BID ENVELOPE
MSCAA PROJECT NO. 08-1260-05

NAME OF PROJECT: **GLYCOL MANAGEMENT PROGRAM - CONTROL FACILITY - CONSTRUCTION**

BIDS DUE: **7/29/2021** **TIME:** **2:00 PM Local Time**

MEMPHIS SHELBY COUNTY AIRPORT AUTHORITY (MSCAA)
PROCUREMENT DEPARTMENT
MEMPHIS INTERNATIONAL AIRPORT
4150 Louis Carruthers Drive
Memphis, TN 38118 (901) 922-8000

BIDDER IDENTIFICATION:

Bidder _____

Address _____

TENNESSEE CONTRACTOR LICENSE INFORMATION:

License Number _____

License Classification Applicable to Project _____

License Expiration Date _____

Dollar Limit _____

SUBCONTRACTORS (OR PRIME CONTRACTORS) TO BE USED ON THIS PROJECT IN THE BELOW LISTED CAPACITIES:

Note: Where applicable, one contractor/subcontractor performing electrical, plumbing, heating, ventilation, air conditioning, and masonry work must have its license number, applicable classification, expiration date and dollar limit on the BID ENVELOPE containing the BID PROPOSAL. ***Prime contractors*** who are to perform the electrical, plumbing, heating, ventilation, air conditioning or masonry work MUST list themselves as "Self-Perform" in the Sub-contractor list below.

	Sub-contractor List	License No.	Applicable Classification	Expiration Date	Dollar Limit
Electrical					
Plumbing					
Heating					
Ventilation					
Air Conditioning					
Masonry					

BID ENVELOPE

COMPLETE THIS FORM AND ATTACH IT TO THE OUTSIDE OF THE BID ENVELOPE. PLEASE REVIEW INSTRUCTIONS TO BIDDERS FOR BID PACKAGE DELIVERY AND FOR OTHER INFORMATION AND CONDITIONS. MSCAA RESERVES THE RIGHT, IN ITS SOLE DISCRETION, TO REJECT AND DISQUALIFY YOUR BID IF YOU, YOUR PARENT, SUBSIDIARY, AFFILIATE, OR PREDECESSOR IN INTEREST OR ANY OF YOUR SUBCONTRACTORS, SUPPLIERS, AND/OR THEIR PARENTS, SUBSIDIARIES, AFFILIATES OR PREDECESSORS IN INTEREST HAVE PENDING LITIGATION OR CLAIMS WITH THE MSCAA.

SPECIFICATIONS

FOR

GLYCOL MANAGEMENT PROGRAM - CONTROL FACILITY - CONSTRUCTION

MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA PROJECT NO. 08-1260-05

DATED: 06/29/2021

ISSUED FOR BID

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SPECIFICATIONS
FOR
GLYCOL MANAGEMENT PROGRAM DEICE CONTROL FACILITY
AT
MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA NO. 08-1260-05

July 02, 2021

ARCHITECTURAL

I hereby certify that the Architectural Specifications including but not limited to Sections 04 10 00, 04 20 25, 06 10 00, 06 41 00, 07 11 13, 07 21 00, 07 21 10, 07 41 14, 07 42 13, 07 42 57, 07 42 65, 07 42 93, 07 52 10, 07 62 00, 07 68 80, 07 72 00, 07 72 33, 07 90 05, 08 11 13, 08 30 50, 08 33 23, 08 42 20, 08 43 13, 08 71 00, 08 80 00, 08 83 00, 09 05 61, 09 21 16, 09 30 00, 09 51 00, 09 65 80, 09 68 13, 09 69 00, 09 90 00, 09 97 24, 10 14 00, 10 21 15, 10 28 00, 11 13 30, 11 24 00, 12 24 13, 12 52 40, 12 59 10, 12 59 20, 12 59 30, 34 70 00, 41 22 00 were prepared by me or under my direct supervision and that I am a duly Registered Architect under the laws of the State of Tennessee.

Benjamin A. Witt
Date: 07/02/2021 Reg. No.023180

ISSUED FOR BID

SPECIFICATIONS
FOR
GLYCOL MANAGEMENT PROGRAM DEICE CONTROL FACILITY
AT
MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

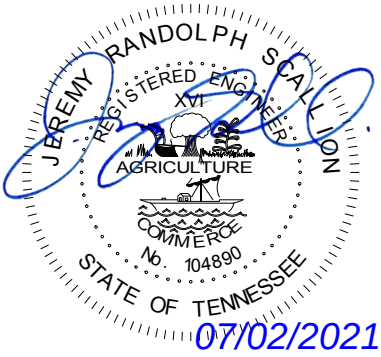
MSCAA NO. 08-1260-05

July 2, 2021

STRUCTURAL

I hereby certify that the Specifications 03 10 00, 03 20 00, 03 30 00, 04 22 00, 05 12 00, 05 21 00, 05 31 00, 05 50 00 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.

Jeremy Scallion, P.E.
Date: 07/02/2021 Reg. No.104890



SPECIFICATIONS
FOR
GLYCOL MANAGEMENT PROGRAM DEICE CONTROL FACILITY
AT
MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA NO. 08-1260-05

July 2, 2021

MECHANICAL AND ELECTRICAL

I hereby certify that the Mechanical and Electrical Specifications including but not limited to Sections:
230513, 230529, 230548, 230553, 230713, 231123, 233113, 233300, 233423, 236200, 238126, 238239, 260500, 260523, 260526, 260529, 260533, 260553, 260923, 260943, 262200, 262416, 262726, 263600, 264113, 264313, 265100, 265600, 270500, 271500, and 283100 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.

