>
</tr>
<tr>
<td>Minimum Fabric Width (inches)</td>
<td>36</td>
<td>22</td>
<td>36</td>
</tr>
</tbody>
</table>

B. Silt Fence Posts

The Contractor may use either wooden stakes or steel posts for Type A and Type B silt fence construction. The Contractor shall use steel posts for Type C silt fence construction. All posts shall be as shown in the table below.

<table>
<thead>
<tr>
<th>SILT FENCE POSTS</th>
<th>Min. Length</th>
<th>Post Type</th>
<th>Post Size</th>
<th>Max. Post Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type A</td>
<td>4’</td>
<td>Soft wood Oak Steel</td>
<td>3” dia. or 2x4 1.5” x 1.5” 1.3 lbs/ft min.</td>
<td>6’</td>
</tr>
<tr>
<td>Type B</td>
<td>3’</td>
<td>Soft wood Oak Steel</td>
<td>2” dia. or 2x2 1” x 1” 0.75 lbs/ft min.</td>
<td>6’</td>
</tr>
<tr>
<td>Type C</td>
<td>4’</td>
<td>Steel</td>
<td>1.3 lbs/ft min.</td>
<td>4’</td>
</tr>
</tbody>
</table>

2.2 COMPONENTS FOR CHECK DAMS

A. Stone: Graded size 2-10 inch stone.

B. Geotextile Underliner: A woven or nonwoven geotextile meeting or exceeding the following:

3. Grab Tensile Strength: 150 lbs. in either direction when wet by ASTM D4632-15 after.
4. Grab Tensile Elongation: 15% minimum, 130% maximum by ASTM D4632-15 after.
5. Mullen Burst: 200 psi when wet.
2.3 COMPONENTS FOR ROCK FILTER DAMS
   A. Facing Stone: Graded 3 to 5 lb. Stone.
   B. Dam Stone: National Stone Association R-5 (d_{50} = 9 inches).

2.4 COMPONENTS FOR OUTLET STRUCTURE RETROFFITS
   A. Perforated half-round pipe with stone filter
      1. Pipe: Corrugated metal pipe with a diameter of 1.5 times the principal outlet
         pipe or wider than the greatest width of the concrete weir as applicable.
      2. Stone: Graded and washed 3 to 4 inch stone.
   B. Slotted board dam with stone filter
      1. Boards: Nominal 2 x 4 inch boards.
      2. Posts: Nominal 4 x 4 inch posts.
      3. Stone: Graded and washed 3 to 4 inch stone.

2.5 COMPONENTS FOR INLET SEDIMENT TRAPS
   A. Fabric and frame inlet sediment trap
      1. Fabric: Fabric shall be as specified for Type A silt fence in section 2.1.
      2. Stakes: Nominal 2 x 4 inch boards a minimum of 36 inches long.
      3. Frame: Nominal 2 x 4 inch boards.
   B. Curb inlet sediment trap using 8" Concrete Block wrapped in Filter Fabric
      2. Filter Fabric: A woven or nonwoven geotextile meeting or exceeding
         the following:
         b. Apparent Opening Size: no larger than 40 nor smaller than 100 U.S.
            sieve size by ASTM D4751-12.
         c. Grab Tensile Strength: 100 lbs. in either direction when wet by
            ASTM D4632-15.
         d. Grab Tensile Elongation: 15% minimum, 130% maximum by
            ASTM D4632-15.
         e. Mullen Burst: 200 psi when wet.
   C. Curb inlet sediment trap using Rock Bags: Washed #4 stone wrapped in a
      geogrid material with wire fasteners as indicated on the contract documents. Each
      bag to have the following measurements.
      1. Length = 12 to 18 inches
      2. Width = 6 to 8 inches
      3. Thickness = 4 to 6 inches
D. Grate inlet sediment trap using a Rigid Inlet Protection Device: The rigid inlet protection device shall consist of a main housing and fitted filter assembly as follows.

1. Main housing:
   a. Shall be a solid formed high molecular weight, high-density polyethylene copolymer.
   b. Shall be designed to meet or exceed the Standard Specifications for Polyethylene Plastic Molding and Extrusion Materials specification section ASTM D4976-12a.
   c. Shall completely span and enclose the inlet structure.
   d. Shall have minimum tensile impact rating or 170 ft. lbs/sq. in., with a minimum tensile strength yield of 3600 psi.
   e. Shall be self-sealing around the inlet structure, have a minimum height of 26" above the inlet structure, and have an enclosed top.
   f. Peripheral frame shall consist of multiple slatted openings, providing a minimum of 6.0 sq. ft. open area, to facilitate filtration of the storm water during normal operational conditions.

2. Fitted Filter Assembly:
   a. Shall be constructed of 100% continuous polyester needle-punched non-woven Architecting fabric.
   b. Shall be fabricated to provide a direct fit adjacent to the associated Main Housing.
   c. Fitted Filter Assembly - Geotextile Fabric
      1. The filter fabric shall have a weight on no less than 3.0 ounces per square yard.
      2. The filter fabric shall have a tensile strength of no less than 80 psi with an elongation at break of no less than fifty percent (50%).
      3. The filter fabric shall have puncture strength of no less than 42 psi.
      4. The filter fabric shall have a minimum U.V. rating of no less than 70% at 500 hrs.
   d. The filter fabric shall be capable of reducing effluent turbidity and concentration by no less than 80% under typical sediment migration conditions.
   e. Shall be constructed with integral anti-buoyancy pockets capable of holding no less than 3.0 CF of stabilization material.
   f. Shall be constructed to form a two-stage design, stage one shall be adjacent to the perimeter of the Main Housing and convey normal flows at a minimum clean water flow rate of 100 gpm per sq. ft.; stage two shall provide coarse screening across the top of the Main Housing and convey high flow rates, with a minimum apparent opening of ½" per sq. in. (NO.12 std sieve opening).
   g. All seaming of components associated with the Filter Fabric Assembly shall use a continuous over edge sew through seam using a 1680 den thread and meet American Society for Testing and Materials ASTM D6193-11; Standard Practice for Stitches and Seams.
2.6 COMPONENTS FOR STORM DRAIN OUTLET PROTECTION

A. Stone: Select stone from field stone or quarry stone. The stone should be hard, angular, and highly weather resistant. The specific gravity of the individual stones should be at least 2.5. Stone size shall be as indicated on the Contract documents.

B. Geotextile Underliner: A woven or nonwoven geotextile meeting or exceeding the following:
   5. Mullen Burst: 300 psi when wet.

2.7 COMPONENTS FOR ALL OTHER STRUCTURAL PRACTICES

A. Components for all other structural practices shall be as indicated on the Contract documents, and as specified in the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas.

2.8 COMPONENTS FOR VEGETATIVE PRACTICES

A. Components for all vegetative practices shall be as indicated on the Contract documents, as indicated by the Architect or Testing Agent, or as indicated in the Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

B. Report in writing to the Architect and Testing Agent prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Architect.

3.2 PREPARATION


B. Notify the Testing Agent and Architect of deficiencies or changes in the Erosion Control
Plan required by current site conditions. Revisions of plan will be made as determined by the Architect.

3.3 EROSION CONTROL

A. Maintain erosion control features until all disturbed ground is covered with permanent vegetation or structures and permanent drainage system is fully installed and operational.

B. The Testing Agent or Architect may direct Contractor to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and may direct Contractor to provide immediate permanent or temporary pollution control measures.

C. Provide permanent erosion control measures at earliest practical time to minimize requirement for temporary erosion controls controls. Permanently seed and mulch cut slopes as excavation proceeds.

D. Maintain temporary erosion control systems installed by Contractor as directed by the Architect or Testing Agent to control siltation at all times throughout Work. Provide maintenance or additional Work directed by the Architect or Testing Agent within 48 hours of notification by the Architect or Testing Agent.

E. Minimum procedures for grassing are:
   1. Scarify slopes to a depth of not less than 6" and remove large clods, rock, stumps, roots larger than 1/2" in diameter and debris.
   2. Sow seed within 24 hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
   3. Apply mulch loosely and to a thickness of between 3/4" and 1-1/2".
   4. Apply netting over mulched areas of sloped surfaces.
   5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Re-seed areas which exhibit unsatisfactory growth.

F. Backfill and seed eroded areas.

3.4 SEDIMENTATION CONTROL

A. Provide and maintain silt fencing, silt dams, traps, sediment basins, barriers and appurtenances as shown on the approved descriptions and working contract documents. Hay bales which deteriorate and filter stone which is dislodged shall be replaced.

B. Sediment accumulation shall not be allowed within the floodplain or wetland areas downstream of the construction area limits of disturbance.
3.5 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed fail to produce results which comply with the requirements of the authority having jurisdiction, immediately take necessary steps to correct the deficiency.

3.6 REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES

A. The Contractor shall remove all temporary erosion and sediment control devices at the completion of construction and final stabilization. All disturbed areas shall be regraded and seeded with permanent grassing as necessary.

END OF SECTION 31 25 00
SECTION 32 01 00
PAVEMENT REPAIR AND RESTORATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary to remove and replace pavements as indicated on the contract documents.

B. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS

A. American Society for Testing and Materials

B. American Association of State Highway and Transportation Officials
   1. AASHTO M 324 Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

1.3 GENERAL

A. All damage, as a result of work under this project, done to existing structures, pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basins, rocked, graveled or stabilized areas or driveways and including all obstructions not specifically named herein, shall be repaired in a manner to restore the surface to its original condition. The scope of work shall include the furnishing of all labor, materials, equipment and incidentals necessary for the cutting, repair and restoration of the damaged areas.

B. All materials and workmanship shall be first class and nothing herein shall be construed as to relieve the Contractor from this responsibility. The Architect reserves the right to require testing or materials tests, should the adequacy or the quality of materials used be questionable. Costs of these tests shall be borne by the Owner.

C. All street, road, driveway and highway repair shall be made in accordance with the details indicated on the Contract documents.

PART 2 - PRODUCTS
2.1 ASPHALTIC CONCRETE PAVING

A. The material shall be Type F, Bituminous Paving as specified Elsewhere in Division 32.

2.2 CRACK FILLER

A. The crack filler shall be a hot applied type meeting the requirements of ASTM-D1190, AASHTO-M173 and Fed. Spec. SS-S-164.

PART 3 - EXECUTION

3.1 CUTTING PAVEMENT

A. The Contractor shall cut and remove pavement as necessary for replacement as per the contract documents. Make all cuts square or rectangular with faces straight and vertical.

B. Before removing pavement, the pavement shall be marked. Asphalt pavements shall be cut along the markings with a rotary saw.

C. No pavement shall be machine pulled until completely broken and separated along the marked cuts.

3.2 PAVEMENT REPAIR AND REPLACEMENT

A. Remove the surface and asphalt base course as necessary to reach firm support, extending at least one foot into good pavement outside the cracked area. Re-work the subgrade and/or the existing aggregate base as necessary.

B. Apply tack coat to all existing vertical faces.

C. If new aggregate base is required to be installed, a prime coat shall be applied.

D. Backfill the hole with full-depth dense-graded hot asphalt plant-mix. Spread carefully to prevent segregation of the mixture. Compact in layers if the patch is more than 6 inches deep. Compaction should be done by vibration, plate or roller.

E. Use a straightedge to check the quality and alignment of the patch.

3.3 CRACK REPAIR

A. Clean the cracks with brooms and oil free compressed air.

B. The crack is to be free of moisture, dust, loose aggregate or other contaminants.

C. All cracks are to be cleaned and treated with a hot applied crack filler prior to seal coating.

3.4 CLEAN-UP

A. After all repair and restoration or paving has been completed, all excess asphalt, dirt, rock and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

3.5 MAINTENANCE
A. All wearing surfaces shall be maintained by the Contractor in good order and be suitable for traffic at all times for a period of one year after completion and acceptance of the work. Prior to the end of the maintenance period a final inspection will be made of the repaired surface and any settlement or depression shall be adjusted as previously noted herein.

END OF SECTION 32 01 00
SECTION 32 01 16
COLD MILLING OF BITUMINOUS PAVEMENTS

PART 1 – GENERAL

For cold milling alone on structurally sound pavements to be used in conjunction with asphalt overlays produced from hot recycled material to provide structural improvement to distressed pavements. Location and extent of pavement and required elevation of finish surface of new pavement are indicated on the project drawings. Depth indicating in inches the depth that existing pavement that is to be removed and location of existing manholes, valve boxes and utility lines are provided on project drawings.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only

ASTM INTERNATIONAL (ASTM)

1.2 QUALITY ASSURANCE

A. Grade

Conform the finished milled surfaces to the lines, grades, and cross sections indicated. The finished milled-pavement surfaces shall vary not more than 1/4 inch from the established plan grade line and elevation. Finished surfaces at a juncture with other pavements shall coincide with the finished surfaces of the abutting pavements. The deviations from the plan grade line and elevation will not be permitted in areas of pavements where closer conformance with planned grade and elevation is required for the proper functioning of appurtenant structures involved.

B. Surface Smoothness

Finished surfaces shall not deviate from the testing edge of a straightedge more than 1/4 inch in the transverse or longitudinal direction.

C. Traffic Control

Provide all necessary traffic controls during milling operations.

D. Environmental Requirements

Milling shall not be performed when there is accumulation of snow or ice on the pavement surface.

PART 2 – PRODUCTS

Not Used
PART 3 – EXECUTION

3.1 EXECUTING EQUIPMENT

A. Cold-Milling Machine

Provide a cold-milling machine which is self-propelled, capable of milling the pavement to a specified depth and smoothness and of establishing grade control; with means of controlling transverse slope and dust produced during the pavement milling operation. The machine shall have the ability to remove the millings or cuttings from the pavement and load them into a truck. The milling machine shall not cause damage to any part of the pavement structure that is not to be removed.

B. Cleaning Equipment

Provide cleaning equipment suitable for removing and cleaning loose material from the pavement surface.

C. Straightedge

Furnish and maintain at the site, in good condition, one 12 foot straightedge or other suitable device for each milling machine, for testing the finished surface. Make straightedge available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal, with blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on the pavement.

3.2 PREPARATION OF SURFACE

Clean the pavement surface of excessive dirt, clay, or other foreign material immediately prior to milling the pavement.

3.3 MILLING OPERATION

Conduct cold-milling operation to ensure that only bituminous pavement is removed and base course is not disturbed. Leave in place a layer of bituminous pavement, (1/2 to 1 inch) thick, over the undisturbed base course. A minimum of seven days notice is required, prior to start work, for the Contracting Officer to coordinate the milling operation with other activities at the site. Make sufficient passes so that the designated area is milled to the grades and cross sections indicated. The milling shall proceed with care and in depth increments that will not damage the pavement below the designated finished grade. Repair or replace, as directed, items damaged during milling such as manholes, valve boxes, utility lines, pavement that is torn, cracked, gouged, broken, or undercut. The milled material shall be removed from the pavement and loaded into trucks.

3.4 GRADE AND SURFACE-SMOOTHNESS TESTING

A. Grade-Conformance
Test the finished milled surface of the pavement for conformance with the plan-grade requirements and for acceptance by the Contracting Officer by running lines of levels at intervals of 25 feet longitudinally and 25 feet transversely to determine the elevation of the completed pavement. Correct variations from the designated grade line and elevation in excess of the plan-grade requirements as directed. Skin patching for correcting low areas will not be permitted. Remove and replace the deficient low area. Remove sufficient material to allow asphalt concrete to placed per project drawings.

B. Surface-Smoothness Tests

After completion of the final milling, the finished milled surface will be tested with a straightedge. Other approved devices may be used, provided that when satisfactorily and properly operated, such devices reveal all surface irregularities exceeding the tolerances specified. Correct surface irregularities that depart from the testing edge by more than 1/4 inch. Skin patching for correcting low areas will not be permitted. Remove and replace the deficient low area. Remove sufficient material to allow at least 1 inch of asphalt concrete to be placed.

C. Removal of Milled Material

Material that is removed shall become the property of the Contractor and removed from the site or reused for select backfill material if approved.

END OF SECTION 32 01 16.17
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary for the installation of asphalt concrete pavement. Including but not limited to the following:

1. Bituminous concrete paving.
2. Surface course.
3. Binder course.
4. Paving base course.

B. Design Requirements: Provide asphalt-aggregate mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations that meet standard state highway specifications and exhibit satisfactory records of previous installations.

C. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

D. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS


D. American Society for Testing and Materials
   2. ASTM D 2172 (2011) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
   3. ASTM D 2950-14 Density of Bituminous Concrete in Place by Nuclear Methods
   4. ASTM D 2397-13 Standard Specification for Cationic Emulsified Asphalt
   5. ASTM D 2399-12 Standard Practice for Selection of Cutback Asphalts
E. American Association of State Highway and Transportation Officials

1. AASHTO T 30 (2010) Mechanical Analysis of Extracted of Aggregate
2. AASHTO T 230 (1968;2004) Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures
4. AASHTO M 17-07 Mineral Filler for Bituminous Paving Mixtures

1.3 SUBMITTALS

A. For each material, submit certification of compliance with requirements of the contract documents.

1.4 QUALITY ASSURANCE

A. General: Work of this section shall be performed in the presence of the Testing Agent's representative.

B. Perform testing and inspection in accordance with requirements of the referenced standard.

C. Preliminary Paving Conference:

2. The following shall be present:
   a. Paving installer.
   b. Subbase installer.
   c. Installers of other work adjoining or associated with paving work.
   d. The Owner
   e. The Architect.
   f. Representative of testing agency.
3. Review requirements of contract documents, submittals, certifications, and status of related work.
4. Review inspection and testing requirements, governing regulations, and proposed installation equipment and procedures. Review anticipated weather conditions and procedures for coping with unfavorable conditions.
5. Review required certifying and accounting procedures for material usage.
6. Tour representative portions of areas to receive paving.
7. Inspect and discuss condition of substrate and preparatory work performed by other trades.
8. Discuss requirements for protection of paving work, including restriction of traffic both during installation period and for remainder of construction period.
9. Review and establish construction schedule for paving and related work. Verify availability of materials, paving installer's personnel, and equipment required to execute the work without delays.
10. Record discussion including agreement or disagreement on matters of significance. Furnish copy of recorded discussions to each participant.

1.5 PROJECT CONDITIONS

A. Comply with environmental requirements specified in the referenced standard for each type of construction and paving material.
PART 2 - PRODUCTS

2.1 GENERAL

A. Provide materials as required or recommended for paving construction by the referenced standard and as indicated on the contract documents.

2.2 BASE COURSE

A. Base Course: As indicated on Contract documents, complying with applicable state highway specifications regarding source, quality, gradation, liquid limit, plasticity index and mix proportioning.

2.3 PRIME COAT

A. Prime Coat: A medium curing cut-back asphalt or an asphalt penetrating prime coat consisting of either ASTM D 2397-13 or ASTM D 2399-12, MC-30 or SS-1h.