Ryan J. Hertter
Date: 07/02/2021 Reg. No.106919

SPECIFICATIONS
FOR
GLYCOL MANAGEMENT PROGRAM DEICE CONTROL FACILITY
AT
MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

MSCAA NO. 08-1260-05

July 2, 2021

PLUMBING AND FIRE PROTECTION

I hereby certify that the Plumbing and Fire Protection Specifications including but not limited to Sections 21 05 17, 21 05 18, 21 05 48, 21 13 13, 22 05 13, 22 05 16, 22 05 17, 22 05 18, 22 05 19, 22 05 23, 22 05 29, 22 05 53, 22 07 19, 22 11 16, 22 11 19, 22 13 16, 22 13 19, 22 13 23, 22 33 00, 22 34 00, 22 40 00, 22 45 00, and 22 47 00 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.

Jeremiah E. Watson
Date: 07/02/2021 Reg. No.110226

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MSCAA Comprehensive Storm Water Pollution Prevention Plan
Geotechnical Report Dated March 30, 2021

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END OF SECTION 00015

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LEGAL NOTICE
Request for Bids
MSCAA Project Number 08-1260-05
Glycol Management Program - Control Facility - Construction

Sealed bids for Glycol Management Program - Control Facility - Construction will be received by the Memphis-Shelby County Airport Authority (Authority), Procurement Department, 4150 Louis Carruthers Drive, Memphis, TN 38118, until **2:00 PM Local Time on 7/29/2021**. Bids will not be received at any other location. Within 30 minutes thereafter, the bids will be opened and publicly read via phone/video conference (link: https://zoom.us/j/97769525201?pwd=dmZpRUd1c1BlakdrMXcwakg2Sk9ldz09; phone: (312) 626 6799; Meeting ID: 977 6952 5201; Passcode: 729627). The Bid Documents, including a description of the scope of work, the required response format, and additional instructions may be obtained on or after **June 30, 2021** online at www.flymemphis.com.

A Pre-Bid Meeting will be held Thursday, July 8th, at 1:30 PM local time via phone/video conferencing (link: https://zoom.us/j/94094548206?pwd=bkZkU2hmV0M1WE9vcVo3a3d3NGs1dz09; phone: (312) 626 6799; Meeting ID: 940 9454 8206; Passcode: 389856). The project site will be available for inspection immediately following the meeting. Attendance at the Pre-Bid is strongly recommended.

All Bidders are responsible for checking the Authority's website up to the submission deadline for any updates, addenda or additional information. The successful Bidder must sign a contract with the Authority that includes Federal Aviation Administration provisions, if applicable, regarding the Buy American Preference, Foreign Trade Restriction, Davis-Bacon, Affirmative Action, Debarment and Suspension, and Drug-Free Workplace, all of which are incorporated herein by reference.

Each bid must be made by a contractor licensed in Tennessee and be accompanied by a 5% Bid Guarantee. The successful bidder must execute a Performance Bond and a Payment Bond in the amount of 100% each of the Contract Price and meet the Disadvantaged Business Enterprise (DBE) participation goal for this project, which is 25%.

The Authority reserves the right to reject any or all responses to this Request for Bids in whole or in part; to waive any informalities, technicalities, or omissions related to this Request for Bids; and to reject responses on any other basis authorized by the Authority's purchasing policies.

The Authority is an equal opportunity employer and prohibits discrimination based on the grounds of age, race, sex, color, national origin, disability, marital status, military service, or sexual orientation in its hiring and employment practices and in the admission to, access to, or operation of its programs, services, and activities.

By order of:
Scott A. Brockman, A.A.E.
President and CEO
Memphis-Shelby County Airport Authority

DIVISION 0 – SECTION 00200

INSTRUCTIONS TO BIDDERS / PROPOSERS

Instruction for the preparation of proposals and the delivery thereof to the Memphis-Shelby County Airport Authority (MSCAA) are contained in General Provision Section 20 and additionally as follows. Prepare and submit proposals accordingly.

1. RESERVATION OF RIGHTS:

MSCAA reserves the right, in its sole discretion, to reject and disqualify the bid of any bidder that has pending litigation or claims with the MSCAA and to reject the bid when a parent, subsidiary, affiliate, or predecessor in interest of the Bidder has pending litigation or claims with the MSCAA.

MSCAA also reserves the right, in its sole discretion, to reject and disqualify the bid of any bidder if the bid includes any subcontractor(s) or supplier(s) of any tier that have pending litigation or claims with MSCAA, and to reject the bid when a parent, subsidiary, affiliate, or predecessor in interest of the subcontractor or supplier has pending litigation or claims with the MSCAA.

Bidders shall request from MSCAA a list of entities that have pending claims or litigation with MSCAA to avoid including such entities or their parents, subsidiaries, affiliates, or predecessors in interest in their proposal or bid. A list of affected entities may be obtained by a written or telephone request to Development Division at MSCAA, 2491 Winchester Road, Suite 113, Memphis, TN 38116-3856, telephone number (901) 922-8033.

2. PRE-BID CONFERENCE:

A Pre-Bid Meeting will be held Thursday, July 8th, at 1:30 PM local time via phone/video conferencing (link: https://zoom.us/j/94094548206?pwd=bkZkU2hmV0M1WE9vcVo3a3d3NGs1dz09 ; phone: (312) 626 6799; Meeting ID: 940 9454 8206; Passcode: 389856). The project site will be available for inspection immediately following the meeting. Attendance at the Pre-Bid is strongly recommended.

3. DRAWINGS AND SPECIFICATIONS FURNISHED TO CONTRACTOR:

One printed set of contract documents will be furnished to the Contractor who is awarded the work at no cost to him. Contractor may obtain additional printed copies of the contract documents at their reproduction cost. If the Contractor waives his right to one printed set of contract documents, one digital set of contract documents will be furnished to the Contractor at no cost to him.

4. REFUSAL OF ISSUANCE OF PROPOSAL FORM TO BIDDERS IN DEFAULT AND DISQUALIFICATION OF BIDDERS:

See General Provision Section 20 for disqualification of bidders and bidders in default.

5. SUBMIT THE FOLLOWING WITH THE BID IN THE MANNER DESCRIBED BELOW:

A.
(1) Proposal
(2) Proposal Guarantee (Required Bid Security)
(3) DBE Assurance Statement/Letter of Intent on Bidder's / Proposer's Letterhead for each DBE subcontractor, subcontractors' signatures not required.
(4) Written quote or proposal or other communication from each DBE upon which the scope of work and dollar value contained in your Assurance Statements is based with items included in the Proposal either circled and/or highlighted.
(5) DBE Goals Accomplishment Statement
(6) Information on All Firms that Provide Bids or Quotes
(7) Signed Addenda (if applicable)

B. The following must be submitted within 24 hours of the proposal submittal deadline:

(1) DBE Assurance Statement/Letter of Intent on Bidder's / Proposer's Letterhead for each DBE subcontractor, subcontractors' signatures required.

See General Provision Section 20, PROPOSAL REQUIREMENTS AND CONDITIONS.

C. By executing the proposal submittal, the Contractor is confirming that (1) neither the Contractor nor any of Contractor's potential subcontractors or suppliers have pending claims or litigation, arbitration, or other dispute resolution proceedings where the Owner and the Contractor or potential subcontractors or suppliers are parties; or (2) the Contractor has disclosed in writing any such pending claims or proceedings to Owner through its own writing and/or the writing of Contractor's potential subcontractors or suppliers and submitted same to Owner with the proposal submittal.

D. Bids should be delivered to the following address:

Memphis-Shelby County Airport Authority
Procurement Department
Memphis International Airport
4150 Louis Carruthers Drive
Memphis, TN 38118
Project No. 08-1260-05

The bid must be sealed and the project number must be included in the address.

Within 30 minutes thereafter, the bids will be opened and publicly read via phone/video conference (link: https://zoom.us/j/97769525201?pwd=dmZpRUd1c1BlakdrMXcwakg2Sk9ldz09; phone: (312) 626 6799; Meeting ID: 977 6952 5201; Passcode: 729627). Please note that bids will not be accepted at the Project Center; they must be delivered prior to the deadline to the 4150 Louis Carruthers Drive address or they will be rejected.

6. CONSIDERATION OF BID:

The Owner reserves the right to reject any or all bids in whole or in part and to waive any informalities, technicalities, or omissions therein.

It is intention of the Owner to award a contract based upon the lowest responsive bid on the lump sum base bid. Bidder understands and agrees that, after a review of all the bids, the Owner will select the lump sum base bid that best suits the Owner's needs within the sole discretion of the Owner.

7. NO FINANCIAL INTEREST:

Respondent understands and agrees that no Airport Authority employee or member of the Board of Commissioners shall receive any financial benefit arising out of this proposal or its contract, if awarded, either directly or indirectly. Further, any fees paid to any person or entity by contractor for assistance in obtaining this contract, if awarded, with the Authority must be fully disclosed to the Authority.

8. PROTEST:

A. Any protest must be filed in writing and received by the Authority within seven (7) calendar days of the date of the occurrence of the event that is the subject of the protest, e.g., the opening of responses, the award, or a determination that a respondent is not responsible or that a response is

not responsive. Any protest must be actually delivered to the Authority during the business hours of 7:00 AM – 3:30 PM Local Time in order to be deemed to be received by the Authority as required under this Section. A protest must be submitted in hard copy and addressed as follows:

Memphis-Shelby County Airport Authority
Attention: Director of Procurement
4150 Louis Carruthers Drive
Memphis, Tennessee 38118-6613

Any protest sent by telegraphic or facsimile transmission or by email or other electronic means will not meet the filing requirements set forth herein and will not be deemed to be received by the Authority.

No objections with regard to the application, meaning, or interpretation of the specifications contained herein will be considered after the opening of the subject bid.

END OF SECTION 00200

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DIVISION 0 – SECTION 00405

PROPOSAL

Project Identification: **Glycol Management Program - Control Facility - Construction**

Contract Number: MSCAA Project No. **08-1260-05**

For Overnight Courier (FedEx/UPS), or Hand Delivery Submit to:

Memphis-Shelby County Airport Authority
Memphis International Airport
Procurement Department
4150 Louis Carruthers Drive
Memphis, Tennessee 38118

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with other terms and conditions of the Contract Documents.