2.4 ASPHALT CONCRETE SURFACE COURSE

A. Asphalt concrete surface type and thickness shall be as shown on the Contract documents.

B. Asphalt Cement: Comply with ASTM D 3381-13; Table 2 AC-10, AC-20, or AC-30, viscosity grade, depending on local mean annual air temperature as indicated below:

<table>
<thead>
<tr>
<th>TEMPERATURE CONDITION</th>
<th>ASPHALT GRADES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold, mean annual air temperature at 45 degrees F or lower</td>
<td>AC-10 85/100 pen.</td>
</tr>
<tr>
<td>Warm, mean annual air temperature between 45 degrees F and 75 degrees F</td>
<td>AC-20 60/70 pen.</td>
</tr>
<tr>
<td>Hot, mean annual air temperature at 75 degrees F or higher</td>
<td>AC-30</td>
</tr>
</tbody>
</table>

2.5 TACK COAT

A. Tack Coat: Emulsified asphalt; ASTM D 2397-13 or ASTM D 2399-12, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

2.6 MINERAL FILLER

A. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17-07/ASTM D 242-09(2014), if recommended by applicable state highway department standards.
## 2.7 ASPHALT-AGGREGATE MIXTURE

A. Asphalt-Aggregate Mixture – The Design Mix shall be within ranges below:

### JOB MIX FORMULA AND DESIGN LIMITS

<table>
<thead>
<tr>
<th>MIXTURE CONTROL % TOLERANCES</th>
<th>TYPE MIXTURE</th>
<th>&quot;B&quot;</th>
<th>&quot;B&quot; Modified</th>
<th>&quot;F&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRADING REQUIREMENTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 0.0 % Passing 1&quot; Sieve</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 0.7 % Passing 1&quot; Sieve</td>
<td>*100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 0.7 % Passing 3/4&quot; Sieve</td>
<td>85-100</td>
<td>85-100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 1.6 % Passing 1/2&quot; Sieve</td>
<td>*100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.6 % Passing 3/8&quot; Sieve</td>
<td>55-75</td>
<td>64-85</td>
<td>90-100</td>
<td></td>
</tr>
<tr>
<td>5.7 % Passing No. 4 Sieve</td>
<td>55-75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>± 4.6 % Passing No. 8 Sieve</td>
<td>30-36</td>
<td>44-48</td>
<td>44-50</td>
<td></td>
</tr>
<tr>
<td>3.8 % Passing No. 50 Sieve</td>
<td>11-19*</td>
<td>10-25</td>
<td>14-25**</td>
<td></td>
</tr>
<tr>
<td>2.0 % Passing No. 200 Sieve</td>
<td>4-7</td>
<td>4-7</td>
<td>4-7</td>
<td></td>
</tr>
</tbody>
</table>

### DESIGN REQUIREMENTS

<table>
<thead>
<tr>
<th>Range for % AC</th>
<th>50 Blow Marshall</th>
<th>75 Blow Marshall</th>
<th>75 Blow Marshall</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.40</td>
<td>4.00-5.50</td>
<td>4.75-7.00</td>
<td>5.25-7.50</td>
</tr>
<tr>
<td>n/a</td>
<td>8.16</td>
<td>8.16</td>
<td>8.16</td>
</tr>
<tr>
<td>Flow (AASHTO T-245)</td>
<td>8-14</td>
<td>8-14</td>
<td>8-14</td>
</tr>
<tr>
<td>n/a</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>Min. Stability - Lbs. (AASHTO T-245)</td>
<td>1800</td>
<td>1800</td>
<td>1800</td>
</tr>
<tr>
<td>n/a</td>
<td>5. ± 05.4</td>
<td>5. ± 05.4</td>
<td>5. ± 05.4</td>
</tr>
<tr>
<td>n/a</td>
<td>65-75</td>
<td>65-82</td>
<td>70-82</td>
</tr>
<tr>
<td>% Aggregate Voids Filled With Asphalt Cement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n/a</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Tensile Splitting Ratio After Freeze - Thaw Cycle (GDT 66)</td>
<td>Min. 0.8</td>
<td>Min. 0.8</td>
<td>Min. 0.8</td>
</tr>
<tr>
<td>n/a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Retention of Coating (GDT 56)</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
</tbody>
</table>

* Mixture Control Tolerance not applicable to this sieve for this mix.

** Production mixture shall be maintained within these ranges regardless of Job Mix Formula and Mixture Control Tolerance values.

## PART 3 - EXECUTION

### 3.1 GENERAL

A. Comply with cross sections, elevations, and grades indicated on the contract documents.

B. Examine, prepare, and install pavements in accordance with the contract documents and with applicable provisions of the referenced standard.

C. Perform paving work when the weather is dry, the subgrade is thawed and dry, and the temperature of the surrounding air is at least 40°F.
3.2 EXAMINATION

A. Verification of Subbase Conditions:
   1. Verify that subbase is dry and in suitable condition to support paving and imposed loads.
   2. Notify Architect and Testing Agency in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.
   3. Commencement of paving work shall constitute acceptance of subbase conditions.

3.3 GENERAL PREPARATION

A. Immediately before placing asphalt concrete mix, remove all loose or deleterious material from surface over which pavement will be placed. Ensure that subbase is properly prepared to receive paving. Include primer coat on subbase and tack coat on binder.

3.4 SUBGRADE PREPARATION

A. Bring subgrade to line and grade and shape to indicate cross slope. Compact to 98 percent standard proctor maximum dry density (ASTM D698-12e1). Remove and dispose of all soft and unstable material, and replace with compacted fill or base material. Protect subgrade from traffic damage, water ponding and washouts.

3.5 BASE COURSE INSTALLATION

A. Perform base course construction in a manner that will drain surface properly at all times and at the same time prevent runoff from adjacent areas from draining onto base course construction.

B. Compact base material to not less than 98 percent of optimum density as determined by ASTM D 698-07e1 or 95 percent of optimum density, as determined by ASTM D 1557-12, unless otherwise indicated on the Contract documents.

C. Granular Base: Construct to thickness indicated on Contract documents. Apply in lifts or layers not exceeding 8 inches, measured loose.

D. Sand/Shell Base: Construct to thickness indicated on Contract documents. Apply in lifts or layers not exceeding 4 inches, measured loose.

E. Asphalt Institute Type IV Mix for Full Depth Asphalt Base: Construct to thickness indicated on Contract documents in lifts or layers not exceeding 3 inches, measured loose.

F. Asphalt Institute Type VI, VII, or VIII Mixes for Hot-Mix Sand Asphalt Bases: Construct to thickness indicated on Contract documents. Apply in lifts or layers not exceeding 3 inches, measured loose.

G. Soil Cement Stabilized Base: Construct to thickness and strength as indicated on Contract documents and in accordance with applicable state highway specifications. If not indicated on the Contract documents, the minimum compressive strength shall be 500 pounds per square inch, tested at 28 days.

H. Spray prime coat on base course. Let cure 24 hours before installing binder course.

3.6 APPLICATIONS
A. Prime Coat:
1. Apply bituminous prime coat to all base material surfaces where bituminous concrete paving will be constructed.
2. Apply bituminous prime coat in accordance with applicable state highway specifications.
3. Apply at minimum rate of 0.25 gallon per square yard over compacted base material. Apply to penetrate and seal, but not flood surface.
4. Make necessary precautions to protect adjacent areas from overspray.
5. Cure and dry as long as necessary to attain penetration of compacted base and evaporation of volatile substances.

B. Tack Coat:
1. Apply to contact surfaces of previously constructed bituminous concrete base courses or Portland cement concrete and surfaces abutting or projecting into bituminous concrete or into bituminous concrete pavement.
2. Apply tack coat to bituminous concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth bituminous concrete and sand asphalt bases and on surface of all such bases where bituminous concrete paving will be constructed.
3. Apply emulsified asphalt tack coat in accordance with applicable state highway specifications.
4. Apply at minimum rate of 0.05 gallon per square yard of surface.
5. Allow to dry until at proper condition to receive paving.

3.7 BINDER AND SURFACE COURSE INSTALLATION

A. Place bituminous concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:

1. When ambient temperature is between 40 degrees F and 50 degrees F, mixture temperature equal to 285 degrees F.
2. When ambient temperature is between 50 degrees F and 60 degrees F, mixture temperature equal to 280 degrees F.
3. When ambient temperature is higher than 60 degrees F, mixture temperature equal to 275 degrees F.

B. Whenever possible, all pavement shall be spread by a finishing machine; however, inaccessible or irregular areas may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster that they can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of bituminous concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10 feet wide.

D. Joints: Make joints between old and new pavements or between successive days and work in a manner that will provide a continuous bond between adjoining work. Construction joints shall
have same texture, density, and smoothness as other sections of bituminous concrete course. Clean contact surfaces of all joints and apply tack coat.

E. Perform 1 asphalt extraction and 1 aggregate gradation for every 1,000 tons of binder or wear surface placed. Compact binder and wearing surface to at least 92 percent of its maximum theoretical voidless density.

F. Perform coring checks after wearing surface has been completed and determine density of the core. Composite thickness shall be within \( \frac{1}{4} \) inch of specified total thickness. Coring shall be performed at a frequency of 1 core for every 15,000 square feet of paving.

3.8 INSTALLATION

A. Placing the mix:

1. Place asphalt concrete mix on prepared surface and strike off. Place inaccessible and small areas using hand tools.
2. Before rolling operations begin, check surface using template and straightedge, and correct irregularities.

B. Joints: Construct joints to form continuous bond between adjoining portions of work. Apply tack coat to existing surfaces prior to paving against adjoining areas. Ensure that texture and density of pavement are continuous across the joint. Surface across joint shall form smooth, uninterrupted plane and shall not pond water.

C. Rolling:

1. Start rolling operation as soon as hot mix will bear weight of roller and can be compacted without unacceptable displacement of material.
2. Comply with roller manufacturers recommended rolling speed, but in no case exceed 3 miles per hour.
3. Avoid sharp turns and abrupt starts and stops.
4. Compact mixture in areas inaccessible to rollers using hot hand tampers or vibrating plate compactors.
5. Breakdown rolling:
   a. If grade is not absolutely level, begin breakdown rolling on low side of spread. Progress toward high side.
   b. Examine surface immediately after breakdown rolling. Repair as necessary by loosening material in defective areas and filling with hot material.
6. Second (intermediate) rolling:
   a. Execute second rolling as soon as possible after breakdown rolling, while mixture is still hot enough to achieve maximum density.
   b. Continue repeating the pattern until mixture has been compacted thoroughly.
7. Finish rolling:
   a. Execute finish rolling while mixture is sufficiently warm to allow removal of roller marks.
   b. Continue rolling operation until maximum density is achieved and roller marks are entirely eradicated.

D. Patching: Remove paved areas which are contaminated with foreign materials or which are defective in any way. Replace removed material with fresh, hot mix. Compact by rolling until
maximum density and smoothness are achieved and there is no detectable variation between patch and adjacent paving.

E. Restriction of traffic:

1. Upon completion of rolling operations, do not permit vehicular traffic on pavement until it has cooled and hardened sufficiently.
2. Erect clearly visible barricades and take other measures as required to protect pavement.

END OF SECTION 32 12 16
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary for the installation of portland cement concrete pavement. Including but not limited to the following:

1. Formwork for pavements.
2. Formwork accessories.
3. Form stripping.
4. Reinforcing steel for pavements.
6. Concrete curing.

B. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCES DOCUMENTS


C. American Association of State Highway and Transportation Officials
   1. AASHTO M 148 – (2005) Liquid Membrane-Forming Compounds for Curing Concrete
   2. AASHTO M 171 – (2005) Sheet Materials for Curing Concrete
   3. AASHTO M 182 – 05(R2012) Standard Specification for Burlap Cloth Made from Jute or Kenaf

D. American Concrete Institute
   1. ACI 211.1 1999R2009 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
   2. ACI 301-11 – Specifications for Structural Concrete for Buildings
   3. ACI 302.1R-04 – Guide for Concrete Floor and Slab Construction
   4. ACI 304R2010 – Guide for Measuring, Mixing, Transporting, and Placing Concrete
   5. ACI 305R-10 – Hot Weather Concreting
   6. ACI 325.9R-91(R1997) – Guide for Construction of Concrete Pavements and Concrete Bases
8. ACI 318-14 - Building Code Requirements for Structural Concrete

E. American Society for Testing and Materials

2. ASTM A 615 – 14 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. ASTM C 31 – 12 Standard Practice for Making and Curing Concrete Test Specimens in the Field
4. ASTM C 33 – 13 Standard Specification for Concrete Aggregates
5. ASTM C 39 – 14a Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
6. ASTM C 42 – 13 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
7. ASTM C 94 – 14b Standard Specification for Ready-Mixed Concrete
8. ASTM C 143 – 12 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
10. ASTM C 156 – 11 Standard Test Method for Water Retention by Concrete Curing Materials
12. ASTM C 172 – 14a Standard Practice for Sampling Freshly Mixed Concrete
13. ASTM C 173 – 14 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
14. ASTM C 231 – 14 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
15. ASTM C 309 – 11 Standard Specification for Liquid membrane-Forming Compounds for Curing Concrete
17. ASTM C 1059 – 13 Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete

F. CRSI MSP - Manual of Standard Practice; Concrete Reinforcing Steel Institute

1.3 SUBMITTALS

A. Quality Control Submittals: Submit the following information related to quality assurance requirements specified:

1. Design data: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted the method by which proportions have been selected.
   a. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength f(cr) calculations.
   b. For mix designs based on trial mixtures, include trial mix proportions, test results, and graphical analysis and show required average compressive strength f(cr).
   c. Indicate quantity of each ingredient per cubic yard of concrete.
2. Certifications: Submit affidavits from an independent testing agency certifying that all materials furnished under this section conform to specifications.

3. Delivery tickets: Submit copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to site. Include on the tickets the additional information specified in the ASTM document.

4. Cold weather concreting: Submit description of planned protective measures.

5. Hot weather concreting: Submit description of planned protective measures.

B. Contractor shall submit certified laboratory reports on each additive material to the Architect

1.4 QUALITY ASSURANCE

A. Testing Agency Services:

1. Design Professional will engage testing agency to conduct tests and perform other services specified for quality control during construction.

2. Contractor shall engage an independent testing agency to conduct testing necessary for design mix and material certification submittals.

B. Source of Materials: Obtain materials of each type from same source for the entire project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths, and other data corresponding to information shown on placement contract documents.

C. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or rust.

C. Store cementitious materials in a dry, weathertight location. Maintain accurate records of shipment and use.

D. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.

E. Handle aggregates to avoid segregation.

1.6 PROJECT CONDITIONS

A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306. Well in advance of proposed concrete operations, advise the Testing Agent and Architect of planned protective measures including but not limited to heating of materials, heated enclosures, and insulating blankets.

B. Hot Weather Concreting: Comply fully with the recommendations of ACI 305R. Well in advance of proposed concrete operations, advise the Testing Agent and Architect of planned protective measures, including but not limited to cooling of materials before or during mixing, placement during evening to dawn hours, fogging during finishing and curing, shading, and wind breaks.
PART 2 - PRODUCTS

2.1 FORMWORK

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required.

1. APA Exterior Plyform BB with a medium density, smooth, hard, fused resin fiber overlay, or metal forms.
2. Single piece; depth equal to slab thickness.
3. Base width at least three-fourths of form depth but not less than 8 inches, unless otherwise approved.
4. Straightness tolerance: 1/8 inch in 10 feet from true plane surface along top; 1/4 inch in 10 feet along face.
5. Locking provisions at ends of abutting form sections.
6. Wood forms complying with the above provisions, including base and locking, may be used only where form of less than 10 feet is required.
7. Form Oil: Coat forms with nonstaining type coating that will not discolor or deface surface of concrete.

B. Curb, Curb and Gutter Forms: Use flexible spring-steel forms or laminated boards to form radius bends. Tolerance: Not to deviate more than 1/4 inch in 10 feet in grade and alignment.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, and as follows:

1. Type I, except where other type is specifically permitted or required.
2. Type I maybe replaced by Type III (high early strength) for concrete placed during cold weather.

B. Water: Potable.

C. Aggregates: ASTM C33.

1. Fine aggregate shall be natural sand, or sand prepared from stone or gravel. Grains shall; be clean, hard, durable, uncoated and free from silt, loam and clay.
2. Coarse Aggregates: Crushed stone, gravel, or other approved inert materials of similar characteristics, or combinations thereof, having hard, strong, durable pieces free from adherent coatings. Maximum size of pieces shall be 3/4" to #4 except for footings, which may be 1-1/2". The maximum size of aggregate may also be not larger than one fifth of the narrowest dimension between forms, nor larger than three fourths of the minimum clear spacing between reinforcing bars.

D. Admixtures:

1. May be used at contractors option to provide workability at low slumps, increased compressive strength, retardation or acceleration of the concrete.
a. Water-Reducing Admixture: ASTM C 494, Type A.
b. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.
c. Water-Reducing and accelerating Admixtures: ASTM C 494 E.
d. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or G.
4. The cement factor shall not be reduced and changes shall be made in the other mix proportions to ensure the minimum strength requirements.
5. Use of admixtures approved in writing by Testing Agent and Architect. No additional expense to the Architect will be allowed.
6. No calcium chloride shall be used.
7. Before any admixture is accepted for use, the Contractor shall submit certified laboratory reports on each additive material to the Testing Agent and Architect. The report shall show the following:
   a. Confirmation of compliance with the applicable ASTM Standard.
   b. Evaluation of the effects of the admixture on the properties of the concrete to be made on the job, including consideration of the anticipated ambient conditions on the job, and proposed construction procedures.
   c. Determination of within-lot uniformity of product proposed for use.
8. Admixtures, which result in more than 0.1 percent of soluble chloride ions by weight of cement, are prohibited.


1. Use air-entrained concrete for exterior exposed concrete including walls, walks, paving, etc. where minimum daily temperatures are expected below 38 degrees F during pouring or subsequent 28 day curing period.
2. Proportion air-entraining concrete to attain minimum 28-day compressive strength specified.
3. Total Air Entrainment in Concrete: Not less than four percent nor more than six percent volume of concrete.

2.4 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Bonding Compound: Non-redispersable acrylic bonding admixture, ASTM C 1059, Type II.

2.5 CONCRETE MIX DESIGN

A. Concrete Proportions:

1. Concrete shall be homogenous, and when hardened, shall have the required strength, resistance to deterioration, durability, water tightness and the properties as specified. Minimum concrete strength at 28 days shall be 3,000 psi unless otherwise specified on Contract documents. Minimum 28-day compressive strength for concrete paving shall be 4,000 psi unless otherwise specified on the Contract documents.
2. Slump of concrete:
   a. Slabs on ground: 2-1/2 inch minimum to 4 inch maximum.
   b. Ramps and sloping surfaces: Not more than 3 inches.
3. Maximum water-cement ratio by weight: 0.40.
4. Maximum nominal size of coarse aggregate: As recommended in ACI 211.1.
5. Total air content as recommended by Table 1.4.3 of ACI 201.2 for maximum size of coarse aggregate and severe exposure.
6. Design mix to meet or exceed each requirement specified. Where more than one criterion is specified, the most stringent shall apply. For example, a minimum cement content or maximum water-cement ratio might result in strengths greater than the minimum specified; likewise, a greater cement content or lower water-cement ratio may be required in order to achieve the required strength.

B. Ready-Mix Concrete:

1. Ready-mix concrete shall conform to ASTM C94. The mixing agitation shall begin within 30 minutes, and the concrete shall be discharged from the truck within one hour after the water has been added to the concrete mix.
2. Delivery tickets are to accompany each concrete truck and shall be kept in the job superintendent’s file. Delivery tickets must indicate the following information or be subject to rejection:
   a. Name of project.
   b. Supplier of concrete.
   c. Truck identity and ticket serial number.
   d. Date of delivery.
   e. Brand of cement.
   f. Cement content.
   g. Strength classification.
   h. Batching time.
   i. Point of deposit.
   j. Total amount of water.
   k. Weight of aggregate.
   l. Daily temperature.
   m. Number of cubic yards in load.
   n. Admixture content.
   o. Name of Contractor.
   p. Name of driver.
   q. Time loaded and first mixing of concrete.
   r. Reading of revolution counter.
3. Quantity of water used for each batch shall be accurately measured.

C. Admixtures:

1. Air-Entraining Admixture: Add at rate to achieve specified air content.
2. Water-Reducing Admixture: Add as required for placement and workability.
3. Water-Reducing and Retarding Admixture: Add as required in concrete mixes to be placed at ambient temperatures above 90° F.
4. Water-Reducing and Accelerating Admixture: Add as required in concrete mixes to be placed at ambient temperatures below 50° F.
5. High-Range Water-Reducing Admixture: (Superplasticizer): Add as required for placement and workability.
6. Do not use admixtures not specified or approved.

D. Mix Adjustments: Provided that no additional expense to Owner is involved, contractor may submit for Architect’s approval requests for adjustment to approved
concrete mixes when circumstances such as changed project conditions, weather, or unfavorable test results occur. Include laboratory test data substantiating specified properties with mix adjustment requests.

2.6 CONTROL OF MIX IN THE FIELD

A. Slump: A tolerance of up to 1 inch above approved design mix slump will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidation is obtained.

B. Do not use batches that exceed tolerances.

2.7 JOINT MATERIALS

A. Sealed expansion and contraction joints: Filler of nonbituminous rubber or cork conforming to ASTM D1752.

B. Non-sealed joints: Filler premolded bituminous type conforming to ASTM D1751.

C. Noncompressive Filler: 2 inch or 1 inch thick sheets.

D. Compressive Filler: 2 inch or 1 inch thick sheets, compression modulus within the range of 15 to 25 pounds per square inch per inch.

E. Filler Adhesive for Noncompressive Filler and Compressive Filler:

F. Slab-on-grade Construction Joints: Provide a full slab depth 24 gauge metal preshaped key, approximate depth of key to be 1/4 slab thickness and a key width of about 1/10 slab thickness.


2.8 CURING MATERIALS

A. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.

B. Moisture-Retaining Cover: AASHTO M 171, and as follows:

1. White waterproof paper.
2. Opaque-white polyethylene sheet, 0.006 inch thick.

C. Sealers: ASTM C156 and ASTM C309, Type I. Material shall become integral part of concrete and leave slab free of residue or film.

D. Membrane Curing Compound: Liquid membrane-forming compounds shall meet the requirements of AASHTO M148.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Conform with the requirements specified elsewhere in Division 31.

B. Thoroughly wet subgrade and then compact with two passes of a 500 pound roller.
C. Pumping: Where concrete paving or sidewalks, and curbs are to be placed, yielding material deflecting more than 1/2 inch under a 500 lb. roller shall be removed to a depth of not less than 4 inches below subgrade elevation and replaced with an approved granular material which shall then be compacted as described above.

D. The subgrade shall be in a moist condition when the concrete is placed. In cold weather the subgrade shall be prepared and protected so as to provide a subgrade free from frost when the concrete is deposited.

3.2 CONCRETE FORM PREPARATION

A. General: Comply with requirements of ACI 325R-91(R 2007) for formwork, and as herein specified. The Contractor is responsible for design, Architecting, and construction of formwork, and for its timely removal.

B. Construction: Construct and brace formwork to accurately achieve end results required by concrete documents, properly located and accurately aligned. Provide for screens, bulkheads, anchorages, and other features shown or otherwise required.

C. Release Agent: Provide field-applied form coating. Thoroughly clean and recondition formwork and reapply coating before each use.

D. Comply with the requirements of Section 03 30 00 Cast-in-Place Concrete. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least 24 hours after concrete placement.

E. Check complete formwork for grade and alignment to the following tolerances:
   1. Top of form: Not more than 1/8 inch in 10 feet.
   2. Vertical face: Longitudinal axis not more than 1/4 inch in 10 feet.

3.3 CONNECTION TO EXISTING CONCRETE

A. Preparation: At locations where new concrete is to join existing concrete, prepare existing surface by cleaning with wire brush and applying bonding compound in accordance with manufacturer’s instructions.

3.4 PLACING REINFORCEMENT

A. General: Comply with requirements of ACI 301 and as herein specified.

B. Preparation: Clean reinforcement of loose rust and mill scale, soil, and other materials which adversely affect bond with concrete.

C. Placement: Place reinforcement to achieve not less than minimum concrete coverage required for protection. Accurately position, support, and secure reinforcement against displacement. Provide Class C tension lap splices complying with ACI 318 unless otherwise indicated. Do not field-bend partially embedded bars unless otherwise indicated or approved.

   1. Use approved bar supports and tie wire, as required. Set wire ties to avoid contact with or penetration of exposed concrete surfaces. Tack welding of
reinforcing is not permitted.

2. Wire fabric: Install in maximum lengths possible, lapping adjoining pieces not less than one full mesh. Offset end laps to prevent continuous laps in either direction, and splice laps with tie wire.

D. Welding: Welding of reinforcement is not permitted.

E. Do not place concrete until reinforcement has been inspected and approved by local authorities, if required.

3.5 JOINT CONSTRUCTION

A. General: Provide joints of the types and in the locations shown on the contract documents.

1. Construct joints in adjacent panels in precise alignment. Do not offset joints.
2. Tool slab edges and formed joints with 1/8-inch radius jointing tool.

B. Expansion Joints:

1. Provide positive, firm support of filler during placement of concrete to ensure accurate alignment.
2. Install expansion joint filler to the full concrete depth.
3. Recess top edge of filler to the depth indicated to accommodate joint sealant. Protect top edge of filler with removable metal channel while concrete is being placed, or provide filler with removable portion of the required depth.
4. Install transverse expansion joints at returns and 15 feet on center.
5. Install longitudinal expansion joints where curbs and paved areas about each other, buildings, other concrete slabs and pads or vertical restraints.
6. Place joint filler with top edge 1/4" below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing.
7. Immediately after finishing operations are completed, round joint edges with edging tool having a radius of 1/8". Remove concrete over the joint filler.
8. At the end of the curing period, clean and fill expansion joints with joint sealer. Fill joints flush with concrete surface. Dummy groove joints shall not be sealed.

C. Sawn Contraction Joints:

1. Use only wet saws of an approved type.
2. Saw cut concrete as soon as the surface is firm enough so that it will not be damaged by the blade. The optimum time to cut the slab will be the Contractor's responsibility. Generally in moderate weather conditions, this time will be with in 4 to 12 hours after the concrete is poured. This time will be earlier in hot or dry weather conditions. Concrete with shrinkage cracks will not be accepted.
3. Saw to one-fourth of slab depth.
4. Extend saw cut to full width of concrete section, including adjacent curbs and gutters, if any.
5. Membrane-cured surface damaged during the sawing operations shall be resprayed as soon as the surface becomes dry.

D. Curb Expansion Joints: Fill joints with 1/2 inch thick joint filler strips conforming to ASTM D1751 or ASTM D1752.
3.6 CONCRETE PLACEMENT

A. Preparation: Provide materials necessary to ensure adequate protection of concrete during inclement weather before beginning installation of concrete.

B. Inspection: Before beginning concrete placement, inspect formwork, reinforcing steel, and items to be embedded, verifying that all such work has been completed.

C. Placement - General: Comply with requirements of ACI 304 and as follows:
   1. Schedule continuous placement of concrete to prevent the formation of cold joints.
   2. If a section cannot be placed continuously, provide keyed construction joints with tie bars of size and spacing as approved by the architect.
   3. Deposit concrete as close as possible to its final location, to avoid segregation.

D. Slab Placement: Schedule continuous placement and consolidation of concrete within planned construction joints.
   1. Thoroughly consolidate concrete without displacing reinforcement or embedded items, using internal vibrators, vibrating screens, roller pipe screens, or other means acceptable to the Architect and Testing Agent.

E. Cold Weather Placement: Comply with recommendations of ACI 306 when air temperatures are expected to drop below 40°F either during concrete placement operations or before concrete has cured.
   1. Do not use frozen or ice-laden materials.
   2. Do not place concrete on frozen substrate.

F. Hot Weather Placement: Comply with recommendations of ACI 305R when ambient temperature before, during, or after concrete placement is expected to exceed 90°F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would otherwise exceed 0.2 pounds per square foot per hour.
   1. Do not add water to approved concrete mixes under hot weather conditions.
   2. Provide mixing water at lowest feasible temperature, and provide adequate protection of poured concrete to reduce rate of evaporation.
   3. Use fog nozzle to cool formwork and reinforcing steel immediately prior to placing concrete.

3.7 FINISHING PAVEMENTS

A. Finishing Operations - General:
   1. Do not directly apply water to slab surface or dust with cement.
   2. Use hand or powered equipment only as recommended in ACI 325.9R and 330R.
   3. Screening: Strikeoff to required grade and within surface tolerances indicated. Verify conformance to surface tolerances. Correct deficiencies while concrete is still plastic.
   4. Bull Floating: Immediately following screening, bull float or darby before bleed water appears to eliminate ridges, fill in voids, and embed coarse aggregate.
Recheck and correct surface tolerances.

5. Do not perform subsequent finishing until excess moisture or bleed water has disappeared and concrete will support either foot pressure with less than 1/4-inch indentation or weight of power floats without damaging flatness.

6. Final floating: Float to embed coarse aggregate, to eliminate ridges, to compact concrete, to consolidate mortar at surface, and to achieve uniform, sandy texture. Recheck and correct surface tolerances.

B. Broomed Float Finish: After floating and when water sheen has practically disappeared, apply uniform transverse corrugations approximately 1/16 inch deep, without tearing surface.

C. Slab Surface Tolerances:

1. Achieve flat, level planes except where grades are indicated. Slope uniformly to drains.
2. Flatness tolerance: Maximum depression between high spots when measured by placing a 10-foot straightedge on surface at any orientation: 3/16 inch.

D. Repair of Slab Surfaces: Test slab surfaces for smoothness and to verify surface plane to tolerance specified. Repair defects as follows:

1. High areas: Correct by grinding after concrete has cured for not less than 14 days.
2. Low areas: Immediately after completion of surface finishing operations, cut out low areas and replace with fresh concrete. Finish repaired areas to blend with adjacent concrete. Proprietary patching compounds may be used when approved by the Architect and Testing Agent.

3.8 CONCRETE CURING AND PROTECTION

A. General:

1. Prevent premature drying of freshly placed concrete, and protect from excessively cold or hot temperatures until concrete has cured.
2. Provide curing of concrete by one of the methods listed and as appropriate to service conditions and type of applied finish in each case.

B. Curing Period:

1. Not less than 7 days for standard cements and mixes.
2. Not less than 4 days for high early strength concrete using Type III cement.

C. Surfaces Not in Contact with Forms: Start curing as soon as free water has disappeared, but before surface is dry. Place to protect adjacent concrete edges. Acceptable curing methods include the use of burlap, moisture retaining covers, or curing compound as specified herein.

D. Ensure that joints and slab edges receive adequate curing. Ensure that sawn joints receive adequate curing after sawing.

E. During and following curing period, protect concrete from temperature changes of adjacent air in excess of 5° F per hour and 50° F per 24 hours. Progressively adjust
protective measures to provide uniform temperature changes over entire concrete surface.

3.9 REMOVAL OF FORMS AND SUPPORTS

A. Provided that concrete has hardened sufficiently that it will not be damaged, forms may be removed after concrete has cured at not less than 50° F for 8 hours. Maintain curing and protection operations after form removal.

3.10 BACKFILLING

A. After curing, remove debris and backfill the adjoining areas, grade and compact to conform to the surrounding area in accordance with the lines and grades indicated.

3.11 QUALITY CONTROL TESTING DURING CONSTRUCTION:


1. Take samples at point of discharge.
2. For pumped concrete, perform sampling and testing at the frequencies specified herein at point of delivery to pump, and perform additional sampling and testing at the same frequency at discharge from line. Results obtained at discharge from line shall be used for acceptance of concrete.

B. Slump: ASTM C 143. One test per batch. Modify sampling to comply with ASTM C 94.

C. Air Content of Normal Weight Concrete: ASTM C 173 or ASTM C 231. One test per strength test performed on Air-entrained concrete.

D. Concrete Temperature:

1. Test hourly when air temperature is 40° F or below.
2. Test hourly when air temperature is 90° F or above.
3. Test each time a set of strength test specimens is made.


1. Compression test specimens: Mold and cure one set of 4 standard cylinders for each compressive strength test required.
2. Testing for acceptance of potential strength of as-delivered concrete:
   a. Obtain samples on a statistically sound, random basis.
   b. Minimum frequency:
      i. One set per 100 cubic yards or fraction thereof for each day's pour of each concrete class.
      ii. One set per 3500 square feet of slab area or fraction thereof for each day's pour of each concrete class.
      iii. When the above testing frequency would provide fewer than 5 strength tests for a given class of concrete during the project, conduct testing from not less than 5 randomly selected batches, or from each batch if fewer than 5.
   c. Test one specimen per set at 7 days for information unless an earlier age is required.
   d. Test 2 specimens per set for acceptance of strength potential; test at 28 days unless other age is specified. The test result shall be the
average of the two specimens. If one specimen shows evidence of improper sampling, molding, or testing, the test result shall be the result of the remaining specimen; if both show such evidence, discard the test result and inform the Architect and Testing Agent.

e. Retain one specimen from each set for later testing, if required.
n. Strength potential of as-delivered concrete will be considered acceptable if all of the following criteria are met:

i. No individual test result falls below specified compressive strength by more than 500 psi.

ii. Not more than 10 percent of individual test results fall below specified compressive strength $f'(c)$.

iii. Average of any 3 consecutive strength test results equals or exceeds specified compressive strength $f'(c)$.

g. Testing for evaluation of field curing:

i. Frequency: 1 field set of specimens per strength acceptance test.

ii. Mold specimens from same sample used for strength acceptance tests.

Field-cure, and test at same age as for strength acceptance tests.

iii. Evaluate construction and curing procedures and implement corrective action when strength results for field-cured specimens are less than 85 percent of test values for companion laboratory-cured specimens.

F. Test Results: Testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

1. Test reports shall contain the following data:

   a. Project name, number, and other identification.

   b. Name of concrete testing agency.

   c. Date and time of sampling.

   d. Concrete type and class.

   e. Location of concrete batch in the completed work.

   f. All information required by respective ASTM test methods.

2. Nondestructive testing devices such as impact hammer or sonoscope may be used at Architect's option for assistance in determining probable concrete strength at various locations or for selecting areas to be cored, but such tests shall not be the sole basis for acceptance or rejection.

3. The testing agency shall make additional tests of in-place concrete as directed by the Architect when test results indicate that specified strength and other concrete characteristics have not been attained.

   a. Testing agency may conduct tests of cored cylinders complying with ASTM C 42, or tests as directed.

   b. Cost of additional testing shall be borne by the Contractor when unacceptable concrete has been verified.

3.12 OPENING PAVEMENTS TO TRAFFIC

A. Protect the completed work from damage. Repair damaged concrete and clean concrete discolored during construction. Remove work that is damaged and reconstruct to entire length between regularly scheduled joints. Refinishing damaged portion is not acceptable.
B. Pavements may be opened to traffic only after 14 days have elapsed after placement and pavements have developed at least 85 percent of specified strength.

End of Section 32 13 13
SECTION 32 16 13
CONCRETE SIDEWALKS, CURBS AND GUTTERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment, and incidentals necessary for the construction of concrete sidewalks, curbs, and gutters.

B. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS


C. American Association of State Highway and Transportation Officials
   1. AASHTO M 148 – 2005(R2009) Liquid Membrane-Forming Compounds for Curing Concrete
   2. AASHTO M 171 – (2005) Sheet Materials for Curing Concrete

D. American Society for Testing and Materials
   1. ASTM A 185 – (2007) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
   2. ASTM A 615 – 14 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   3. ASTM A 616 – (1996a) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
   4. ASTM A 617 – (1996a) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
   5. ASTM C 31 – 12 Making and Curing Concrete Test Specimens in the Field
   6. ASTM C 143 – 12 Slump of Hydraulic Cement Concrete
   7. ASTM C 156 – 11 Standard Test Method for Water Retention by Concrete Curing materials
   9. ASTM C 172 – 14 Sampling Freshly Mixed Concrete
   10. ASTM C 173 – 14 Air Content of Freshly Mixed Concrete by the Volumetric Method
   11. ASTM C 231 – 14 Air Content of Freshly Mixed Concrete by the Pressure Method
Compounds for Curing Concrete

13. ASTM C 920 – 14a Elastomeric Joint Sealants
15. ASTM D 1752 – 04a(2013) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.3 SUBMITTALS

A. Copies of all test reports shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES within 24 hours of completion of the test.

1.4 WEATHER LIMITATIONS

A. Placing During Cold Weather

1. Concrete placement shall not take place when the air temperature reaches 40 degrees F and is falling, or is already below that point. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F.
2. Provisions shall be made to protect the concrete from freezing during the specified curing period. 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.
   a. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited.
   b. 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.
   c. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer.
   d. 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

1. The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used.
2. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature.
3. The placing temperature shall not exceed 95 degrees F at any time.

1.5 EQUIPMENT, MACHINES, AND TOOLS

A. Equipment, machines, and tools used in the work shall be subject to approval and shall be 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. Use of the equipment shall be discontinued if it produces unsatisfactory results.

B. Slip form pavers or curb forming machines, 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 UTILITY PROTECTION

A. Forty-eight (48) hours prior to excavation, the Contractor shall call the U.P.C. (Utilities Protection Center) 1-800-282-7411 to locate and protect existing utilities. Any damage to these utilities is to be repaired at no additional cost to the Owner. The Contractor is responsible for locating all utilities, either private or public.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Concrete shall conform to the applicable requirements of Section 03 30 00 CAST-IN-PLACE STRUCTURAL CONCRETE except as otherwise specified. Concrete shall have a minimum compressive strength of 3000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

B. 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. The concrete slump shall be 2 inches plus or minus 1 inch where determined in accordance with ASTM C 143.

D. Reinforcement bars, if required or shown on the contract documents, shall conform to ASTM A 615, ASTM A 616, or ASTM A 617. Wire mesh reinforcement shall conform to ASTM A 185.

2.2 CURING MATERIALS

A. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.

B. Moisture-Retaining Cover: AASHTO M 171, and as follows:
   1. White waterproof paper.
   2. Opaque-white polyethylene sheet, 0.006 inch thick.

C. Sealers: ASTM C156 and ASTM C309, Type I. Material shall become integral part of concrete and leave slab free of residue or film.

D. Membrane Curing Compound: Liquid membrane-forming compounds shall meet the requirements of AASHTO M148.
2.3 JOINT FILLER STRIPS

A. Contraction joint filler for curb and gutter shall consist of hard-pressed ¾ inch thick mineral fiberboard, asphalt impregnated, conforming to ASTM D1751.

B. Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 3/8 inch thick, unless otherwise indicated.

2.4 JOINT SEALANTS

A. Joint sealant, cold-applied shall conform to ASTM C 920.

B. Joint sealant, hot-poured shall conform to ASTM D 3405.

2.5 FORM WORK

A. Form work shall be designed and constructed 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. Wood forms shall be surfaced plank, 2 inches nominal thickness, straight, and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness.

C. 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. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. 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.

D. Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

E. Curb and gutter 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. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together. 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. Subgrade shall be placed and compacted in conformance with Section 31 00 00 EARTHWORK.
B. Sidewalk subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

C. Curb and gutter subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be compacted graded aggregate based equal in bearing quality to the subgrade under the adjacent pavement.

D. 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. Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms.

B. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired.

C. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

D. Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10 foot straightedge. Forms shall have a transverse slope 1/4 inch per foot with the low side adjacent to the roadway unless noted otherwise. Side forms shall not be removed for 12 hours after finishing has been completed.

E. 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. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

A. Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

B. Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. 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. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.
C. After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood 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.

D. All slab edges, including those at formed joints, shall be finished with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. 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.

E. 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 AND GUTTER CONCRETE PLACEMENT AND FINISHING

A. Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

B. Approved slipformed curb and gutter machines may be used in lieu of hand placement.

C. 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. 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. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

D. Curb edges at formed joints shall be finished as indicated.

E. 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. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. 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.

B. 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. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. 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.

C. Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. 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. At the end of the curing period, expansion joints shall be cleaned and filled with joint sealant.

3.6 CURB AND GUTTER JOINTS

A. Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

B. 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 shall be constructed by means of 1/8 inch thick separators and of a section conforming to the cross section of the curb and gutter. 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.

C. Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 10 feet.

3.7 CURING AND PROTECTION

A. Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

B. Mat Method: The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

C. Impervious Sheeting Method: The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. 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. 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. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

D. Curing compound: Apply at rate stated by manufacturer to conform with moisture-retention requirements specified, using second, immediate application at right angle to first, if necessary, and reapply if damaged by rain.

E. 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.

F. Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction at no additional cost to the Owner. 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.

3.8 FIELD QUALITY CONTROL

A. The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

B. The Contractor shall 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 C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 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.

C. Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 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 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.

D. 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.

E. 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.

F. The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

A. 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. 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. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

C. The Testing Agent, Architect, and Owner will inspect exposed surfaces of the finished work 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 at no additional cost to the Owner.

END OF SECTION 32 16 13
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary for the installation of road and parking striping and directional markings on asphaltic concrete and concrete paving including parking deck levels.

B. The Contractor shall provide barricades, warning signs, and warning lights around the work area as necessary to prevent injury to persons.

C. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS


1.3 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1. Product data for marking paint and thermoplastic. Indicate application methods and rates.

2. Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

1.4 DELIVERY AND STORAGE

A. All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.5 EQUIPMENT

A. All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition.

B. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.
1.7 MAINTENANCE OF TRAFFIC

A. When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

1.8 WEATHER LIMITATIONS

A. Apply pavement marking paint only when the ambient temperature in the shade is at least 50°F for 12 hours immediately prior to application.

B. Do not apply when surface is wet or contains moisture.

C. Do not apply paint when wind conditions would result in debris being deposited on painted surfaces.

PART 2 - PRODUCTS

2.1 PAINT

A. The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. The paint shall be capable of readily and uniformly dispersing to a complete homogeneous mixture providing good flowing and brushing properties capable of drying or curing free of streaks or sags.

B. All paint shall comply with Section 701 of the Department of Transportation, State of Alabama, Standard Specifications.

2.2 THERMOPLASTIC COMPOUNDS

A. The thermoplastic reflectorized pavement marking compound shall be extruded or sprayed in a molten state onto a primed pavement surface. Following a surface application of glass beads and upon cooling to normal pavement temperatures, the marking shall be an adherent reflectorized strip of the specified thickness and width that is capable of resisting deformation by traffic.

B. All thermoplastic shall comply with Section 701 of the Department of Transportation, State of Alabama, Standard Specifications.