2. Bidder accepts all of the terms and conditions of the Legal Notice to Bidders and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for seventy-five (75) days after the day of Bid opening. Bidder will sign and submit the Construction Contract with the Bonds and other documents required by the Bidding Requirements, within ten (10) days after the date of Owner's Notice of Award.

3. In submitting this Bid, Bidder represents, as more fully set forth in the Contract that:

   (a) Bidder has examined copies of all the Bidding Documents and of the following Addenda (receipt of all which is hereby acknowledged):

Date	Number
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

   (b) Bidder has familiarized itself with the nature and extent of the Contract Documents, Work, site, locality, and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the Work.

(c) Bidder has studied carefully all reports and drawings of subsurface conditions and drawings of physical conditions which are identified in Division 0 and Division 1 Specifications, and accepts the determination set forth in General Provision Section 20 paragraph 20-06 of the extent of the technical data contained in such reports and drawings upon which Bidder is entitled to rely.

(d) Bidder has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies (in addition to or to supplement those referred to in (c) above) which pertain to the subsurface or physical conditions at the site or otherwise may affect the cost, progress, performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with other terms and conditions of the Contract Documents, including specifically the provisions of General Provision Section 20 paragraph 20-06; and no additional examination, investigations, explorations, tests, reports or similar information or data are or will be required by Bidder for such purposes.

(e) Bidder has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities. No additional examinations, investigations, explorations, tests, reports or similar information or data in respect of said Underground Facilities are or will be required by Bidder in order to perform and furnish the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents.

(f) Bidder has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Contract Documents.

(g) Bidder has given Owner or Engineer written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by Owner or Engineer is acceptable to Bidder.

(h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid: Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

4. Bidder will complete Base Bid Work for the following price(s).

UNIT PRICE SCHEDULE – BASE BID

ITEM NO.	DESCRIPTION	UNIT	QUANT.	TOTAL PRICE
1	GLYCOL CONTROL FACILITY	LS	1	$
2	UTILITY ALLOWANCE	ALLOW	1	$125,000
3	INTERIOR FURNISHINGS	ALLOW	1	$25,000
4	IT ALLOWANCE	ALLOW	1	$100,000
5	MOBILIZATION (FIXED COST)	LS	1	$500,000
6	DEMOBILIZATION (FIXED COST)	LS	1	$300,000
TOTAL BASE BID (TOTAL OF LINE ITEMS 1-6)				**$**_____

CONTRACT BASE BID TOTAL (TOTAL OF LINE ITEMS 1-6):

_____

(use words)

_____

($_____)

5. The Owner reserves the right to reject any or all bids in whole or in part and to waive any informalities, technicalities, or omissions therein.

   It is intention of the Owner to award a contract based upon the lowest responsive bid on the lump sum base bid. Bidder understands and agrees that, after a review of all the bids, the Owner will select the lump sum base bid that best suits the Owner's needs within the sole discretion of the Owner.

6. Bidder agrees that the Work: will be completed and ready for final payment within the calendar days (as described in Section 01100) after the date when the Contract Time commences to run. Bidder accepts the provisions of the Contract as to liquidated damages in the event of failure to complete the Work on time.

7. See Section 00200, INSTRUCTIONS TO BIDDERS, for a complete list of documents that are made a condition of this Bid.

8. Communications concerning this Bid shall be addressed to: _____
   (Printed Name)

   The address of Bidder indicated above, or

   the following address: _____

   email address: _____

9. The terms used in this Bid which are defined in General Provision Section 10 of the Specifications included as part of the Contract Documents have the meanings assigned to them in the Division 0 and Division 1 Specifications.

   Submitted on _____, 20____.

10. The undersigned Bidder confirms that (1) neither Bidder nor any of Bidder's potential subcontractors or suppliers have pending claims or litigation, arbitration, or other dispute resolution proceedings where the Owner and Bidder or Bidder's potential subcontractors or suppliers are parties; or (2) such claims or proceedings are pending and Bidder is disclosing same through its own writing and/or the writing of Bidder's potential subcontractors or suppliers and submitting same to Owner with this proposal submittal.

If Bidder is:

An Individual

_____

(Individual's Printed Name)

_____

(Individual's Signature)

doing business as: _____

Business address: _____

_____

Phone No.: _____ FAX No. _____ E-Mail _____

A Partnership

_____

(Firm Name)

By: _____

(Signature of General Partner and Printed Name)

Business address: _____

_____

Phone No.: _____ FAX No. _____ E-Mail _____

A Corporation

_____
(Corporation Name)

By:_____ Title:_____
(Signature of person authorized to sign)

_____
(Printed Name)

(Corporate Seal)

Attest:_____
(Signature of Secretary) (Printed Name)

_____
(State of Incorporation)

Business address:_____

_____

Phone No.:_____ FAX No. _____ E-Mail_____

A Joint Venture

_____
(Joint Venture)

By:_____
(Signature of Joint Venturer) (Printed Name)

_____
(Address)

Phone No.:_____ FAX No. _____ E-Mail_____

By:_____
(Signature of Joint Venturer) (Printed Name)

_____
(Address)

Phone No.:_____ FAX No. _____ E-Mail_____

(Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above).