2.3 PAVEMENT MARKING SCHEDULE

A. Pavement marking colors shall be as indicated below unless otherwise noted on Construction Drawings:

1. Pedestrian Crosswalks: White (Outside); Yellow (Inside).
2. Light Pole Bases and Bollards: Yellow.
3. Fire Lanes: Red or per local code.
4. Lane Striping Where Separating Traffic in Opposite Directions: Yellow.
6. Handicap Symbols: Blue or per local code.
7. Parking Stall Striping: White (Outside); Yellow (Inside)
8. Directional Arrows: White (Outside; Asphalt)
   Yellow (Inside; Concrete)
   Yellow (Outside; Concrete)

9. Lettering: White (Outside); Yellow (Inside)

PART 3 - EXECUTIONS

3.1 PREPARATIONS

A. Do not begin pavement marking until substrate has cured.

B. Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required.

C. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint.

D. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking.

E. Surfaces shall be recleaned, when work has been stopped due to rain.

F. Where existing pavement markings are indicated on Contract documents to be removed or would interfere with the adhesion of new paint, use a motorized abrasive device to remove existing markings.

   1. Use equipment that will not damage existing paving or create surface hazardous to vehicle or pedestrian traffic.
   2. Use marking removal methods approved by governing authority having jurisdiction in areas within public rights-of-way.

3.2 APPLICATION

A. All pavement markings and patterns shall be placed as shown on the plans. All linework not otherwise indicated shall be 4" uniform thickness. All directional markings shall be painted using spray equipment and stencils or templates of approved design to prevent overspray.

B. Paint

   1. Apply paint products in accordance with manufacturer’s published instructions using application procedures approved for the particular application and substrate to the specified Minimum Dry Film Thickness (MDF). Apply each coat to uniform finish. Apply 2 coats at manufacturer recommended rate without addition of thinner, with maximum 100 square feet per gallon coverage.
2. Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Paint temperature shall be maintained within these same limits. Do not apply paint markings if rain is expected within 24 hours.

3. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint.

4. Paint shall be applied pneumatically with approved equipment at rate of coverage specified. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

5. The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

C. Thermoplastic Compounds

1. Thermoplastic shall be applied in accordance with Section 701 of the Department of Transportation, State of Alabama, Standard Specifications.

2. Thermoplastic pavement markings shall be placed upon dry pavement; surface dry only will not be considered an acceptable condition. At the time of installation, the pavement surface temperature shall be a minimum of 40 degrees F and rising. Thermoplastics, as placed, shall be free from dirt or tint.

3. All centerline, skipline, edgeline, and other longitudinal type markings shall be applied with a mobile applicator. All special markings, crosswalks, stop bars, legends, arrows, and similar patterns shall be placed with a portable applicator, using the extrusion method.

4. Immediately following application, reflective glass spheres shall be dropped onto the molten thermoplastic marking at the rate of 1 pound per 20 square feet of compound.

3.3 MARKING REMOVAL

A. Pavement marking, including plastic tape, shall be removed in the areas shown on the contract documents. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process.

B. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph 3.1. Contractor shall demonstrate removal of pavement marking in an area designated by the Architect. The demonstration area will become the standard for the remainder of the work.

C. Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.
D. The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations. Debris shall be disposed of at approved sites.

END OF SECTION 32 17 23
SECTION 32 31 19
HEAVY INDUSTRIAL ALUMINUM ORNAMENTAL FENCE SYSTEM

PART 1 GENERAL

1.1. WORK INCLUDED
   A. The contractor shall provide all labor, materials and appurtenances necessary for installation of the industrial ornamental aluminum fence system defined herein.

1.2. RELATED WORK
   A. Division 3 - Concrete
   B. Division 31 – Earthwork

1.3. SYSTEM DESCRIPTION
   A. The manufacturer shall supply a total industrial ornamental aluminum fence system of the Ameristar® Echelon II® Classic design, 4-rail with circles. The system shall include all components (i.e., pickets, rails, posts, gates and hardware) required.

1.4. QUALITY ASSURANCE
   A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.5. REFERENCES
   A. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
   E. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

1.6. SUBMITTAL
A. The manufacturer's submittal package shall be provided prior to installation.

1.7. PRODUCT HANDLING AND STORAGE

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

PART 2 - MATERIALS

2.1 MANUFACTURER

A. Basis of Design Product: Subject to compliance with requirements, provide products listed by Ameristar Fence Products, Inc., www.ameristarfence.com, or comparable product by one of, but not limited to, the following:


2.2 MATERIAL

A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T52.

B. The manufactured framework shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be Black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

C. Material for fence pickets shall be 1” square x 0.062” thick (.125” wall for Invincible) extruded tubing. The cross-sectional shape of the rails shall conform to the manufacturer's ForeRunner™ design with outside cross-section dimensions of 1.75” square. The top wall and internal web of the rail shall be 0.070” thick; the sidewalls shall be 0.070” thick for superior vertical load strength. Picket holes in the ForeRunner rail shall be spaced 4.715” o.c., except for Invincible style 6’ long, which shall be, spaced 4.98” o.c. Picket retaining rods shall be 0.125” diameter galvanized steel. Fence posts and gate posts shall meet the minimum size requirements of Table 1. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections.

D. Bracket to rail attachments shall be made using specially designed one-way tamperproof security nuts with carriage bolt. Bracket to post connections shall be made using self-drilling
hex-head screws.

E. Aluminum castings shall be used for all rings, post caps, finials, and miscellaneous adornments.

2.1 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner rails shall be pre-punched to accept pickets.

B. The rail inner slide shall be fully inserted into the rail outer channel to form the raceway for the internal retaining rod. Grommets shall be inserted into the pre-punched holes in the rails, and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal raceway of the two-part ForeRunner rails. (Note: This can best be accomplished by using an alignment template). Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.

C. Completed panels shall be capable of supporting a 300 lb. load (applied at midspan) without permanent deformation. Panels shall be biasable to a 25% change in grade.

D. Gates shall be fabricated using 1.75" sq. reinforced ForeRunner rail material, 2” sq. x .250” gate ends, and 1” sq. x .125” pickets. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall be joined by welding.

PART 3 - EXECUTION

3.1 PREPARATION

A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.2 FENCE INSTALLATION

A. Fence post shall be spaced according to Table 3, plus or minus ½”. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36”. The “Earthwork” and “Concrete” sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application. See drawings for details required for post setting in slab and in top of retaining wall.

3.3 MAINTENANCE

A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed surfaces;

   1) Remove all metal shavings from cut area.
   2) Apply custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1 & 2 above will negate warranty. Ameristar
spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures’ warranty.

3.4 GATE INSTALLATION

A. Gate posts shall be spaced according to the manufacturers’ gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers’ gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.5 CLEANING

A. The contractor shall clean the jobsite of excess materials; debris caused by core drilling post holes in slab and retaining wall shall be cleaned and all stains removed from exposed concrete finishes.

<table>
<thead>
<tr>
<th>Fence Posts</th>
<th>Panel Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/2” x 2-1/2” x .080” Alum. w/ reinforced web</td>
<td>Up to &amp; Including 6’ Height</td>
</tr>
<tr>
<td>3” x 3” x .120” Alum.</td>
<td>Over 6’ Up to &amp; Including 8’ Height</td>
</tr>
<tr>
<td>4” x 4” x .250” Alum.</td>
<td>Over 8’ Height Up to 10’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gate Posts</th>
<th>Panel Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/2” x 2-1/2” x .080” Alum. w/ reinforced web</td>
<td>Up to &amp; Including 6’ Height</td>
</tr>
<tr>
<td>3” x 3” x .120” Alum.</td>
<td>Over 6’ Up to &amp; Including 8’ Height</td>
</tr>
<tr>
<td>4” x 4” x .250” Alum.</td>
<td>Over 8’ Height Up to 10’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gate Leaf</th>
<th>Up to &amp; Including 4’</th>
<th>Over 4’ Up to &amp; Including 6’</th>
<th>Over 6’ Up to &amp; Including 8’</th>
<th>Over 8’ Up to &amp; Including 10’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 4’</td>
<td>3” x 3” x .120” Alum.</td>
<td>4” x 4” x .250 Alum.</td>
<td>4” x 11 Ga. steel</td>
<td>4” x 11 Ga. steel</td>
</tr>
<tr>
<td>4’1” to 6’</td>
<td>4” x 4” x .250 Alum. or 3” x 12 Ga. steel</td>
<td>3” x 12 Ga. steel</td>
<td>4” x 11 Ga. steel</td>
<td>4” x 11 Ga. steel</td>
</tr>
<tr>
<td>6’1” to 8’</td>
<td>4” x 11 Ga. steel</td>
<td>4” x 11 Ga. steel</td>
<td>4” x 11 Ga. steel</td>
<td>6” x 3/16” steel</td>
</tr>
<tr>
<td>8’1” to 10’</td>
<td>4” x 11 Ga. steel</td>
<td>4” x 11 Ga. steel</td>
<td>6” x 3/16” steel</td>
<td>6” x 3/16” steel</td>
</tr>
<tr>
<td>10’1” to 12’</td>
<td>4” x 11 Ga. steel</td>
<td>6” x 3/16” steel</td>
<td>6” x 3/16” steel</td>
<td>6” x 3/16” steel</td>
</tr>
<tr>
<td>12’1” to 14’</td>
<td>6” x 3/16” steel</td>
<td>6” x 3/16” steel</td>
<td>6” x 3/16” steel</td>
<td>6” x 3/16” steel</td>
</tr>
</tbody>
</table>
Table 2 – Coating Performance Requirements

<table>
<thead>
<tr>
<th>Quality Characteristics</th>
<th>ASTM Test Method</th>
<th>Performance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesion</td>
<td>D3359 – Method B</td>
<td>Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).</td>
</tr>
<tr>
<td>Corrosion Resistance</td>
<td>B117 &amp; D1654</td>
<td>Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8” coating loss from scribe or medium #8 blisters).</td>
</tr>
<tr>
<td>Impact Resistance</td>
<td>D2794</td>
<td>Impact Resistance over 60 inch lb. (Forward impact using 0.625” ball).</td>
</tr>
<tr>
<td>Weathering Resistance</td>
<td>D822 D2244, D523 (60˚ Method)</td>
<td>Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).</td>
</tr>
</tbody>
</table>

Table 3 – Echelon II – Post Spacing By Bracket Type

<table>
<thead>
<tr>
<th>Span</th>
<th>For INVINCIBLE® 8’ Nominal (91.25” Rail)</th>
<th>For CLASSIC, GENESIS, &amp; MAJESTIC 8’ Nominal (92.625” Rail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Size</td>
<td>2-1/2”</td>
<td>3”</td>
</tr>
<tr>
<td>Bracket Type</td>
<td>Industrial Flat Mount (BB301)</td>
<td>Industrial Universal (BB302)</td>
</tr>
<tr>
<td>Post Settings</td>
<td>± ½” O.C.</td>
<td>94-1/2”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Span</th>
<th>For INVINCIBLE® 6’ Nominal (71.375” Rail)</th>
<th>For CLASSIC, GENESIS, &amp; MAJESTIC 6’ Nominal (67.75” Rail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Size</td>
<td>2-1/2”</td>
<td>3”</td>
</tr>
<tr>
<td>Bracket Type</td>
<td>Industrial Flat Mount (BB301)</td>
<td>Industrial Universal (BB302)</td>
</tr>
<tr>
<td>Post Settings</td>
<td>± ½” O.C.</td>
<td>75”</td>
</tr>
</tbody>
</table>

*Note: When using BB304 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.

End of Section 32 31 19
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sodding.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.
B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Product certificates.
C. Planting Schedule: Indicating anticipated planting dates.

1.4 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.6 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Sodded Lawns: 30 days from date of Substantial Completion.

B. Mow lawn as soon as top growth is tall enough to cut. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings.
PART 2 - PRODUCTS

A. Turfgrass Sod: Certified including limitations on thatch, weeds, diseases, nematodes, and insects], complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: T-10 Bermuda Sod.

C. Retain paragraph above for warm-season grass or paragraph below for cool-season grass. Turfgrass sod grown from a warm-season single-species grass predominates in the South and southern transition zones. Turfgrass sod grown from cool-season grass seed mixes or blends predominates in the North and northern transition zones.

2.1 PLANTING MATERIALS

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site and supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Verify suitability of stockpiled surface soil to produce topsoil.

2. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources.

B. Inorganic Soil Amendments:

1. Lime: ASTM C 602, Class T or O, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

2. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

3. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.


C. Organic Soil Amendments

1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8.

2. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with pH range of 3.4 to 4.8.
3. Peat: Finely divided or granular texture, with pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having water-absorbing capacity of 1100 to 2000 percent.

4. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

D. Fertilizer:
1. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
2. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
3. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
   a. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight
4. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorous, and potassium in the following composition:
   a. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

E. Mulches:
1. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
2. Peat Mulch: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with pH range of 3.4 to 4.8.
3. Peat Mulch: Finely divided or granular texture, with pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having water-absorbing capacity of 1100 to 2000 percent.
4. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8.

2.2 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:

1. Ratio of Loose Compost to Topsoil by Volume: 1:3
2. Weight of Lime per 1000 Sq. Ft. (92.9 Sq. m):
3. Weight of Iron Sulfate per 1000 Sq. Ft. (92.9 Sq. m):
4. Weight of Bonemeal per 1000 Sq. Ft. (92.9 Sq. m):
5. Weight of Superphosphate per 1000 Sq. Ft. (92.9 Sq. m):
6. Weight of Commercial Fertilizer per 1000 Sq. Ft. (92.9 Sq. m):
7. Weight of Slow-Release Fertilizer per 1000 Sq. Ft. (92.9 Sq. m):

PART 3 - EXECUTION

3.1 LAWN PREPARATION

A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches (150 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply superphosphate fertilizer directly to subgrade before loosening.

2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

3. Spread planting soil mix to a depth of 6 inches (150 mm) but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

B. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

2. Loosen surface soil to a depth of at least 6 inches (150 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches (150 mm) of soil. Till soil to a homogeneous mixture of fine texture.

3. Remove stones larger than 1-1/2 inches (38 mm) in any dimension and sticks, roots, trash, and other extraneous matter.

4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.2 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
1. Lay sod across angle of slopes exceeding 1:3.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.3 SATISFACTORY LAWNS

A. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

END OF SECTION 32 92 23
SECTION 32 93 00
LANDSCAPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section includes furnishing labor, materials, equipment and services for all trees, shrubs, ground covers, bedding, installation, and related work required by the Drawings and Specifications.

B. The Contractor's attention is directed to the fact that there are active utilities located within the limits of work. Before commencing any work required under the Contract, he shall find the location of all utilities, subsurface drainage, and underground construction and take proper precautions not to disturb or damage any subsurface improvements. The Contractor is responsible for all repairs to damaged utilities resulting from the work covered by this Contract without claims against the Owner for additional cost.

C. The Contractor shall make a field examination of the project site for the purpose of verifying the following:

1. Accuracy of all finish grades within the work area
2. That drawing dimensions relate with actual field conditions.

The Contractor shall notify the Landscape Architect of any conditions that will prevent proper execution of the work.

1.2 QUALITY ASSURANCE

A. American National Standards Institute

1. ANSI A300 1995 Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance
2. ANSI Z60.1 2004 Nursery Stock

B. American Wood Protection Association

1. AWPA P5 2009 Standard for Waterborne Preservatives
2. AWPA T1 2009 Use Category System: Processing and Treatment Standard
3. AWPA U1 2009 Use Category System: User Specification for Treated Wood

C. American Society for Testing and Materials International

2. ASTM C 602 2013a Agricultural Liming Materials
3. ASTM D 4427 2013 Peat Samples by Laboratory Testing
4. ASTM D 4972 2013 pH of Soils
5. ASTM D 5268 2013 Topsoil Used for Landscaping Purposes
6. ASTM D 5539 2014 Seed Starter Mix
7. ASTM D 5852 2000(2007)e1 Standard Test Method for Erodibility Determination of Soil in the Field or in the Laboratory by the Jet Index Method


D. L.H. Bailey Hortorium

1. LHBH 1976 Hortus Third

E. U.S. Department of Agriculture


F. Topsoil Composition Tests

1. Commercial test from an independent testing laboratory including basic soil groups (moisture and saturation percentages, Nitrogen-Phosphorus-Potassium (N-P-K) ratio, pH (ASTM D 4972), soil salinity), secondary nutrient groups (calcium, magnesium, sodium, Sodium Absorption Ratio (SAR)), micronutrients (zinc, manganese, iron, copper), toxic soil elements (boron, chloride, sulfate), cation exchange and base saturation percentages, and soil amendment and fertilizer recommendations with quantities for plant material being transplanted. Soil required for each test shall include a maximum depth of 18 inches of approximately 1 quart volume for each test. Areas sampled should not be larger than 1 acre and should contain at least 6-8 cores for each sample area and be thoroughly mixed. Problem areas should be sampled separately and compared with samples taken from adjacent non-problem areas. The location of the sample areas should be noted and marked on a parcel or planting map for future reference.

G. Nursery Certifications

1. Indicate on nursery letterhead the name of plants in accordance with the LHBH, including botanical common names, quality, and size.

2. Inspection Certificate

3. Mycorrhizal fungi inoculum for plant material treated

H. State Landscape Contractor’s License

1. Construction company shall hold a landscape contractors license in the state where the work is performed and have a minimum of five years landscape construction experience. Submit copy of license and three references for similar work completed in the last five years.

I. Erosion Assessment
1. Assess potential effects of soil management practices on soil loss in accordance with ASTM D 6629. Assess erodibility of soil with dominant soil structure less than 2.8 to 3.1 inches in accordance with ASTM D 5852.

J. Pre-Installation Meeting

1. Convene a pre-installation meeting a minimum of one week prior to commencing work of this section. Require attendance of parties directly affecting work of this section. Review conditions of operations, procedures and coordination with related work. Agenda shall include the following:

   a. Tour, inspect, and discuss conditions of planting materials.

   b. Review planting schedule and maintenance.

   c. Review required inspections.

1.3 SUBMITTALS

A. SD-01 Preconstruction Submittals

1. State Landscape Contractor's License

2. Time Restrictions and Planting Conditions

B. SD-03 Product Data

1. Local/Regional Materials

   a. Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

      a) Peat
      b) Composted Derivatives
      c) Rotted Manure
      d) Organic Mulch Materials
      e) Landscape Materials, shrubs, groundcovers

   b. Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

      i. Fertilizer
c. Submit documentation certifying products are from salvaged/recovered lumber sources and indicating percentage of salvaged/recovered content per unit of product.

C. SD-04 Samples
1. Mulch (mulch to be multi-colored river rock – 1” to 1 1/2” diameter.

D. SD-06 Test Reports
1. Topsoil composition tests; Soil Test of current growing area.
2. Percolation Test; Percolation Test of current growing area; Percolation Test of proposed area.

E. SD-07 Certificates
1. Forest Stewardship Council (FSC) Certification
2. Nursery certifications: in accordance with the Alabama Certified Landscape Professionals.
3. Indicate names of plants in accordance with the Alabama Certified Landscape Professionals, including type, quality, and size.

F. SD-10 Operation and Maintenance Data
1. Plastic Identification
2. When not labeled, identify types in Operation and Maintenance Manual.

1.4 GUARANTEE

A. All plants shall be guaranteed for one year beginning on the date of inspection by the Contracting Officer to commence the plant establishment period, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance or by weather conditions unusual for the warranty period. Transplanted plants require no guarantee.

B. Guarantee plants installed during fall planting season until the following August 1: guarantee plants installed during spring planting season until the following October 1. The minimum guarantee shall be 90 days from the time of planting.

C. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season. At end of warranty period, replace planting materials that die or have 25 percent or more of their branches that die during the construction operations or the guarantee period.
1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Branched Plant Delivery

Deliver with branches tied and exposed branches covered with material which allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.

2. Soil Amendment Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer, gypsum, sulfur, iron, and lime may be furnished in bulk with a certificate indicating the above information. Store in dry locations away from contaminates.

3. Plant Labels

Deliver plants with durable waterproof labels in weather-resistant ink. Provide labels stating the correct botanical and common plant name and variety as applicable and size as specified in the list of required plants. Attach to plants, bundles, and containers of plants. Groups of plants may be labeled by tagging one plant. Labels shall be legible for a minimum of 60 days after delivery to the planting site.

B. Storage

1. Plant Storage and Protection

Store and protect plants not planted on the day of arrival at the site as follows:

i. Shade and protect plants in outside storage areas from the wind and direct sunlight until planted.

ii. Heel-in bare root plants.

iii. Protect balled and burlapped plants from freezing or drying out by covering the balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering which allows air circulation.

iv. Keep plants in a moist condition until planted by watering with a fine mist spray.

v. Do not store plant material directly on concrete or bituminous surfaces.

2. Fertilizer, Gypsum, pH Adjusters and Mulch Storage
Store in dry locations away from contaminants.

3. Topsoil

Prior to stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks prior to stockpiling existing topsoil.