END OF SECTION 00405

DIVISION 0 – SECTION 00410

PROPOSAL GUARANTEE

KNOW ALL MEN BY THESE PRESENT, that we, the undersigned, _____

_____ as Principal, and

_____ as Surety, are

hereby held and firmly bound unto Memphis-Shelby County Airport Authority as Owner, in the sum of _____ for the payment of which, well and truly to be made, the said Principal and Surety hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

Whereas the Principal has submitted to Memphis-Shelby County Airport Authority a certain bid, attached hereto and hereby made a part hereof, to enter into a contract in writing for the Glycol Management Program - Control Facility - Construction, MSCAA Project No. 08-1260-05.

NOW, THEREFORE, if said bid shall be rejected, or in the alternate, if said bid shall be accepted and the Principal shall execute and deliver a contract in accordance with the terms of the Contract Documents and shall furnish a bond for its faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void, otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligation of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the Owner may accept such bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers,

this _____ day of _____, 20_____.

PRINCIPAL

By:_____

_____
(Name and Title)

SURETY

SEAL

By:_____
(Attorney-in-Fact)

END OF SECTION 00410

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DIVISION 0 – SECTION 00445

DISADVANTAGED BUSINESS ENTERPRISE (DBE) REQUIREMENTS

MSCAA operates a federal Disadvantaged Business Enterprise (DBE) Program and a non-federal Business Diversity Development Program (BDDP) to ensure full and fair opportunities in MSCAA contracting for businesses owned by socially and economically disadvantaged individuals. Memphis-Shelby County Airport Authority (MSCAA) administers both programs according to the regulations that apply to the federal program, primarily 49 CFR Part 26. Because the BDDP program applies to contracts involving non-federal funds, not every aspect of 49 CFR Part 26 is relevant to the BDDP program. In most areas, 49 CFR Part 26 will guide our operation of the BDDP including, but not necessarily limited to, rules dealing with certification and counting participation. Only firms that are certified consistent with 49 CFR Part 26 and by the MSCAA or Tennessee Department of Transportation Unified Certification Program (TN UCP), as identified below, will be considered to be certified as a Disadvantaged Business Enterprise.

This section, entitled "Disadvantaged Business Enterprise Requirements" is provided in an effort to assist Respondents. The information contained in this section is not intended to, nor does it, supplement or amend any federal regulation. All Respondents are responsible for compliance with all applicable federal and MSCAA rules and requirements.

It is a requirement that all Respondents providing services for the MSCAA take all reasonable steps to ensure that DBE have a full and fair opportunity to compete for and perform contract work without discrimination on the basis of age, race, sex, color, national origin, creed, religion, sexual orientation or disability. In order to satisfy this requirement, Respondents will be expected to timely submit documentation as identified below and throughout the contract period if selected, and cooperate with MSCAA. Failure to timely submit requested documentation, cooperate with MSCAA or answer inquiries truthfully will be considered a material contract breach and may result in termination.

The following documents must be submitted with your response to this solicitation:

DBE Assurance Statement/Letter of Intent. The Respondent must submit an Assurance Statement for each DBE whose participation the Respondent is counting toward the goal. This may include first, second, third and so on tier subcontractors and the Respondent and all subcontractors between the Respondent and the DBE should sign the Assurance Statement. The Respondent must submit this Assurance Statement on Company Letterhead.

For each Assurance Statement, the Respondent must also provide the written quote or proposal from the DBE or other communication from the DBE upon which the scope of work and dollar value contained in your Assurance Statement is based ("quote/proposal").

For all RFQs using federal monies, the Assurance Statement(s) must still be submitted and list the DBE s to be used and their scope of work, but no dollar amount(s) is entered. Dollar amounts(s) will be submitted by the prevailing Respondent upon completion of the selection process.

All portions of the Assurance Statement must be completed (including the description of work, the estimated contract amount, and the estimated dollar value of DBE participation for counting and goal purposes) before the Assurance Statement is signed by either the DBE or the Respondent. If the DBE's, and if applicable the 2nd/3rd Tier Subcontractor's, signature(s) can be obtained on the completed Assurance Statement before the bid

submission deadline, the Respondent should submit the fully-completed and fully-signed Assurance Statement. If the Respondent submits an Assurance Statement that is completed except for the DBE's, and if applicable, the 2nd/3rd Tier Subcontractor's signature(s) and a quote/proposal from the DBE as described above, the Respondent will be given 24 hours from the bid submission deadline to submit the completed Assurance Statement signed by the DBE and if applicable the 2nd/3rd Tier Subcontractor. Each Assurance Statement submitted during this 24 hour window must conform to the previously submitted Assurance Statement except for DBE signature. These signed Assurance Statements must be submitted pursuant to the same location and time restrictions that applied to the solicitation response and late signed Assurance Statements will only be accepted for good cause as determined solely by MSCAA.

MSCAA reserves the right to ask questions of the Respondent, investigate and require additional information as it determines necessary in its sole discretion to ensure that the regulations and MSCAA's rules are followed as it relates to DBE participation.