C. Handling

Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle container plants carefully to avoid damaging or breaking the earth ball or root structure. Do not handle plants by the trunk or stem. Puddle bare-root plants after removal from the heeling-in bed to protect roots from drying out. Remove damaged plants from the site.

D. Time Limitations

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum of 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum of 24 hours.

E. Time Restrictions and Planting Conditions

Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.

1. Restrictions

Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

PART 2 – PRODUCTS

2.1 PLANTS

A. Regulations and Varieties

Existing trees and shrubs to remain shall be protected and a planting plan be arranged around them. Furnish nursery stock in accordance with ANSI Z60.1, except as otherwise specified or indicated. Furnish plants, including turf grass, grown under climatic conditions similar to those in the locality of the project. Plants specified shall be indigenous or naturally adaptive low maintenance varieties, tolerant of site's existing soils and climate without supplemental irrigation or fertilization once established. Spray plants budding into leaf or having soft growth with an ant desiccant before digging. Plants of the same specified size shall be of uniform size and character of growth. Plants shall be chosen with their mature size and growth habit in mind to avoid over-planting and conflict with other plants, structures or underground utility lines. All plants shall comply with all Federal and State Laws requiring inspection for plant diseases and infestation.
B. Shape and Condition

Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having a healthy, normal, and undamaged root system.

1. Deciduous Trees and Shrubs

Symmetrically developed and of uniform habit of growth, with straight boles or stems, and free from objectionable disfigurements.

2. Ground Covers and Vines

Number and length of runners and clump sizes indicated, and of the proper age for the grade of plants indicated, furnished in removable containers, integral containers, or formed homogeneous soil section.

C. Plant Size

Minimum sizes measured after pruning and with branches in normal position, shall conform to measurements indicated, based on the average width or height of the plant for the species as specified in ANSI Z60.1. Plants larger in size than specified may be provided with approval of the Contracting Officer. When larger plants are provided, increase the ball of earth or spread of roots in accordance with ANSI Z60.1.

D. Root Ball Size

All box-grown, field potted, field boxed, collected, plantation grown, bare root, balled and burlapped, container grown, processed-balled, and in-ground fabric bag-grown root balls shall conform to ANSI Z60.1. All wrappings and ties shall be biodegradable. Root growth in container grown plants shall be sufficient to hold earth intact when removed from containers. Root bound plants will not be accepted.

1. Before shipment, root systems shall contain mycorrhizal fungi inoculum.

E. Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANSI Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

F. Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANSI Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.
2.2 TOPSOIL

A. Existing Soil

Modify to conform to requirements specified in paragraph entitled "Composition."

B. On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site.

C. Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

D. Composition

Evaluate soil for use as topsoil in accordance with ASTM D 5268. From 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D 4972. Topsoil shall be free of sticks, stones, roots, plants, and other debris and objectionable materials. Other components shall conform to the following limits:

- Silt: 20-50, 7-17 percent
- Clay: 10-30, 4-12 percent
- Sand: 20-35, 70 to 82 percent
- pH: 5.5 to 7.0
- Soluble Salts: 600 ppm maximum

2.3 SOIL CONDITIONERS

Provide singly or in combination as required to meet specified requirements for topsoil. Soil conditioners shall be nontoxic to plants.

A. Lime

Commercial grade hydrated or burnt limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C 602 of not less than 80 percent.

B. Aluminum Sulfate

Commercial grade.

C. Sulfur
100 percent elemental

D. Iron

100 percent elemental

E. Peat

Natural product of peat moss derived from a freshwater site and conforming to ASTM D 4427 and ASTM D 5539 as modified herein. Shred and granulate peat to pass a 1/2 inch mesh screen and condition in storage pile for minimum 6 months after excavation. Biobased content shall be a minimum of 100 percent. Peat shall not contain invasive species, including seeds.

F. Sand

Clean and free of materials harmful to plants.

G. Perlite

Horticultural grade.

H. Composted Derivatives

Ground bark, nitrolized sawdust, humus or other green wood waste material free of stones, sticks, invasive species, including seeds, and soil stabilized with nitrogen and having the following properties:

1. Particle Size

   Minimum percent by weight passing:
   No. 4 mesh screen  95
   No. 8 mesh screen  80

2. Nitrogen Content

   Minimum percent based on dry weight:
   Fir Sawdust        0.7
   Fir or Pine Bark   1.0

3. Biobased Content

   Minimum 100 percent.

I. Gypsum

Coarsely ground gypsum from recycled scrap gypsum board comprised of calcium sulfate dihydrate 91 percent, calcium 22 percent, sulfur 17 percent; minimum 96 percent passing through 20 mesh screen, 100 percent passing thru 16 mesh screen.

J. Vermiculite
Horticultural grade for planters.

K. Rotted Manure

Well rotted horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of seeds, stones, sticks, soil, and other invasive species.

2.4 PLANTING SOIL MIXTURES

100 percent topsoil as specified herein.

100 percent on-site topsoil.

Sandy topsoil: one part topsoil to one part peat; clay topsoil: two parts topsoil to one part peat.

Thoroughly mix all parts of planting soil mixture to a uniform blend throughout.

2.5 FERTILIZER

Fertilizer for groundcover, wildflowers and grasses is not permitted. Fertilizer for trees, plants, and shrubs shall be as recommended by plant supplier, except synthetic chemical fertilizers are not permitted. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not permitted.

2.6 WEED CONTROL FABRIC

A. Roll Type Polypropylene or Polyester Mats

Fabric shall be woven, needle punched or non-woven and treated for protection against deterioration due to ultraviolet radiation. Fabric shall be minimum 99 percent opaque to prevent photosynthesis and seed germination from occurring, yet allowing air, water and nutrients to pass thru to the roots. Minimum weight shall be 5 ounces per square yard with a minimum thickness of 20 mils with a 20 year (minimum) guarantee.

2.7 MULCH

Free from noxious weeds, mold, pesticides, or other deleterious materials. Mulch to be ‘multi-colored river rock 1 to 1 ½” diameter, provided within 100 miles from the project site.

A. Inert Mulch Materials

Provide materials from site and construction waste to the greatest extent possible. Mulch shall contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content. Mulch may contain post-consumer or post-industrial recycled content.

2.8 ANTIDESICCANTS
Sprayable, water insoluble vinyl-vinledine complex which produce a moisture retarding barrier not removable by rain or snow. Film shall form at temperatures commonly encountered out of doors during planting season and have a moisture vapor transmission rate (MVT) of the resultant film of maximum 10 grams per 24 hours at 70 percent humidity.

2.9 WATER

Source of water to be approved by the City and suitable quality for irrigation and shall not contain elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

A. Hose

Hoses used for watering shall be a minimum of 60 percent post-consumer rubber or plastic.

2.10 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

2.11 SOURCE QUALITY CONTROL

The Contracting Officer and Landscape Architect of Record will inspect plant materials at the project site and approve them. Tag plant materials for size and quality.

PART 3 – EXECUTION

3.1 EXTENT OF WORK

Provide soil preparation, fertilizing, shrub, groundcover, and planting, installation and a mulch topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 ALTERNATIVE HERBICIDE TREATMENT (SOLARIZING SOIL)

Within 48 hours of subsoil preparation, saturate soil with water to a depth of 3 feet. Maintain sheeting in place for a minimum of 6 weeks. Immediately after removing sheeting, cover area to be planted with topsoil. Do not till soil prior to applying topsoil.

3.3 PREPARATION

A. Protection

Protect existing and proposed landscape features, elements, and sites from damage or contamination. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than the drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.
B. Layout

Stake out approved plant material locations and planter bed outlines on the project site before digging plant pits or beds. The Contracting Officer reserves the right to adjust plant material locations to meet field conditions. Do not plant closer than 12 inches to a building wall, and other similar structures. Provide on-site locations for excavated rock, soil, and vegetation.

C. Soil Preparation

1. pH Adjuster Application Rates
   Apply pH adjuster at rates as determined by laboratory soil analysis of the soils at the job site.

2. Soil Conditioner Application Rates
   Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site.

3. Fertilizer Application Rates
   Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site.

3.4 PLANT BED PREPARATION

Verify location of underground utilities prior to excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to a depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Depth of plant pit excavation shall be as indicated and provide proper relation between top of root ball and finished grade. Install plant material as specified in paragraph entitled "Plant Installation." Do not install trees within 10 feet of any utility lines or building walls.

3.5 PLANT INSTALLATION

A. Individual Plant Pit Excavation
   Excavate pits at least twice as large in diameter as the size of ball or container to depth shown.

B. Plant Beds with Multiple Plants
   Excavate plant beds continuously throughout entire bed as outlined to depth shown.

C. Handling and Setting
   Move plant materials only by supporting the container. Set plants on hand compacted layer of prepared backfill soil mixture 6 inches thick. Set plants on native soil and hold
plumb in the center of the pit until soil has been tamped firmly around root ball. Replace plant material whose root balls are cracked or damaged either before or during the planting process.

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas.

1. Container Grown Stock

Remove from container and prevent damage to plant or root system.

2. Ground Covers and Vines

Plant after placing mulch topdressing. Do not remove plant materials from flats or containers until immediately before planting. Space at intervals indicated. Plant at a depth to sufficiently cover all roots. Start watering areas planted as required by temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to a depth of 6 inches without run off or puddling. Smooth planting areas after planting to provide even, smooth finish. Mulch as indicated.

Smooth planting areas before planting to provide even, smooth finish. Do not remove plant material from flats or containers until immediately before planting. Space at the intervals indicated. Plant at a depth to sufficiently cover all roots. Start watering areas planted as required by temperature and wind conditions. Apply water at a rate sufficient to ensure thorough wetting of soil to a depth of 6 inches without run off or puddling. Add mulch topdressing as needed.

D. Earth Mounded Watering Basin for Individual Plant Pits

Form with topsoil around each plant by replacing a mound of topsoil around the edge of each plant pit. Watering basins shall be 6 inches deep for trees and 4 inches deep for shrubs. Eliminate basins around plants in plant beds containing multiple plants.

Form with topsoil around each plant by placing a mound of topsoil around the edge of each plant pit. Watering basins shall be 6 inches deep for trees and 4 inches deep for shrubs. Construct watering basin in a 4 1/2 foot diameter circle around specimen (not planted in a close group) trees and shrubs.

E. Weed Control Fabric Installation

Remove grass and weed vegetation, including roots, from within the area enclosed by edging. Completely cover areas enclosed by edging with specified weed control fabric prior to placing mulch layer. Overlap cut edges 6 inches.

F. Erosion Control Material

Install in accordance with manufacturer's instructions.
G. Placement of Mulch Topdressing

Place specified mulch topdressing on top of weed control fabric covering total area enclosed by edging. Place mulch topdressing to a depth of 3 inches.

H. Mulch Topdressing

Provide mulch topdressing over entire planter bed surfaces and individual plant surfaces including earth mound watering basin around plants to a depth of 3 inches after completion of plant installation and before watering. Keep mulch out of the crowns of shrubs and tree rings. Place mulch a minimum 2 to 3 inches away from trunk of shrub or tree. Mini Pine nuggets shall be used in the Tree Mulch Ring only, otherwise "Multi- Colored river shall be used. Place on top of any weed control fabric.

I. Fertilization

1. Fertilizer Tablets

Place fertilizer planting tablets evenly spaced around the plant pits to the manufacturer's recommended depth.

2. Granular Fertilizer

Apply granular fertilizer as a top coat prior to placing mulch layer and water thoroughly.

J. Watering

Start watering areas planted as required by temperature and wind conditions. Slow deep watering shall be used. Apply water at a rate sufficient to ensure thorough wetting of soil to a depth of 12 inches without run off or puddling. Watering of other plant material or adjacent areas shall be prevented.

K. Pruning

Prune in accordance with safety requirement of TCIA Z133.1.

1. Trees and Shrubs

Remove dead and broken branches. Prune to correct structural defects only. Retain typical growth shape of individual plants with as much height and spread as practical. Do not cut central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars shall remain in place. Pruning shall be accomplished by trained and experienced personnel and shall be accordance with ANSI A300.
3.6 RESTORATION AND CLEAN UP

A. Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

B. Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite at an approved landfill, recycling center, or composting center composted on site. Separate and recycle or reuse the following landscape waste materials: nylon straps, wire, ball wrap, burlap, wood stakes, and containers. Adjacent paved areas shall be cleaned and cleared of all installation materials included but not limited to topsoil, plant material and containers.

END OF SECTION 32 93 00
SECTION 33 11 00
WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary for the installation of the water distribution system. Including but not limited to the following:

1. Domestic water system pipe and fittings.
2. Connection of domestic water system to municipal water system.
3. Fire protection water system pipe, fittings, valves, and hydrants.
4. Connection of fire protection water system to municipal water system.

B. The construction required herein shall include constructing water lines to points of connection with the building lines 5 feet outside the building to which the water distribution system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Owner. Excavation and backfilling is specified in Section 31 23 00 EXCAVATION AND FILL. Backfilling shall be accomplished after inspection by the Testing Agent. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Architect or Testing Agent.

C. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

D. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS


B. City of Birmingham’s Standard Specifications for the Construction of Public Works Projects, Current Edition

C. American Society for Testing and Materials

1. ASTM B88-09 Standard Specification for Seamless Copper Water Tube
2. ASTM D412-06ae2 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
10. ASTM D2774-08 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
13. ASTM F477-10 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

D. ASME International
2. ASME B16.1-2010 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
3. ASME B16.3-2006 Malleable Iron Threaded Fittings
4. ASME B16.26-2006 Cast Copper Alloy Fittings for Flared Copper Tubes

E. American Water Works Association
1. AWWA B300-10: Hypochlorites
2. AWWA B301-10: Liquid Chlorine
3. AWWA C104/A21.4-08: Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
4. AWWA C105/A21.5-10: Polyethylene Encasement for Ductile-Iron Pipe Systems
5. AWWA C110/A21.10-08: Ductile-Iron and Gray-Iron Fittings, for Water
6. AWWA C111/A21.11-07: Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
8. AWWA C151/A21.51-09: Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
9. AWWA C153/A21.53-06: Ductile-Iron Compact Fittings for Water Service
10. AWWA C500-09: Metal-Sealed Gate Valves for Water Supply Service
11. AWWA C502-05: Dry-Barrel Fire Hydrants
12. AWWA C503-05: Wet-Barrier Fire Hydrants
13. AWWA C504-10: Rubber-Seated Butterfly Valves
14. AWWA C509-09: Resilient-Seated Gate Valves for Water Supply Service
15. AWWA C600-10: Installation of Ductile-Iron Water Mains and Their Appurtenances
16. AWWA C606-06: Grooved and Shouldered Joints
17. AWWA C651-05: Disinfecting Water Mains
18. AWWA C800-05: Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials)
20. AWWA C905-10 Polyvinyl Chloride (PVC), Pressure Pipe, and Fabricated Fittings 14 In. - 36 In.

F. Ductile Iron Pipe Research Association

G. Manufacturers Standardization Society of the Valve and Fittings Industry
   1. MSS SP-80(2003) Bronze Gate, Globe, Angle and Check Valves

H. National Fire Protection Association
   1. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances
   2. NFPA 49(1994) Hazardous Chemicals Data
   5. NFPA 196: Standard on Fire Hose

I. NSF International

J. The Society for Protective Coatings
   1. SSPC Paint 21(1991) White or Colored Silicone Alkyd Paint
   2. SSPC Paint 25(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

1.3 SUBMITTALS

A. Submit, within thirty (30) days after execution of the contract, the manufacturer's certificate of compliance or certified analysis in accordance with applicable standards for each shipment of materials.

B. Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

C. Complete shop contract documents of all pipes, valves, structures and appurtenances shall be submitted for review.

D. The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.
E. Project Record Documents: Accurately record the following:

1. Actual locations of pipe runs, connections, and top of pipe elevations.
2. Test results from commercial laboratory verifying disinfection.
3. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

F. Submit As-Builts for all components of the domestic and fire water distribution system, such as pipes, valves, and structures.

1.4 QUALITY ASSURANCE

A. The types of valves and appurtenances shall be the products of firms fully experienced and qualified in the manufacture of the particular material to be furnished. The manufacturer's name and pressure rating shall be marked on the valve body.

B. All additional temporary piping, pumps, and equipment necessary for the successful testing of the system is to be provided by the Contractor.

C. All materials to meet the requirements of the governing authority.

D. System Testing: All additional temporary piping, pumps and equipment necessary for the successful testing of the system to be provided by the contractor

E. Regulatory Requirements: Perform work in accordance with utility company requirements and local authority having jurisdiction requirements.

1.5 PRODUCT HANDLING AND STORAGE

A. Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Owner.

B. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied.

C. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe.

D. 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.

E. 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.

F. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.
1.6 UTILITY PROTECTION

A. Forty-eight (48) hours prior to excavation, the Contractor shall call the U.P.C. (Utilities Protection Center) 1-800-282-7411 to locate and protect existing utilities. Any damage to these utilities is to be repaired at no additional cost to the Owner. The Contractor is responsible for locating all utilities, either private or public.

PART 2 - PRODUCTS

2.1 GENERAL

A. All piping, valves and appurtenances shall be of the same size shown on the contract documents and as far as possible all equipment of the same type shall be from one manufacturer.

B. All piping, valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

C. All buried valves shall have cast iron three piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and to extend to such elevation at or slightly above the finished grade. The barrel shall be two-piece, sliding type, having 5-1/4 inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling.

2.2 PIPE

A. Pipe sizes less than 3 inches that are installed below grade and outside buildings shall comply with one or a combination of following, unless otherwise specified on the contract documents:

1. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88 latest edition and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B16.22.

2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D 2241 with an SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1785 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139 with factory supplied elastomeric gaskets and lubricant.

B. Pipe sizes 3 inches and larger that are installed below grade and outside buildings shall comply with one of the following, unless otherwise specified on the contract documents:

1. Ductile Iron Water Pipe: In accordance with AWWA C 151, Fittings shall be either mechanical joint or push-on joint complying with AWWA C 110 or AWWA C-111 (CLASS 50).

2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall meet the requirements of AWWA C-900 and comply with ASTM D 2241, rated SDR 21 (Class 150). Pipe shall be continually marked as for smaller pipes. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

2.3 GATE VALVES - 2 Inches and Larger

A. Manufacturers: Per Jefferson County Standards.
B. Gate valves for water shall meet the requirements of AWWA C509. Valve shall be rated for 250 psi working pressure. Valves shall be iron body, bronze-mounted, resilient wedge, parallel seat, non-rising stem type fitted with "O-Ring" seals. The operating nuts shall be 2" square. All valves shall open left, or counterclockwise. Stuffing boxed shall be the "O-Ring" type. Gate valves shall be mechanical joint, ANSI Standard 21.11 except where shown otherwise. Flange joint shall be ANSI B16.1 standard. Bell joint shall be AWWA Class 150.

2.4 BALL VALVES - 2 Inches and Smaller
   A. Manufacturers: Per Jefferson County Standards.
   B. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

2.5 BUTTERFLY VALVES - 2 inches to 24 inches
   A. Manufacturers: Per Local Municipal Standards.
   B. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

2.6 CHECK VALVES, POST INDICATOR VALVES, SUPERVISORY CONTROL VALVE SWITCH, AND BACKFLOW PREVENTORS
   A. See also - Fire Suppression elsewhere in Division 21.
   B. Post Indicator Valves shall be a below grade visual type per Jefferson County Standards.

2.7 HYDRANTS
   A. Hydrant: Type as required by utility company, local authority having jurisdiction and as indicated on Contract documents.
   B. Hydrant Extensions: Provide in multiples of 6 inches with rod and coupling to increase barrel length.
   C. Hose and Stream Connection: Match sizes with utility company, two hose nozzles, one pumper nozzle.
   D. Finish: Primer and two coats of enamel or special coating to color as required by utility company.

2.8 ACCESSORIES
   A. Concrete for Thrust Blocks: Elsewhere in Division 03. Place thrust blocking consisting of 3,000 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 pounds per square foot when water main pressure is 100 psi.
MINIMUM THRUST BLOCKING BEARING AREAS

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<tr>
<th>Pipe Diameter</th>
<th>Tees</th>
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B. Locked Mechanical Joint fittings shall be installed where vertical changes in direction are required and, if approved by the Architect, can be installed in lieu of the above thrust blocking requirements.

C. Trace Wire: Magnetic detectable conductor, clear brightly colored plastic covered, imprinted in large letters.
   1. Domestic Water Lines: "DOMESTIC WATER SERVICE"
   2. Fire Protection Water Lines: "FIRE PROTECTION WATER SERVICE"

D. Insulating Joints: Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

E. Reinforcing Steel; Deformed bars, ASTM A615

PART 3 - EXECUTION

3.1 GENERAL

A. Excavation and backfilling as specified elsewhere in Division 31.
   1. Trench width (measured at 2 feet above top of pipe).
      a. Not less than 12 inches, not more then 16 inches plus outside diameter of pipe, up to 33-inch diameter pipe.
      b. 24 inches plus outside diameter of pipe, for pipes greater than 33 inches.