Respondent DBE Goals Accomplishment Statement
Submit on Company Letterhead

Information on All Firms that Provide Bids or Quotes

We ask, but do not require, that the Respondent submit the following information with the response to this solicitation:

Voluntary Disclosure of Respondent Data

Definition of Socially and Economically Disadvantaged

The rules that govern eligibility and certification of DBE are found generally at 49 CFR Part 26.5 and 26.61 through 26.73. These rules define a DBE as a for-profit, small business concern which is at least fifty-one percent (51%) owned and controlled by one or more socially and economically disadvantaged individuals. In the case of any publicly owned business, at least fifty-one percent (51%) of the stock must be owned by one or more socially and economically disadvantaged individuals. In addition, the personal net worth of the socially and economically disadvantaged owners of the small business concern must not exceed one million three hundred twenty thousand dollars ($1,320,000).
As defined by 49 CFR, Part 26.5, a socially and economically disadvantaged individual is any individual who is a citizen (or lawfully admitted permanent resident) of the United States and who is –

(1) Any individual who a recipient finds to be a socially and economically disadvantaged individual on a case-by-case basis.

(2) Any individual in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:

(i) "Black Americans" which includes persons having origins in any of the Black racial groups of Africa;

(ii) "Hispanic Americans" which includes persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race;

(iii) "Native Americans" which includes persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians;

(iv) "Asian-Pacific Americans" which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U. S. Trust Territories of the Pacific islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Tuvalu, Nauru, Federated States of Micronesia, or Hong Kong;

(v) "Subcontinent Asian Americans" which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives islands, Nepal or Sri Lanka;

(vi) Women;

(vii) Any additional groups whose members are designated as socially and economically disadvantaged by the SBA, at such time as the SBA designation becomes effective.

DBE Liaison Officer

The DBE Liaison Officer is responsible for developing, implementing, and monitoring the DBE program on a day-to-day basis in coordination with other appropriate officials; carrying out technical assistance for a DBE ; and, disseminating information on available business opportunities so that a DBE is provided an equitable opportunity to bid on MSCAA contracts. The DBE Liaison Officer reports directly to the President of the MSCAA. For questions or information related to the DBE program, contact Joe Claiborne at (901) 922-2556.

DBE Certification

MSCAA certifies all of its DBEs through internal processes. The MSCAA compiles a directory of firms who have met the selection criteria for eligibility as a DBE, including 49 CFR Part 26. You can review the searchable directory of certified firms for MSCAA at our website (https://mscaa.mwdbe.com/). In the right hand column, you will find links to both the TN UCP Directory and the MSCAA DBE/ACDBE Directory. The TN UCP is a cooperative of entities which are recipients of federal funds that have developed a "one-stop shop" for certification throughout the State of Tennessee of which MSCAA is a certifying member. In order to be considered as meeting the DBE goal for a contract, each business wishing to participate as a DBE or a joint venture DBE, must either be:

(1) **certified by the MSCAA or the TN UCP** in accordance with 49 CFR Part 26, or;

(2) **receive affirmation from the MSCAA or the TN UCP** that their certification from another entity is consistent with and acceptable to the MSCAA or the TN UCP.

Persons or entities who consider themselves a DBE but who are not certified by MSCAA, the TN UCP as a DBE, have not received affirmation from the MSCAA or the TN UCP that their certification from another entity is consistent with and acceptable to the MSCAA or the TN UCP will not be considered. Unless a firm meets the criteria above by the time the responses to this solicitation are due, its participation will not be considered as meeting the DBE goal in the solicitation. Each business wishing to participate as a DBE or a joint venture DBE must be certified at the time of bid opening and a current copy of the DBE's certification must be attached to the Assurance Statement.

Identification of Contract Goal and Requirements

As an example: "For this contract, the DBE goal is established as **25%**." In order to be responsive, a Respondent must either meet the goal or make good faith efforts to do so. Good faith efforts are defined in Appendix A to 49 CFR Part 26 and discussed in the following section.

If a Respondent's DBE Assurance Statement proposes a DBE percentage less than the established goal, the Respondent must, at the time of making the response, submit appropriate documentation justifying its submitted DBE percentage. MSCAA reserves the right to request additional documentation or information from Respondent regarding its DBE Assurance Statement and, if applicable, any good faith efforts documentation. If MSCAA enters into a contract based on the Respondent's DBE Goals Accomplishment Statement and documentation, the DBE percentage accepted by MSCAA will become a contractual requirement. If the Respondent's DBE Assurance Statement proposes to attain a DBE percentage higher than the established goal, the established goal will remain the contractual requirement.

Respondents shall not contract with, demand, require or coerce a DBE into any agreement or into the signing of any Assurance Statement or any other document which prohibits the DBE from providing subcontracting quotations or doing business with other Respondents. The DBE shall be free to provide their services to any number of Respondents. To ensure that all obligations under sub-contracts awarded to a DBE are met, the MSCAA will review the agreement between the Respondent and DBE, and Respondent's DBE involvement efforts during the performance of the contract. The Respondent shall bring to the attention of the MSCAA any situation in which regularly scheduled progress payments are not made to a DBE. If, in the opinion of the MSCAA, the Respondent has made significant deviations from the DBE program commitments, it shall be considered a breach of contract.