B. Existing underground utilities which are to be abandoned are to be capped off and are to remain in place. Where they are within the new building area or come in conflict with new construction, they shall be completely removed.

3.2 BEDDING

A. Bedding shall be of the type and thickness shown on the contract documents.

B. Excavate pipe trench and place bedding material in accordance with Excavation and Fill...
elsewhere in Division 31 for work of this Section. Provide trench wall shoring as required.

C. Form and place concrete for pipe thrust restraints at any change of pipe direction and at fittings as indicated on Contract documents. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil per schedule on Contract documents.

D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade as indicated on Contract documents.

E. Maintain optimum moisture content of bedding material to attain required compaction density.

F. Remove excess backfill and excavated material from site.

3.3 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local code.

B. Install pipe and fittings in accordance with AWWA C600.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.

D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local utility company.

F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

G. Establish elevations of buried piping in accordance with Excavation and Fill elsewhere in Division 2 for work in this Section.

H. Backfill trench in accordance with Excavation and Fill elsewhere in Division 31.

I. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utility standards.

3.4 INSTALLATION - VALVES AND HYDRANTS

A. Install gate valves as indicated on Contract documents and supported on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

B. Install fire hydrant assemblies as indicated on Contract documents in vertical and plum position with stream/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to a street, roadway or parking lot drive or toward the protected building unless otherwise
directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

C. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

D. Paint hydrants in accordance with local utility company requirements

3.5 SHOP PAINTING

A. Paint used for coating valves shall comply with the following Fed. Spec. TT-V-51, TT-C-494a, AWWA C-550. The asphalt varnish shall be applied to the ferrous parts of the valves except for finished or seating surfaces. Surfaces shall be clean and dry before painting. Two coats shall be applied to both the inside and outside ferrous metals. A coating conforming to AWWA C-550 may be used on the interior and/or exterior ferrous surfaces.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts/million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part/million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA specifications. Do not place distribution system in service until approval is obtained from applicable governing authorities.

3.7 INSPECTION AND TESTING

A. Completed pipe shall be subjected to hydrostatic pressure test for 12 hours at full working pressure. All leaks shall be repaired and lines re-tested. Prior to testing, pipelines shall be supported in an approved manner to prevent movement during tests. The Design Professional shall witness and certify that the pressure test meets testing requirements. After completion and testing of the water distribution system, provide the Owner with the Contractor’s Material and Test Certificates required by NFPA Standard 24.

B. Water Lines:

1. Pressure Test: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200psi or 50psi in excess of the system working pressure, whichever is greater as per NFPA 24, Section 10.10.2.2.1. 2014 Edition.

2. Leakage Test: AWWA C600

3.8 SERVICE CONNECTIONS

A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer if required and water meter with bypass valves and sand strainer.

END OF SECTION 33 11 00
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidental necessary for the installation of the storm sewer system. Including but not limited to manholes, pipes, joints, and other appurtenances necessary for a complete system.

B. The construction required herein shall include construction storm sewers to points of connection with the building drains 5 feet outside the building to which the storm system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Owner. Excavation and backfilling is specified in Section 31 23 00 EXCAVATION AND FILL. Backfilling shall be accomplished after inspection by the Testing agent. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Architect.

C. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

D. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCE DOCUMENTS


C. City of Birmingham’s Standard Specifications for the construction of Public Works Projects.

D. American Society for Testing and Materials

2. ASTM A 760/A(2010) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
4. ASTM C 32(2009) Sewer and Manhole Brick (Made from Clay or Shale)
7. ASTM C 62(2010) Building Brick (Solid Masonry Units Made from Clay or Shale)
8. ASTM C 76(2010a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
10. ASTM C 139(2010) Concrete Masonry Units for Construction of Catch Basins and Manholes
19. ASTM D 1171(2008) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
23. ASTM D 3350(2010a) Polyethylene Plastics Pipe and Fittings Materials

D. American Association of State Highway and Transportation Officials

1. AASHTO M 190(2004;R2008) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
2. AASHTO M 218(2003) Steel Sheet Zinc-Coated (Galvanized) for Corrugated Steel Pipe
3. AASHTO M 294(2010) Corrugated Polyethylene Pipe, 300- to 1200- mm Diameter
5. AASHTO M274-87(2008) Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe

1.3 SUBMITTALS

A. Submit, within thirty (30) days after execution of the contract, the manufacturer's certificate of compliance or certified analysis in accordance with applicable standards for each shipment of materials. All certificates shall not be older than one year.

B. Submit As-Builts for all components of the storm water drainage system such as pipes and structures.

C. Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

D. Complete shop contract documents of all pipes, valves, structures and appurtenances shall be submitted for review.

E. Project Record Documents: Accurately record the following.
1. Actual locations of pipe runs, connections, manholes, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.4 QUALITY ASSURANCE

A. All appurtenances shall be the products of firms fully experienced and qualified in the manufacturing of the particular material to be furnished.

B. All additional temporary piping, pumps, and equipment necessary for the successful testing of the system is to be provided by the Contractor.

C. All materials to meet the requirements of the governing authority.

D. In addition to regular maintenance the contractor shall clear all storm drainage structures and pipe of all dirt, debris, and garbage at the completion of construction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris.

B. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material.

C. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Architect.

D. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

E. Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

1.6 UTILITY PROTECTION

A. Forty-eight (48) hours prior to excavation, the Contractor shall call the U.P.C. (Utilities Protection Center) 1-800-282-7411 to locate and protect existing utilities. Any damage to these utilities is to be repaired at no additional cost to the Architect. The Contractor is responsible for locating all utilities, either private or public.

PART 2 - PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

A. All storm sewer shall be as shown on the contract documents. The materials shall be as specified herein and in accordance with the referenced documents.
B. Reinforced Concrete Pipe shall conform to ASTM C 76, Class III for all pipe 42 inches and smaller and Class IV for all pipe 48 inches and larger unless indicated otherwise on the Contract documents. Gaskets shall conform to ASTM C 443; rubber compression gaskets installed in accordance with manufacturer's published instructions.

C. Ductile Iron Culvert Pipe shall comply with ASTM A 716 and shall be bell and spigot type with rubber O-ring gaskets.

D. PVC Pipe shall be smooth wall conforming to ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B. Joints shall comply with ASTM D 3034, Table 2; integrally molded bell ends with factory supplied elastomeric gaskets and lubricant.

E. High Density Polyethylene (HDPE) Pipe:

1. 12 inches through 36 inches nominal diameter: Type “S” smooth interior pipe in conformance with AASHTO M294. Corrugations may be annular configuration only.
2. Resins: Extruded pipe and blow molded fittings shall be made of virgin polyethylene compounds which conform with the requirements of cell class 335420C as defined and described in ASTM D 3350, except that the carbon black content shall not exceed 5 percent. Compounds that have higher cell classifications in one or more properties are acceptable provided product requirements are met.

2.2 FITTINGS

A. Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

B. Reinforced Concrete Pipe shall have rubber-type gaskets conforming to ASTM C 443. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches.

C. Ductile Iron Pipe (DIP): Couplings and fittings shall be as recommended by the pipe manufacturer.

D. Polyvinyl Chloride (PVC) Pipe: Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

E. High Density Polyethylene (HDPE) Pipe: Joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F 477.

2.3 FRAMES, COVERS, AND GRATES

A. Frames, covers, and gates shall be as indicated on the Contract documents and shall comply with the standards of the local governing authority.
2.4 ACCESS STEPS AND SAFETY PLATFORMS

A. Access steps and safety platforms shall be as indicated on the Contract documents and shall comply with the standards of the local governing authority.

2.5 CEMENT MORTAR

A. Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

B. Portland cement shall conform to ASTM C 150, Type II for concrete used in manholes, concrete cradles, concrete encasement, and thrust blocking. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalis shall be used.

C. Portland cement concrete shall conform to ASTM C 94, 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 3000 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for a minimum of 7 days.

2.6 CONCRETE

A. Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for concrete specified elsewhere in division three.

2.7 PRECAST CONCRETE SEGMENTAL BLOCKS

A. Precast concrete segmental block shall conform to ASTM C 139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.8 BRICK

A. Brick shall conform to ASTM C 62, Grade SW; ASTM C 55, Grade S-I or S-II; or ASTM C 32, Grade MS.

B. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure.

C. Brick structures shall be plastered with 1/2 inch of mortar over the entire inside surface of the walls.

D. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course.

E. For round structures, brick shall be laid radially with every sixth course a stretcher course.

2.9 PRECAST REINFORCED CONCRETE STRUCTURES

A. Precast concrete structures shall consist of precast reinforced concrete sections conforming with
the typical details as shown on the contract documents.

B. Precast reinforced concrete manhole sections shall be manufactured, tested, and marked in accordance with the latest provisions of ASTM C478.

C. Joints of manhole sections shall be of the tongue-and-groove type. Sections shall be joined using O-ring rubber gaskets, flexible plastic gaskets conforming to the applicable provisions of ASTM C443 or an approved bituminous mastic joint material.

D. Each section of the precast manhole shall have not more than two holes for the purpose of handling and laying. These holes shall be sealed with cement mortar using one part Portland cement to two parts clean sand, meeting ASTM C144. Holes shall be sealed from the outside prior to backfilling the manhole.

E. Holes in precast bases to receive sewer pipe shall be precast at the factory at the required locations and heights. Knocking out of holes in the field will not be permitted.

F. Manhole bases and inverts shall be constructed of 4000 psi concrete in accordance with details on the contract documents and inverts shall have the same cross-section as the invert of the sewers that they connect.

G. Each manhole base shall be set upon a 6 inch minimum thickness mat of #57 crushed stone.

PART 3 - EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

A. Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 23 00 EXCAVATION AND FILL.

3.2 BEDDING

A. Bedding shall be of the type and thickness shown on the contract documents.

B. The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

C. Concrete Pipe Bedding: When no bedding class is specified or detailed on the contract documents, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of the pipe for the entire length of the pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

D. Ductile Iron Pipe Bedding: Bedding for ductile iron pipe shall be as shown on the contract documents.

E. Plastic Pipe Bedding: Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.
3.3 PIPE INSTALLATION

A. Pipe Laying
   1. Pipe shall be protected during handling against impact shocks and free fall; the pipe interior shall be free of extraneous material. Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements.
   2. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the contract documents. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.
   3. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.
   4. Shape bottom of trench by hand for circumferential support to bottom 1/4 of pipe.
   5. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work.

B. Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

C. As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

D. If the maximum width of the trench at the top of the pipe, as specified in Section 31 23 00 EXCAVATION AND FILL, is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Owner, concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

E. Joints between different pipe materials shall be made as specified, using approved jointing materials.

F. Multiple Culverts: Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.4 JOINTING

A. Reinforced Concrete Pipe:
   1. Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements.
   2. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry.
3. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times.

4. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced.

5. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.5 BACKFILLING AND COMPACTION

A. Backfilling and compaction for culverts and storm drains shall be in accordance with the applicable portions of Section 31 23 00 EXCAVATION AND FILL.

B. When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced at no additional cost to the Owner.

3.6 CONCRETE CRADLE AND ENCASEMENT

A. Pipe shall be supported on a concrete cradle or encased in concrete where indicated on the Contract documents or as required by on-site conditions.

3.7 INSTALLATION OF STORM DRAINAGE STRUCTURES AND HEADWALLS

A. Structures shall be constructed of precast concrete.

B. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar.

C. Pipe connections shall be made to manhole as shown on the Contract documents.

D. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot.

E. Free drop inside the manholes shall not exceed 18 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 18 inches.

F. Manhole access steps shall be installed as shown on the Contract documents.

G. Mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer.

H. Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 6 inches higher than finished grade in unpaved areas. Frame and cover
assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624 unless otherwise specified.

3.8 CONNECTING TO EXISTING MANHOLES

A. Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping.

B. The connection shall be centered on the manhole.

C. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe.

D. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.9 BUILDING CONNECTIONS

A. Building connections shall include the lines to and connection with the building drainage piping at a point approximately 5 feet outside the building, unless otherwise indicated.

B. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 5 feet from the site of the building at a point and in a manner designated on the Contract documents.

3.10 CLEANOUTS AND OTHER APPURTENANCES

A. Cleanouts and other appurtenances shall be installed where shown on the Contract documents or as directed by the Inspector, and shall conform to the detail on the Contract documents.

3.11 TESTING AND INSPECTION

A. Leakage and deflection testing shall be performed in accordance with the requirements of the Jefferson County. At a minimum these test shall comply with International Plumbing Code, 2012 Edition, Section 1101.4 and Section 312 where applicable.

3.12 FRENCH DRAIN SYSTEM

A. French Drain system located as shown on the contract documents, or as required by field conditions, to consist of 6 inches perforated PVC pipe with filter fabric sleeve. Pipe bedding shall be in an 18 inch wide by 30 inch deep (6 inches below pipe) trench backfilled with washed #57 stone. The #57 stone shall be wrapped in filter fabric with fabric overlapping at all seams.

END OF SECTION 33 41 00
PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, equipment and incidentals necessary for the installation of the subdrainage systems. Including but not limited to the connection of the wall footing drains to the site storm drain system.

B. The construction required herein shall include constructing storm lines to points of connection with the building lines 5 feet outside the building to which the wall footing drain is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Owner. Excavation and backfilling is specified in Section 31 23 00 EXCAVATION AND FILL. Backfilling shall be accomplished after inspection by the Testing agent. The Contractor shall have a copy of the manufacturer’s instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Architect.

C. The Contractor shall provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.

D. The Contractor is solely responsible for determining the potential for injury to persons and damage to property. Where such potential is present, the contractor shall take appropriate measures to protect persons from injury and protect existing and new improvements from damage caused directly or indirectly by construction operations.

1.2 REFERENCES


B. American Society for Testing and Materials

1. ASTM D 448-12 -- Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 1986.


7. ASTM F 667-12—Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings
C. Army Corp of Architects

1. COE CW-02215 -- Civil Works Construction Guide Specification for Geotextiles Used as Filters; Department of the Army, Corps of Architects; 1986.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical literature and installation instructions for the following:

1. Drainage piping.
2. Prefabricated drainage system.

B. Samples:

2. Prefabricated drainage system: Submit 6-inch squares.

PART 2 - PRODUCTS

2.1 DRAINAGE PIPE

A. Piping System:

1. Permeable piping: Polyethylene pipe; ASTM F 405 or ASTM F 667, as applicable for size indicated.
2. Standard (solid) pipe: Polyethylene pipe; ASTM F 405 or ASTM F 667, as applicable for pipe size.
3. Standard (solid) pipe: Polyvinyl Chloride (PVC) Sewer Pipe and Fittings; ASTM D2729 as applicable for size indicated.

B. Cleanouts:

1. Riser piping: Polyvinyl Chloride (PVC) pipe; ASTM D 2729.
2. Cleanout plug: Threaded cast plug to fit bell end of riser pipe.
3. Housing: Cast iron, round, flanged, with extra-heavy cast iron locking cover.

2.2 FILTER FABRIC

A. Filter fabric shall be a pervious sheet of synthetic polymer filaments forming a stable network in that the fibers retain their relative positions. The fabric shall meet the following minimum requirements:

1. Water permeability: 350 gpm/sq. ft. at 5" water pressure.
2. Equivalent opening size no larger than 70 nor smaller than 100 U.S. sieve size.
3. Grab tensile strength: 90# in either direction when wet, by ASTM D4632.
4. Grab elongation: 15% minimum, 130% maximum by ASTM D4632.
5. Bursting strength: 150 psi when wet, by ASTM D3786.
6. Minimum weight: 3.5 oz./sq. yd.
BHM VALE PROJECT CNG FUELING STATION

Birmingham Airport Authority

BHM VALE PROJECT CNG FUELING STATION

B. Products:

1. Contech Construction Products C-40NW.
4. Amoco Fabrics and Fibers 4545

2.3 EARTHEN MATERIALS

A. Gravel Fill: ASTM D 448, No. 57 (nominal 1 inch to No. 4) washed stone.

B. Impervious Fill: Mixture of clayey gravel and sand which when compacted forms a dense, impermeable mass.

PART 3 - EXECUTION

3.1 PREPARATION

A. Architecting Layout:

1. Establish lines, grades, and locations of piping and accessories.
2. Maintain grade stakes, batter boards, and the like, to permit rapid checking of grades and lines as work progresses.

3.2 INSTALLATION - GENERAL

A. Earthwork and Trenching: Perform required excavation, backfilling, and compacting in accordance with requirements or other Division 32 sections as applicable.

B. Piping Installation:

1. General: Install piping in accordance with governing authorities, except where more stringent requirements are indicated.
2. Inspect piping before installation to detect apparent defects. Mark defective materials and promptly remove from site.
3. Lay piping, beginning at low point of system, true to line and grade indicated and with unbroken continuity of invert.
4. Polyethylene pipe: Install in accordance with ASTM F 449.
5. Joint adapters: Make joints between different types of pipe or different diameters of the same type of pipe with standard manufactured adapters intended for that purpose.
6. Cleanouts:
   a. Install solid risers at location indicated. Provide watertight connection at drainage piping and at joints in riser.
   b. Bring plug end of cleanout riser to within 4 to 6 inches of finish grade and install housing so that no surface loads will be transmitted to riser pipe.
   c. Set housing and cover flush with finish grade in a 5-inch-thick square concrete pad with each side at least 2 inches greater than the housing diameter.

C. Filling and Backfilling:

1. Place and compact fill or backfill in uniform layers, and achieve required compaction.
2. Take care when backfilling to avoid damaging or dislodging drainage system components.
   a. Do not operate wheeled or tracked vehicles on (in contact with) filter fabric.

D. Filter Fabric Installation:
   1. Grade or shape earthen surfaces to receive filter fabric so that the fabric will not bridge cavities in the soil or be damaged by projecting rock.
   2. Lay filter fabric flat on surfaces without stretching.
   3. Overlap seams a minimum of 12 inches and secure with staples or anchor pins.
   4. Secure edges of filter fabric to earthen surfaces with staples or anchor pins, and to rock or concrete surfaces with mastic or mechanical fasteners.

3.3 WALL/FOOTING DRAINAGE SYSTEMS

A. Install drainage pipe as indicated.

B. Backfilling:
   1. Place and compact general fill in excavation to within 12 inches of finish grade level.
   2. Final backfill: Place and compact impervious fill to finish grade.

3.4 FRENCH DRAIN SYSTEM

A. French Drain system located as shown on the contract documents, or as required by field conditions, to consist of 6 inches perforated PVC pipe with filter fabric sleeve. Pipe bedding shall be in an 18 inch wide by 30 inch deep (6 inches below pipe) trench backfilled with washed #57 stone. The #57 stone shall be wrapped in filter fabric with fabric overlapping at all seams.

3.5 FIELD QUALITY CONTROL

A. Piping: After installation of piping and placement of initial backfill, test piping for crushing and obstructions.
   1. Pull a mandrel with diameter of 90 percent of the pipe diameter through the pipe.
   2. Locate and replace damaged pipe or remove obstructions and retest until mandrel passes entire length of pipe.

END OF SECTION 33 46 16
SECTION 40 05 05
PROCESS - MECHANICAL PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This section identifies process-mechanical piping systems to be provided, specifies unique requirements for each system identified, and references other sections where detailed requirements of piping components are specified.

B. Process-mechanical piping systems are schematically shown on Instrumentation (I) Drawings and on Civil Site Piping (C) Drawings. Civil Site Piping Drawings may also show site utility piping systems which are specified in other sections. CONTRACTOR is responsible for detailed piping and pipe support layout and design.

C. Schedule 1 to Section 40 05 05 includes piping schedule which identifies process-mechanical piping systems to be provided. Piping schedule includes application information and specifies unique system requirements.

1.2 SUBMITTALS

A. Shop Drawings:

1. Layout drawings for each process-mechanical piping system drawn to scale. Identify each piping system with same flow stream identifier as shown on Drawings.

a. Double-line layout for each piping system 3 in. pipe size and larger. Minimum scale: 1/4 in. = 1 ft.

b. Single-line or double-line layout for each piping system smaller than 3 in. pipe size. Minimum scale: 1/4 in. = 1 ft.

c. For each piping system include:
   1) Size for each pipe and fitting.
   2) Material, lining type, and system number for coating to be provided for each pipe and fitting.
   3) Pipe class, thickness or schedule for each pipe and fitting.
   4) Pipe end connections (joint type) and couplings.
   5) Location and type of supports, hangers, anchors, and expansion joints.
   6) Pipe couplings, saddles, sleeves, clamps, adapters, and other piping products.
   7) Pipe mounted equipment and instrumentation identified by tag number assigned on Drawings.
   8) Insulation to be provided.