Good Faith Efforts Statement and Requirements

In order to be responsive, Respondents must either meet the DBE goal or make good faith efforts to meet the goal. Respondents who do not meet the goal must establish adequate good faith efforts by submitting documentation along with the Respondent DBE Goals Accomplishment Statement. This statement should show that they took all necessary and reasonable steps to achieve the DBE goal, which could reasonably be expected to obtain sufficient DBE participation, even if they were not fully successful. The Respondent's DBE Goals Accomplishment Statement and supporting documents should conform to the good faith requirements outlined in Appendix A of 49 CFR Part 26.

The following is a list of types of actions that may be part of a Respondent's efforts to obtain DBE participation and may be included in the Respondent DBE Goals Accomplishment Statement and documentation. This list is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases:

A. Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising and/or written notices) the interest of all certified as a DBE who have the capability to perform the work of the contract. The Respondent must solicit this interest within sufficient time to allow the DBE to respond to the solicitation and take appropriate steps to follow-up initial solicitations to determine interest.

B. Selecting portions of the work to be performed by a DBE in order to increase the likelihood that the goals of the will be achieved.

C. Providing any interested DBE with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.

D. Negotiating in good faith with any interested DBE. It is the Respondent's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those

portions of the work or material needs consistent with the available DBE subcontractors and suppliers, so as to facilitate DBE participation.

E. Not rejecting any DBE as being unqualified without sound reasons based on a thorough investigation of their capabilities.

F. Making efforts to assist any interested DBE in obtaining bonding, lines of credit, or insurance as required by the recipient or contractor.

G. Making efforts to assist any interested DBE in obtaining necessary equipment, supplies, materials, or related assistance or services.

H. Effectively using the services of available minority/women community organizations; minority/women contractors' groups; local, state, and Federal minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of any DBE.

I. Making efforts to identify and assist eligible firms, which are not yet certified by the MSCAA or the TN UCP as a DBE, to obtain certification. These types of efforts will have special weight where it appears that the relevant firms will be certified in time for the execution of the contract.

If a Respondent has not met the DBE goal and submits Respondent DBE Goals Accomplishment Statement and documentation, the Respondent should summarize in detail all good faith efforts taken by the Respondent, including, but not limited to, the activities listed above in A through I, and supporting documentation. While the Respondent should submit documentation to support its good faith efforts at the time of bid submission, MSCAA may ask questions of Respondent or request additional documentation after review of Respondent's DBE Goals Accomplishment Statement and any documentation. In submitting the information required under this section, Respondent understands and agrees that the determination of whether Respondent has met the DBE goal or established good faith efforts to meet the goal is a judgment call that MSCAA will make.

COUNTING THE DBE PARTICIPATION

DBE participation shall be counted toward meeting the DBE goal as outlined in 49 CFR Part 26, especially 26.55. When **the Respondent** completes an Assurance Statement, **the Respondent** must include not only the total value of the work to be performed and/or the materials to be supplied by the DBE but also the total amount of DBE participation that should be counted toward meeting the goal. For example, if a DBE is a regular dealer or supplier of pipe but does not install the pipe, then **the Respondent** can generally count the dollar value spent on the pipe at 60%. This would mean that if the DBE was supplying $100,000 of pipe then the contract amount would be $100,000 but the total amount of DBE participation would be $60,000 for counting and meeting the goal purposes. If you have any questions about counting, we strongly urge you to consult 49 CFR Part 26. The following may be helpful to you in counting DBE participation and in determining which sections of Part 26.55 you need to review in more detail:

(a) When a DBE participates in a contract or subcontract, the provider will count only the value of the work actually performed by the DBE toward the DBE goals. In a construction contract (and other similar contracts), this will include the work performed by the DBE 's own forces and supplies purchased or equipment leased by the DBE as described below, especially (d) (but not supplies or equipment the DBE subcontractor purchases from the prime contractor or its affiliate.) The Respondent will count the entire amount of fees or commissions charged by a DBE for providing a bona fide service toward goals provided that we determine the fees to

be reasonable and not excessive. When a DBE subcontracts part of the work of its contract to another firm, the value of the subcontracted work may be counted toward DBE goals only if the subcontractor is itself a DBE.

(b) When a DBE performs as a participant in a joint venture, the Respondent will count a portion of the total dollar value of the contract equal to the distinct, clearly defined portion of the work of the contract that the DBE performs with its own forces toward DBE goals.

(c) The Respondent will count expenditures to a DBE contractor toward DBE goals only if the DBE is performing a commercially useful function on that contract. A DBE performs a commercially useful function when it is responsible for execution of the work of the contract or subcontract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To determine whether a DBE is performing a commercially useful function, the Respondent will evaluate industry practices, the amount of work subcontracted, whether the amount the firm is to be paid under the contract is commensurate with work it is actually performing, and the DBE credit claimed for its performance of the work, and other relevant factors. The Respondent will determine questions of commercially useful function with regard to trucking companies under 49 CFR Part 26.55 (d).