B. Submit in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Provide pipe and fittings as shown on Drawings and as specified in sections identified in Schedule 1 to Section 40 05 05, Process-Mechanical Piping Schedule, presented at end of this section.
2.2 PRODUCTS FOR PIPING SUPPORT, FLEXIBILITY, THERMAL EXPANSION, ANCHORAGE AND VIBRATION ISOLATION.

A. Provide support system for each non-buried process-mechanical piping system in accordance with Section 40 05 41.

B. Provide anchors, restraints, and concrete blocks as required to resist hydraulic thrust and forces due to thermal expansion.

C. Piping system, including support and anchorage system, shall allow for thermal expansion and contraction due to differences in operating temperatures and temperatures piping is exposed to during construction. Provide piping system products to allow for and control movement of piping due to thermal expansion and contraction.

D. No attempt has been made to show all pipe supports, hangers, anchors, expansion joints, and other piping products required for piping support, thermal expansion, and anchorage. Absence of these products on Drawings does not relieve Contractor of his responsibility for providing them in accordance with these Specifications.

E. Provide joints, couplings, and expansion joints as shown on Drawings and as required for piping flexibility and vibration isolation. No attempt has been made to show all joints, couplings, expansion joints, and other piping products required for piping flexibility and vibration isolation.

2.3 OTHER PIPING PRODUCTS

A. For buried piping, furnish fill material and install piping in accordance with Section 31 23 00.

2.4 COATINGS

A. Coat exterior surfaces of non-insulated piping products with coating system numbers specified in this Section and in accordance with Section 09 90 00.

PART 3 - EXECUTION

3.1 PREPARATION

A. Use implements, tools, and facilities for handling and protection of piping products to avoid damage prior to installation.

B. Inspect piping products before installation. Provide new, repair or recondition damaged piping products. Repair or reconditioning is subject to OWNER'S approval. Patch damaged interior linings and exterior coatings or replace damaged product with new product. Patching is subject to OWNER'S approval.

C. Clean ends of piping product before installation. Remove foreign matter and dirt from inside of piping product and keep product clean until Work has been accepted.

3.2 INSTALLATION

A. Location:

1. Install piping parallel to structure lines unless shown otherwise on Drawings.

2. Do not install piping through beams, columns, or other structural members unless shown on Drawings.
3. Locate valves in piping system in accordance with manufacturer’s instructions. In horizontal piping runs, do not orient valves so operating stem is below horizontal centerline unless specifically noted on Drawings to do so.

B. Assembly:

1. Install piping without springing or forcing in manner which would cause stress in piping, valves, or connected equipment.
2. Set pipe flanges level, plumb, and aligned. Set flanged fittings so flange is true and perpendicular to pipe axis. Set flanges so bolt holes straddle vertical centerline of pipes.
3. For flanged connections, match bolt holes and obtain uniform contact over entire flange area prior to installation of flange bolts. Tighten bolts to uniformly compress gaskets and minimize flange stress. Tighten bolts to torque recommended by gasket manufacturer. Coat nuts and bolts with anti-seize thread compound.

C. Pump, Blower and Equipment Connections:

1. Align pipe, equipment, pumps, and blowers so stresses are not transmitted to connections. Support piping independently from pumps, blowers, and equipment. Do not support piping from equipment, blowers, and pumps. Anchor piping to prevent transmission of hydraulic thrust load to pumps, blowers, and equipment.
2. Install couplings, adapters, expansion joints, flanges, and unions so pumps, equipment, valves, and in-line instruments can be removed from service without disruption to other portions of piping system.
3. Install couplings, expansion joints and other vibration isolation components to isolate piping from pump, blower, and equipment vibration.
4. For welded nozzle connections, allow for shrinkage during welding to prevent excessive stresses on pumps and equipment.
6. Provide control lines such as air piping necessary for operation of pumps, equipment, valves, and in-line instruments.

D. Install insulating flange, insulating coupling or dielectric union at each connection between ferrous and non-ferrous metal piping.

3.3 FIELD QUALITY CONTROL

A. Inspect installed piping products for dents, kinks, abrupt changes of curvature, damage to lining, and other damage. Repair or recondition damaged products as approved by OWNER or replace damaged products with new products.

B. Inspect installed, unlined piping products for corrosion and scale on interior surfaces. Clean products to remove corrosion and scale or replace with new products.

C. Test system in accordance with Section 40 08 10 and specified in Schedule 1 to Section 40 05 05.

3.4 CLEANING

A. After installation and before testing, remove dirt, rocks, debris and other foreign matter from interior of each piping system.

B. Water flush each hydrostatically tested piping system unless specified otherwise.

1. Flushing velocities of 2.5 ft per sec shall be maintained until accumulated debris has been removed.
2. Insert cone strainers at equipment connections prior to flushing. Remove cone strainers after flushing is complete.
3. Remove accumulated debris through drains not less than 2 in. in diameter or by temporarily removing pipe spools, fittings, or valves.
4. Drain piping after flushing and immediately dry piping with compressed air.

C. Blow clean each pneumatically tested piping system with compressed air unless specified otherwise.

3.5 PROCESS MECHANICAL PIPING SCHEDULE

A. **Service** column: Presents Flow Stream Identifiers for process-mechanical piping systems shown on Process-Mechanical, Drawings, Instrumentation Drawings and on Civil Drawings.

B. **Size** column: Presents nominal pipe diameter(s) for each piping system shown on Process-Mechanical Drawings and continuation of piping system on Civil Drawings.

C. **Pipe Material** column: Identify material type to be provided for piping system. Piping material shall conform to requirements of referenced sections:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Section</th>
<th>Abbreviation in Piping Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless Steel Tubing and Fittings</td>
<td>15 48 09</td>
<td>316SS or CNG</td>
</tr>
<tr>
<td>Steel Pipe for Natural Gas Service</td>
<td>40 14 58</td>
<td>CS or NG</td>
</tr>
</tbody>
</table>

D. **Location** Column: Identifies installation location of piping system. Piping system components shall be suitable for condition specified.

E. **Min/Max Temp** column: Presents minimum and maximum operating temperature of piping system. Piping system components shall be suitable for operating temperatures shown.

F. **Max Pressure** column: Presents maximum operating pressure of piping system and type of test to be provided. Piping system components shall be suitable for maximum operating pressure shown and test pressure specified.

1. Provide hydrostatic testing in accordance with Section 40 08 10 where maximum operating pressure value is followed by “-H”.
2. Provide high pressure air testing in accordance with Section 40 08 10 where maximum operating pressure value is followed by “-P”.
3. Provide low pressure air testing in accordance with Section 40 08 10 where “-A” is specified.
4. Test pressure for hydrostatic and high pressure air testing shall be 1.5 times maximum operating pressure, minimum, unless specified otherwise in REMARKS column. Test pressure for low pressure air testing shall be as specified in Section 40 08 10.
5. If maximum operation pressure is followed by “-none”, no test required.

G. **Color** column: Specifies color coding and banding to be provided for non-buried piping systems.
CNG FACILITIES

<table>
<thead>
<tr>
<th>Natural Gas</th>
<th>Orange</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air High Pressure</td>
<td>Dark Green</td>
</tr>
<tr>
<td>Compressed Natural Gas</td>
<td>Yellow</td>
</tr>
<tr>
<td>Vent</td>
<td>Black</td>
</tr>
</tbody>
</table>

UTILITIES

<table>
<thead>
<tr>
<th>Water Lines</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished or Potable</td>
<td>Dark Blue</td>
</tr>
</tbody>
</table>

H. Remarks column: Provides further description of piping system and specifies additional requirements.

I. If process mechanical piping shown on Drawings is not listed in schedule, CONTRACTOR shall provide piping.

1. Provide type of pipe used in similar services on project.
2. Provide piping suitable for pressure, temperature and other service conditions.
3. Submit type of pipe proposed for review by OWNER.
### Schedule 1 to Section 40 05 05
#### Process Mechanical Piping Schedule

<table>
<thead>
<tr>
<th>Service</th>
<th>Size (in.)</th>
<th>Pipe Matl</th>
<th>Location</th>
<th>Min/Max Temp (°F)</th>
<th>Max Press (psig)</th>
<th>Color</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>G or NG</td>
<td>≤3</td>
<td>STL</td>
<td>Buried, Outside</td>
<td>0 /120</td>
<td>10-P</td>
<td>Orange</td>
<td>Natural Gas service</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Exposed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNG</td>
<td>≤1</td>
<td>316SS</td>
<td>Buried, Outside</td>
<td>0 /120</td>
<td>5500-P</td>
<td>None or Yellow</td>
<td>Stainless steel tubing and fittings</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Exposed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>≤3</td>
<td>STL</td>
<td>Outside Exposed</td>
<td>0/120</td>
<td>10-P</td>
<td>Black</td>
<td>Vent</td>
</tr>
</tbody>
</table>

END OF SECTION 40 05 05
PART 1  - GENERAL

1.1. DESCRIPTION

This section includes materials and installation of specialty valves for natural gas systems, such as gas meter shutoff plug valves, and pressure regulators.

1.2. RELATED WORK DESCRIBED ELSEWHERE

Steel Pipe for Natural Gas or LPG Service: 401458.

1.3. SUBMITTALS

A. Submit shop drawings in accordance with the General Provisions and Section 013300.

B. Submit manufacturer’s catalog data and detail construction sheets showing all valve parts. Describe each part by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type.

C. Show valve dimensions including laying lengths. Show port sizes. Show dimensions and orientation of valve actuators, as installed on the valves.

PART 2  - MATERIALS

2.1. GENERAL

Valves are identified in the drawings by size and type number.

2.2. GAS METER SHUTOFF PLUG VALVES FOR NATURAL GAS SERVICE

Valves shall be of the plug type with cast-iron bodies and brass or bronze plug. Valves shall be of the flat-head style, for use in aboveground natural gas piping systems at ambient temperatures between –20°F to 150°F. Valves shall be plug-style, full line size and be rated to operate under the subjected pressure ratings for the site.

2.3. NEEDLE VALVE  6,000 psig

2.4. BALL VALVE  6,000 psig

2.5. BLEED VALVE  6,000 psig

2.6. CHECK VALVE  6,000 psig

2.7. PRESSURE SAFETY VALVE  THREE-WAY VALVE  6,000 psig

2.8. SOLENOID VALVE  6,000 psig

2.9. PRESSURE REGULATOR AT COMPRESSOR
Select the pressure regulator for the specified gas flow ranges of the specified compressor. Regulators shall be capable of regulating the specified gas flow range from 315 psig upstream to high suction set-point on the new compressor downstream (298 psig). Regulator shall be full line size.

PART 3   - EXECUTION

3.1. INSTALLING GAS METER SHUTOFF VALVES FOR NATURAL GAS SERVICE

A. Unless otherwise indicated in the drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating keys or heads vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet and 6 inches and 6 feet 9 inches above the floor with their operating keys or heads horizontal.

B. Install valves on vertical runs of pipe that are next to walls with their keys or heads horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their keys or heads horizontal, oriented to facilitate valve operation.

END OF SECTION 40 05 25
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. System of pipe supports and anchors with necessary inserts, bolts, nuts, restraining and hanger rods, washers, miscellaneous steel, and other accessories.

1.2 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design, detail and installation of pipe support system shall be responsibility of CONTRACTOR.
2. Pipe support system components shall withstand dead loads imposed by weight of pipes filled with water plus insulation, plus live loads due to thermal expansion, vibration, internal test pressures, and have minimum safety factor of 5.
3. Absence of pipe supports and details on Drawings shall not relieve CONTRACTOR of responsibility for providing them throughout CNG station.

1.3 SUBMITTALS

A. Shop Drawings:

1. Pipe supporting system, including manufacturer's product data, dimensions, sizes, types, location, maximum loadings, thrust anchorage, and installation instructions.
2. Calculations for thermal expansion of stainless steel tubing.

B. Submit in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Refer to General Requirements Exhibit A – Federal Contract Provisions

2.2 GENERAL

A. MSS types indicated are typical of types and quality of standard pipe supports and hangers to be employed.

B. Provide factory fabricated piping hangers and supports, clamps, hanger rod attachments, building attachments, saddles, shields, thrust anchorage, and other miscellaneous products of MSS SP-69 type indicated or shop fabricated supports; comply with MSS SP-58 and manufacturer's published product information. Where MSS type not indicated, provide proper selection for installation requirements and comply with MSS SP-69, MSS SP-89 and manufacturer's published product information.
2.3 MATERIALS

A. Hangers, rods, clamps, protective shields, metal framing, support components, and hanger accessories shall be galvanized unless otherwise noted.

B. Hangers, rods, clamps, protective shields, metal framing, support components, and hanger accessories in submerged locations in wet wells, tanks, channels or tank covers shall be Type 316 stainless steel.

2.4 HORIZONTAL PIPING HANGERS AND SUPPORTS

A. General:
   1. Unless otherwise shown or specified, hangers for 2-1/2 in. and smaller pipe shall be split-ring, adjustable swivel, clevis or roller type, hangers for 3 in. pipe or greater shall be clevis or roller type.
   2. Hangers for use with spring supports shall be split-ring or clamp type.
   3. Hangers for fiberglass reinforced pipe shall be saddle type.
   4. Each hanger shall be designed to permit at least 1-1/2 in. vertical adjustment after installation.

B. Adjustable Swivel Split-Ring Hanger: MSS Type 6.

C. Adjustable Clevis Hanger: MSS Type 1, fabricated from steel.

D. Adjustable Band Hanger: MSS Type 7, fabricated from steel.

E. Adjustable Swivel-Band Hanger: MSS Type 10.

F. Clamp: MSS Type 4.

G. Single Roll Support: MSS Type 41, including axle roller and threaded sockets.

H. Adjustable Roller Hanger: MSS Type 43, including axle roller and clevis.

I. Roll/Stand: MSS Type 44, including roller, stand, and axle.

J. Adjustable Roll/Base: MSS Type 46, including roller, adjustable base, and stand.

K. Steel Brackets: Welded structural steel shapes complying with following.
   1. Light Duty: MSS Type 31.
   2. Medium Duty: MSS Type 32.
   3. Heavy Duty: MSS Type 33.

L. Adjustable Saddle Support:
   1. MSS Type 38, including saddle, pipe, and reducer.
   2. Fabricate base support from steel pipe and include cast iron flange or welded steel plate.

M. Stanchion Saddle Support:
   1. MSS Type 37, including saddle and U-bolt.
   2. Fabricate base support from steel pipe and include cast iron flange or welded steel plate.
N. Strap or wire hangers not acceptable.

2.5 VERTICAL PIPING CLAMPS

A. 2-Bolt Riser Clamp: MSS Type 8, galvanized or plastic coated.

B. 4-Bolt Riser Clamp: MSS Type 42, include pipe spacers at inner bolt holes, galvanized or plastic coated.

2.6 HANGER RODS AND ATTACHMENTS

A. Hanger Rods:

1. **ASTM A36/A36M;** threaded both ends or continuous threaded.
2. Rods shall conform to following sizes.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Minimum Rod Diameter (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2 in.</td>
<td>3/8</td>
</tr>
<tr>
<td>2-1/2 in and 3 in.</td>
<td>1/2</td>
</tr>
<tr>
<td>4 in.</td>
<td>5/8</td>
</tr>
<tr>
<td>6 in.</td>
<td>3/4</td>
</tr>
<tr>
<td>8 in. to 12 in.</td>
<td>7/8</td>
</tr>
<tr>
<td>14 in. and Up</td>
<td>1</td>
</tr>
<tr>
<td>Trapeze Hangers</td>
<td>As Required</td>
</tr>
</tbody>
</table>

B. Turnbuckles: MSS Type 13.

C. Weld-less Eye Nut: MSS Type 17.

D. Eye Socket: MSS Type 16.

E. Clevis: MSS Type 14.

2.7 CONCRETE ATTACHMENTS

A. Individual Concrete Inserts:

1. MSS Type 18, malleable iron.
2. MSS Type 19, steel.
3. Minimum Safe Load: 1,100 lbs.

B. Continuous Concrete Inserts:

Refer to General Requirements Exhibit A – Federal Contract Provisions

C. Concrete Anchors:

1. Comply with Section 05 50 00.
2.8 MISCELLANEOUS MATERIALS

A. Metal Framing Systems:
   2. Galvanized material and fabrication

B. Shop-Fabricated Anchors and Supports:
   1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
   3. Fabricate in accordance with Section 05 50 00.

C. Concrete: Class B in accordance with Section 03 30 00.

PART 3 - EXECUTION

3.1 GENERAL

A. Proceed with installation of hangers, supports, and anchors after required building structural work is complete and concrete support structure has reached 28 day compressive strength as specified in Section 03 30 00.

B. Install hangers, supports, clamps, and attachments from building structure. Comply with MSS SP-69. Group parallel runs of horizontal piping to be supported together on trapeze type hangers where possible.

C. Install supports to provide indicated pipe slopes and maximum pipe deflections allowed by ASME B31.1 are not exceeded.

D. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

E. Do not support piping from other piping.

F. Prevent contact between dissimilar metals. Where concrete or metal pipe support is used, place 1/8 in. thick teflon, neoprene rubber or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and support.

G. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, plastic coated or by other recognized industry methods. Electrician’s tape not acceptable isolation method.

H. Apply anti-seize compound to nuts and bolts.

3.2 INSTALLATION OF ATTACHMENTS

A. Support piping from structural framing, unless otherwise noted.

B. Concrete Inserts:
   1. Locate inserts so total load on insert does not exceed manufacturer’s recommended maximum load. Location of inserts shall be approved by OWNER.
2. Where necessary to anchor supports to hardened concrete or completed masonry, use concrete anchors.

C. Attach to structural steel with beam clamps.

3.3 THRUST ANCHORS AND GUIDES

A. Thrust Anchors:

1. For suspended piping, center thrust anchors as closely as possible between expansion joints and between elbows and expansion joints. Anchors shall hold pipe securely and be sufficiently rigid to force expansion and contraction movement to take place at expansion joints or elbows and preclude separation of joints.

2. Provide thrust anchors as required to resist thrust due to changes in diameter or direction or dead ending of pipe lines. Anchorage shall be required wherever bending stresses exceed allowable for pipe. Wall pipes may be used as thrust anchors.

3. Restraining rod size and number shall be as shown on Drawings.

B. Pipe guides shall be provided adjacent to sliding expansion joints in accordance with recommendations of National Association of Expansion Joint Manufacturers.

3.4 PIPE SUPPORT

A. Spacing:

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Maximum Pipe Support Spacing (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Steel</strong></td>
<td></td>
</tr>
<tr>
<td>10 in. and over</td>
<td>22</td>
</tr>
<tr>
<td>8 in.</td>
<td>19</td>
</tr>
<tr>
<td>6 in.</td>
<td>17</td>
</tr>
<tr>
<td>5 in.</td>
<td>16</td>
</tr>
<tr>
<td>4 in.</td>
<td>14</td>
</tr>
<tr>
<td>3-1/2 in.</td>
<td>13</td>
</tr>
<tr>
<td>3 in.</td>
<td>12</td>
</tr>
<tr>
<td>2-1/2 in.</td>
<td>11</td>
</tr>
<tr>
<td>2 in.</td>
<td>10</td>
</tr>
<tr>
<td>1-1/2 in.</td>
<td>9</td>
</tr>
<tr>
<td>1 in.</td>
<td>7</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>6</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>5</td>
</tr>
<tr>
<td><strong>Copper</strong></td>
<td></td>
</tr>
<tr>
<td>4 in.</td>
<td>12</td>
</tr>
<tr>
<td>3-1/2 in.</td>
<td>11</td>
</tr>
<tr>
<td>3 in.</td>
<td>10</td>
</tr>
<tr>
<td>2-1/2 in.</td>
<td>9</td>
</tr>
<tr>
<td>2 in.</td>
<td>8</td>
</tr>
<tr>
<td>1-1/2 in.</td>
<td>8</td>
</tr>
<tr>
<td>1-1/4 in.</td>
<td>7</td>
</tr>
<tr>
<td>1 in.</td>
<td>5</td>
</tr>
<tr>
<td>Type of Pipe</td>
<td>Maximum Pipe Support Spacing (ft)</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>5</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>5</td>
</tr>
<tr>
<td>Plastic (Schedule 80 at 100°F)</td>
<td></td>
</tr>
<tr>
<td>8 in.</td>
<td>9-1/2</td>
</tr>
<tr>
<td>6 in.</td>
<td>9</td>
</tr>
<tr>
<td>4 in.</td>
<td>7-1/2</td>
</tr>
<tr>
<td>3 in.</td>
<td>7</td>
</tr>
<tr>
<td>2 in.</td>
<td>6</td>
</tr>
<tr>
<td>1-1/2 in.</td>
<td>5-1/2</td>
</tr>
<tr>
<td>1 in.</td>
<td>5</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>4-1/2</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>4-1/2</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td></td>
</tr>
<tr>
<td>1 in. and smaller</td>
<td>6</td>
</tr>
<tr>
<td>1-1/2 in. through 4 in.</td>
<td>8</td>
</tr>
<tr>
<td>6 in.</td>
<td>8</td>
</tr>
<tr>
<td>8 in. and 10 in.</td>
<td>10</td>
</tr>
<tr>
<td>12 in.</td>
<td>10</td>
</tr>
<tr>
<td>14 in.</td>
<td>12</td>
</tr>
<tr>
<td>16 in.</td>
<td>12</td>
</tr>
<tr>
<td>18 in. and larger</td>
<td>14</td>
</tr>
<tr>
<td>Cast Iron and Ductile Iron</td>
<td></td>
</tr>
<tr>
<td>1 in. and smaller</td>
<td>6</td>
</tr>
<tr>
<td>1-1/4 in. through 2-1/2 in.</td>
<td>8</td>
</tr>
<tr>
<td>3 in. and 4 in.</td>
<td>10</td>
</tr>
<tr>
<td>6 in.</td>
<td>12</td>
</tr>
<tr>
<td>8 in.</td>
<td>12</td>
</tr>
<tr>
<td>10 in. and 12 in.</td>
<td>14</td>
</tr>
<tr>
<td>14 in.</td>
<td>16</td>
</tr>
<tr>
<td>16 in. and 18 in.</td>
<td>16</td>
</tr>
<tr>
<td>20 in.</td>
<td>18</td>
</tr>
<tr>
<td>24 in. and larger</td>
<td>18</td>
</tr>
</tbody>
</table>

(For cast iron soil pipe plumbing applications, support at 5 ft-0 in. spacing.)

B. Where piping of various sizes is to be supported together, space supports for smallest pipe size or install intermediate supports for smaller diameter pipe.

C. Provide minimum of 2 pipe supports for each pipe run.

D. Where piping connects to equipment, support by pipe support and not by equipment, unless approved by equipment manufacturer.

E. Unless otherwise shown or authorized by OWNER, place piping running parallel to walls approximately 1-1/2 in. out from face of wall and at least 3 in. below ceiling.
F. Pedestal pipe supports shall be adjustable with stanchion, saddle, and anchoring flange.

G. Piping supports for vertical piping passing through floor sleeves shall be galvanized steel riser clamps.

H. Piping passing through sleeves or openings in interior wall sleeves shall be carried by supports or hangers. Do not rest on wall.

I. Support piping in manner preventing undue strain on valve, fitting or equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to nonrigid joints, and where otherwise shown.

J. Install supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Piping shall be free to move when expands or contracts, except where fixed anchors are indicated. Where adequate hanger rod swing length cannot be provided or where pipe movement based on expansion of 1 in./100 ft for each 100°F change in temperature exceed 1/2 in., provide approved roller supports.

L. Support piping 6 in. and larger on trapeze hangers with rollers.

M. Stacked horizontal runs of piping along walls may be supported by metal framing system attached to concrete insert channels.

N. Coat hangers, clamps, protective shields, metal framing support components, and hanger accessories in accordance with Section 09 90 00.

3.5 BURIED PIPING

A. Provide unlugged bell and spigot or bell tees, Y-branches, and bends deflecting 11-1/4° or more and plugs with reaction blocking, anchors, joint harness or other acceptable means for preventing movement of pipe and joints caused by internal pressure.

B. Concrete Blocking:

1. Extend from fitting to solid undisturbed earth and installed so joints accessible for repair.
2. Bearing area of concrete reaction blocking shall be as shown on Drawings.
3. If adequate support against undisturbed ground cannot be obtained, install metal harness anchorages consisting of steel rods across joint and securely anchored to pipe and fitting or other adequate anchorage facilities to provide necessary support.
4. Should lack of solid vertical excavation face be due to improper trench excavation, cost of furnishing and installing metal harness anchorages in excess of Contract value of concrete blocking replaced by such anchorages shall be borne by CONTRACTOR.

C. Provide reaction blocking, anchorages or other supports for fittings installed in fills or other unstable ground or above grade as shown on Drawings.

END OF SECTION 40 05 41
SECTION 40 08 10
TESTING PIPING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hydrostatic pressure testing.
   2. Low pressure air testing.
   3. High pressure air testing.

B. Other sections identify new piping systems to be tested, identify type of test to be performed, specify test pressure, and reference this section for detailed testing requirements.

1.2 SUBMITTALS

A. Test report for each piping system tested.

B. Submit in accordance with Section 01 33 00.

1.3 CODE REFERENCES


PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

3.1 GENERAL

A. Pressure test in presence of ENGINEER.

B. Furnish water required for testing and provide necessary piping connections between section of piping being tested and nearest available source of water or air supply, together with test pressure equipment, meters, pressure gauge, and other equipment, materials, and facilities necessary to perform specified tests.

C. Provide bulkheads, flanges, valves, bracing, blocking or other temporary sectionalizing devices that may be required.

D. Remove temporary sectionalizing device after tests complete.

E. Perform tests on exposed piping after piping completely installed, including supports, hangers, and anchors.

F. Perform tests on piping before insulation installed.

G. Perform tests on piping that is clean and free of dirt, sand or other foreign material.
H. Plug pipe outlets with test plugs. Brace each plug securely to prevent blowouts.

I. Add test fluid slowly.

J. Include regulator set to avoid over pressurizing and damaging piping.

K. Perform pressure testing in accordance with local, state, and federal requirements.

L. Cost of testing including water, personnel, equipment, and materials shall be CONTRACTOR’S responsibility.

M. Correct leaks or defects and retest at no additional cost to OWNER.

3.2 HYDROSTATIC PRESSURE TESTING

A. Perform hydrostatic pressure testing for piping systems identified in other sections to be hydrostatically pressure tested. Test pressure shall be as specified in other sections.

B. Open vents at high points to purge air pockets while piping system is filling. Venting may also be provided by loosening flanges or with equipment vents.

C. Testing:

1. After section of piping to be tested has been filled with water, apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of test.

2. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to ENGINEER.

3. Maintain test pressure for sufficient length of time to permit ENGINEER to observe piping under test but not less than 2 hrs.

4. If repairs required, repeat pressure test until pipe installation conforms to specified requirements and is acceptable to ENGINEER.

D. With exception of buried piping with mechanical joints or push-on joints, piping systems shall show no visual evidence of weeping or leaking.

E. Maximum allowable leakage for buried piping with mechanical joints or push-on joints is as follows.

\[
L = \frac{NDP^{1/2}}{7,400}
\]

Where:

L = Leakage, gallons per hr
N = Number of joints under test
D = Nominal diameter of piping, in.
P = Average pressure during test, lbs per sq in.

3.3 LOW PRESSURE AIR TESTING

A. General:
1. Perform low pressure air testing for gravity sewer and drainage piping systems identified in other sections to be low pressure air tested.

2. Air Test Procedure: Test pipes between adjacent manholes. Test time for air pressure to drop 1 psig.
   
a. For pipes 4 in. through 24 in.: Comply with Table 1.
   
b. Pipe diameters above 36 in. will not be accepted by means of low pressure air test. In all cases, ignore length of laterals.

### Table 1

<table>
<thead>
<tr>
<th>Pipe Dia (in.)</th>
<th>Time/Ft up to Length in Column C (sec)</th>
<th>Test Length (ft)</th>
<th>Test Time for Length Between Columns C &amp; E (min:sec)</th>
<th>Length Time in Column F Applies (ft)</th>
<th>Time/Ft for Total Length (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.18</td>
<td>636</td>
<td>1:54</td>
<td>1,432</td>
<td>0.08</td>
</tr>
<tr>
<td>6</td>
<td>0.40</td>
<td>424</td>
<td>2:50</td>
<td>955</td>
<td>0.18</td>
</tr>
<tr>
<td>8</td>
<td>0.71</td>
<td>318</td>
<td>3:47</td>
<td>716</td>
<td>0.32</td>
</tr>
<tr>
<td>10</td>
<td>1.11</td>
<td>255</td>
<td>4:43</td>
<td>573</td>
<td>0.49</td>
</tr>
<tr>
<td>12</td>
<td>1.60</td>
<td>212</td>
<td>5:40</td>
<td>477</td>
<td>0.71</td>
</tr>
<tr>
<td>15</td>
<td>2.50</td>
<td>170</td>
<td>7:05</td>
<td>382</td>
<td>1.11</td>
</tr>
<tr>
<td>18</td>
<td>3.62</td>
<td>141</td>
<td>8:30</td>
<td>318</td>
<td>1.61</td>
</tr>
<tr>
<td>21</td>
<td>4.92</td>
<td>121</td>
<td>9:55</td>
<td>273</td>
<td>2.19</td>
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<td>24</td>
<td>6.42</td>
<td>106</td>
<td>11:20</td>
<td>239</td>
<td>2.85</td>
</tr>
<tr>
<td>27</td>
<td>8.14</td>
<td>94</td>
<td>12:45</td>
<td>212</td>
<td>3.62</td>
</tr>
<tr>
<td>30</td>
<td>10.00</td>
<td>85</td>
<td>14:10</td>
<td>191</td>
<td>4.44</td>
</tr>
<tr>
<td>33</td>
<td>12.14</td>
<td>77</td>
<td>15:35</td>
<td>174</td>
<td>5.40</td>
</tr>
<tr>
<td>36</td>
<td>14.37</td>
<td>71</td>
<td>17:00</td>
<td>159</td>
<td>6.39</td>
</tr>
</tbody>
</table>

B. Preparation:

1. Isolate pipe section to be tested by plugging each end with air tight plugs. Plug ends of branches, laterals and wyes which are to be included in test section.
2. Brace plugs to prevent slippage and blowout due to internal pressure.
3. One plug shall have inlet tap or other provision for connecting supply air hose.
4. Connect one end of air hose to plug used for air inlet; other end to portable air control equipment.
5. Air control equipment shall consist of valves and pressure gauges to control rate at which air flows into test section and gauges to monitor air pressure inside pipe.
6. Connect air hose between source of compressed air and control equipment.
C. Testing:

1. If pipe to be tested is submerged in groundwater, determine height of groundwater above spring line of pipe at each end of test section and compute average. For every foot of groundwater above pipe’s spring line, increase gauge test pressures by 0.43 lbs/sq in.

2. Add air slowly to test section until pressure inside pipe is raised to 4.0 psig greater than average back pressure of groundwater that may be over pipe.

3. After pressure of 4.0 psig obtained, control supply of air so internal pressure maintained between 3.5 and 4.0 psig (above average groundwater back pressure) for minimum of 2 min to allow temperature of air to come into equilibrium with temperature of pipe walls.

4. Determine rate of air lost by time pressure drop method.

   a. After temperature stabilized for 2-min period, disconnect air supply. Allow pressure to decrease to 3.6 psig. At this pressure, start stopwatch to determine time required for pressure to drop 1 psig. Time required for loss of 1.0 psig is then compared to Table 1. If time is equal or greater than times indicated in table, test shall be acceptable.

3.4 HIGH PRESSURE AIR TESTING

A. Perform high pressure air testing for piping systems as specified in other sections. Test pressure shall be as specified in other sections.


C. Perform final test at test pressure. Pressure in system shall be gradually increased and in small increments until test pressure reached. Test pressure shall be maintained for minimum of 10 min and additional time necessary to conduct soap bubble examination of each joint for leakage.

D. Piping system shall show no evidence of leakage.

3.5 TEST REPORT

A. Prepare and submit test report for each piping system tested. Include following information in test report.

1. Date of test.
2. Description and identification of piping system tested.
3. Type of test performed.
4. Test fluid.
5. Test pressure.
6. Type and location of leaks detected.
7. Corrective action taken to repair leaks.
8. Results of retesting.
SECTION 40 14 58
STEEL PIPE FOR NATURAL GAS SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION
This section includes materials and installation of steel pipe and fittings for natural gas piping.

1.2 RELATED WORK DESCRIBED ELSEWHERE
1. Painting and Coating: 099000.
2. Pressure Testing of Piping: 400810

1.3 SUBMITTALS
1. Submit shop drawings in accordance with the General Provisions and Section 013300.
2. Submit list showing materials and dimensions of pipe and fittings with API and/or ASTM reference and grade. Show coating used on buried piping.
3. Submit certificates of welding rods used for field welding.

PART 2 - MATERIALS

1.1 PIPE
Material shall be seamless; API 5L, Grade B or ASTM A106, Grade B. Minimum wall thickness shall be Schedule 40 per ASME B36.10.

1.2 FITTINGS
1. Fittings shall be butt-welded conforming to ASME B16.9. Material shall conform to ASTM A234, Grade WPB. Wall thickness shall be the same as the pipe as a minimum. Provide fittings at all bends. Do not field bend pipe.
2. Fittings 2 inches and smaller may be socket-welded in accordance with ASME B16.11, Class 3000.

1.3 JOINTS
Joints for pipe shall be butt-welded. Socket welds can be used on pipes smaller than 2 inches in diameter in accordance with ASME B31.8.

1.4 UNIONS
Unions shall comply with MSS SP-83, Class 3000, socket welded.
1.5 FLANGES

Provide weld-neck flanges, Class 150, per ASME B16.5 to connect to flanged valves or equipment. Flanges shall match the connecting flanges on the adjacent valve or piece of equipment. Flanges shall be flat faced.

1.6 GASKETS FOR FLANGES

Provide in accordance with ASME B31.8. Gasket material shall be non-asbestos.

1.7 VALVES

Valves shall be suitable for gas service at the service pressure.

PART 3 - EXECUTION

1.1 GENERAL

Ream, clean, and remove burrs from piping before making up joints.

1.2 WELDING

1. Bevel ed ends for butt-welding shall conform to ASME B31.8. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding.


3. Qualification of field welding procedures shall be in accordance with Section 2 of API 1104. Welder qualification shall be in accordance with Section 3 of same standard.

4. The minimum number of passes for welded joints shall be as follows:

<table>
<thead>
<tr>
<th>Steel Cylinder Thickness (inch)</th>
<th>Minimum Number of Passes for Welds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 0.1875</td>
<td>1</td>
</tr>
<tr>
<td>0.1875 through 0.25</td>
<td>2</td>
</tr>
<tr>
<td>Greater than 0.25</td>
<td>3</td>
</tr>
</tbody>
</table>

Welds shall be full circumferential.

5. Use the SMAW method for welding.

6. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a grinding wheel.

7. Welding rod shall comply with API 1104.

8. Twenty percent of circumferential field welds shall be fully radiographed in accordance with API 1104.
1.3 PAINTING AND COATING

1. Coat buried piping per Section 099000, System No. 25.
2. Coat piping located above ground or in vaults and structures per Section 099000, System No. 10. Color of finish coat shall be OSHA Safety Yellow.

1.4 FIELD COATING OF TRANSITION FITTINGS TO POLYETHYLENE GAS PIPE

1. Coat per manufacturer’s requirements and the following:
2. Extend the primer a minimum of 3 inches onto the adjacent surfaces of the polyethylene gas pipe.
3. Apply the wax tape immediately after the primer application. Work the tape into the crevices around the transition fitting. Wrap the wax tape spirally around the pipe and across the fitting to the other pipe. Use a minimum overlap of 55% of the tape width.

1.5 INSTALLING EXPOSED PIPE

Install in accordance with ASME B31.8 and NFPA 54.

1.6 INSTALLING BURIED PIPE

1. Install in accordance with Section 312316 and the following.
2. Pipe installed underground shall not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert. Maintain a minimum 36-inch cover over the pipe. Maintain a minimum 12-inch clearance between the pipe and underground structures.
3. Do not install gas piping closer than 8 inches to a waterline, drain line, sewer, or other pipe.
4. Material for pipe zone and pipe base shall be sand per Section 312316. Backfill material above pipe zone shall be native material per Section 312316.
5. If the pipe contains dirt, sand, or other foreign materials after it has been strung along the trench or right-of-way, swab each length prior to welding it into the pipeline. The swab may be a wire brush, cloth, or rubber pig. Visually inspect each length internally prior to use.
6. Provide plastic warning tape.
7. After the pipeline is complete, run a pipeline scraper or pig through the line twice. Prior to the pigging operation, install a pig catcher on the end of the line. Fasten the catcher to the end of the pipeline in a manner which will prevent it from blowing off during the pigging operation. The pigging operation shall provide for controlled running of the pig. Move the pig by air pressure only. Do not use gas pressure in the pigging operation.

1.7 PIPELINE PRESSURE TESTING

1. Perform a pneumatic test per Section 400515. Do not test until every joint has set and cooled at least eight hours at a temperature above 50°F. Perform testing before backfilling; however, place sufficient backfill material between fittings to hold pipe in place.
during tests. Systems which may be contaminated by gas shall first be purged as specified herein. Make tests on entire system or on sections that can be isolated by valves. After pressurization, isolate entire piping system from all sources of air during test period.

2. Maintain test pressure for at least eight hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied. Do not take test readings during rapid weather changes. Temperature shall be same as actual trench conditions. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature change in accordance with the relationship \( PF + 14.7 = (P1 + 14.7) \frac{(T2 + 460)}{(T1 + 460)} \), in which \( T \) and \( P \) represent Fahrenheit temperature and gauge pressure, respectively; subscripts 1 and 2 denote initial and final readings; and "PF" is the calculated final pressure.

3. If "PF" exceeds the measured final pressure (final gauge reading) by 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to all joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. A test gauge calibrated in 1-psi increments and readable to 1/2 psi shall be used in performing the tests.

4. In case unacceptable welds are observed during inspection and testing, remove a section of pipe containing the bad weld to a length of 18 inches on either side of the weld. Then weld a new spool piece in place of the removed section of pipe. The closing welds shall be fully radiographed.

5. Under no circumstances shall a valve in a line be used as a bulkhead between gas in one section of the piping system and air in an adjacent section, unless two valves are installed in series with a valved telltale between these valves.

6. Following pneumatic testing, thoroughly purge gas lines with oil-free nitrogen gas to assure that no explosive mixtures will be present in the system during the filling process.

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FORERUNNER Rail 
(See Cross-Section Below)

1" x .065 Wall Picket, 8' O.C. Nom. 
Varies with Height

Standard Heights: 4', 5', 6', 7', 8', 9', 10'
36" Min. Footing Depth
2" Nom.

Post size varies with Height 
(See ECHELON II Post-Sizing chart)

3" TYPICAL 
Varies with Height

NOTES:
1.) Post size depends on fence height and wind loads. See ECHELON II post sizing chart.
2.) Panels also available in 6' on center post spacing
3.) Additional heights available on request. Some heights noted require a third and/or fourth rail.
4.) Third and Fourth rail optional.
1. ALL PROPOSED WORK SHALL BE DONE IN ACCORDANCE WITH THE EXIGENT NEEDS OF THE CITY OF BIRMINGHAM, THROUGH DESIGN AND THE CONSTRUCTION OF PUBLIC WORKS PROJECTS.

2. CONTRACTOR SHALL COORDINATE WITH CITY STAFF PRIOR TO PROPOSED INSTALLATION ALONG WOODLAWN ROAD.

3. CONTRACTOR SHALL CooperATE WITH CITY OF BIRMINGHAM WATER WORKS PRIOR TO PROPOSED INSTALLATION ALONG WOODLAWN ROAD.
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**CNG ONLY**

**SAFETY SIGN**

12" x 22" M & B LETTERS ON WHITE BACKGROUND MATERIAL: WHITE ALUMINUM
**Structural Notes**

**Design Basis**

- **HOT**: 20 psi (static)
- **HDO**: 80 psi (design)

**Wind Components**

- **MAX LOAD**: 0.20 psi

- **HOT LEVEL**: 20 psi

**Shear Wall Design**

- **HOT LEVEL**: 0.20 psi

**Structural Notes**

- **ISSUE/REVISION**: 0
- **DATE**: 09/18/2015
- **DESCRIPTION**: ISSUED FOR BID
- **SHEET TITLE**: STRUCTURAL NOTES
- **SHEET NUMBER**: S001
- **Project Management Initials**: Designer: Checked: Approved: ARR  RP  JAL
- **Filename**: P:\1525\BMA CNG FUELING STATION\WORKING FILES\DWG\BMA CNG - NOT.DWG

**Project Number**: 60432525

**Date Printed**: 09/18/2015

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