(d) The Respondent will count expenditures with the DBE for materials or supplies toward DBE goal in the manner described in 49 CFR Part 26.55 (e). Please review Part 26.55(e) carefully. It is important to note that the rule counts expenditures differently based upon whether the DBE is a manufacturer as defined by the rule (normally counted at 100% percent of the cost), a regular dealer as defined by the rule (normally counted at 60% of the cost) or neither of the two (normally counted at the entire amount of fees or commissions, or fees or transportation charges, provided they are reasonable). It is important to note that materials and supplies provided by a DBE that is not a regular dealer in those materials and supplies do not count toward meeting the goal. For example, if the DBE is a regular dealer of piping, the DBE cannot purchase office equipment and then supply that office equipment to the prime and count any portion of the cost of the office equipment toward meeting the goal. Such conduct for DBE counting purposes is prohibited by the rules and is considered to be an impermissible and illegal pass-through.

(e) If a firm is not currently certified as a DBE, in accordance with the standards of subpart D of this part, at the time of the execution of the contract, the Respondent will not count the Firm's participation toward any DBE goals, except as provided for in 49 CFR Part 26.87(i).

(f) The Respondent will not count the dollar value of work performed under a contract with a firm after it has ceased to be certified toward any goals except as provided in 49 CFR Part 26.87(j).

(g) The Respondent will not count the participation of a DBE subcontractor toward a contractor's final compliance with its DBE obligations on a contract until the amount being counted has actually been paid to the DBE.

SANCTIONS FOR NON-COMPLIANCE

In case of the Respondent's non-compliance with DBE and/or BDDP requirements as applicable, including, but not limited to, documentation, cooperation, and truthfulness, MSCAA shall impose such contract sanctions as it may determine to be appropriate. This may include but is not limited to:

a) Withholding of payments to the Respondent under the Contract until the Respondent complies; and/or

b) Cancellation, termination, or suspension of the Contract, in whole or in part; and/or

c) Payment by the Respondent to MSCAA of an amount equal to the difference in the DBE dollar value contracted for and the dollar value achieved in documented DBE participation or any lesser amount or penalty as deemed appropriate by MSCAA, which dollar value shall be considered liquidated damages for failure to perform the requirements of this Contract and for which Respondent and all of its subcontractors agree to be bound.

PROMPT PAYMENT/RETAINAGE

The Respondent agrees to pay each subcontractor under this prime contract for invoices submitted or normal progress payments for work completed satisfactorily or supplies provided satisfactorily pursuant to its contract and no later than fifteen (15) days from the receipt of each payment it receives from the MSCAA.

There is no retainage or other sums allowed to be withheld from progress payments or any other payments and any exceptions to this prompt pay/retainage provision must be requested in writing by Respondent (Contractor) and approved in writing by an MSCAA Vice-President or higher prior to the delay or withholding of any payments under this provision.

Respondent (Contractor) will include the following paragraphs in all contracts and/or agreements related to the work [under this Contract] with subcontractors or suppliers and will require all its subcontractors and suppliers to include this paragraph in any contracts and/or agreements related to the work [under this Contract] with any other third parties and any other lower tier subcontractors or suppliers:

> "It is understood and agreed by all involved parties that payment for work completed satisfactorily or supplies provided satisfactorily will be made to the appropriate party no later than fifteen (15) days from receipt of payment for that work or those supplies.
>
> There is no retainage or other sums allowed to be withheld from progress payments or any other payments and any exceptions to this prompt pay/retainage provision must be requested in writing to MSCAA and approved in writing by an MSCAA Vice-President or higher prior to the delay or withholding of any payments under this provision."

49 CFR Part 26

The Respondent shall carry out the applicable requirements of 49 CFR Part 26 in the award and administration of MSCAA contracts. Respondent agrees to provide all its subcontractors and suppliers and to require all its subcontractors and suppliers on this project to provide a complete copy of the **Disadvantaged Business Enterprise (DBE) Requirements** of this contract to all those who provide supplies or work related to this contract and to require all those providing supplies or work to be bound by these requirements as it relates to their work related to this contract.

Project No. _____

DBE ASSURANCE STATEMENT/LETTER OF INTENT

RESPONDENT:

Name of Firm: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____

DBE:

Name of Firm: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: _____

Description of work to be performed by DBE:

_____

_____

_____

The Respondent is committed to utilizing the above-named DBE for the work described above. The estimated dollar value of this work is $_____, which is _____% the total base bid proposal.

AFFIRMATION

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

By: _____

Signature of DBE and Title Date Name

By: _____

Signature of 2nd/3rd Tier Subcontractor and Title Date Name

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

By: _____

Signature of Respondent and Title Date Name

(SUBMIT ON RESPONDENT'S LETTERHEAD FOR EACH DBE SUBCONTRACTOR.)

Project No. _____

RESPONDENT DBE GOALS ACCOMPLISHMENT STATEMENT

The undersigned Respondent has satisfied the requirements of the bid/proposal specification in the following manner (please complete the appropriate spaces):

_____ The Respondent is committed to a minimum of 25% DBE utilization on this contract.

_____ The Respondent is unable to meet the DBE goal of _____% but is committed to a minimum of _____% DBE utilization on this contract and submits the attached narrative and documentation demonstrating good faith efforts consistent with Appendix A of 49 CFR 26. **The Respondent should attach as many pages as necessary to provide a full and complete narrative and supporting documentation of good faith efforts made. This narrative must be written on company letterhead and signed.**

Please provide an explanation for the percentage quoted above:

Provide an explanation of the dollar value of DBE's participation and compensation and how this has been determined to meet the specific goal requirements of this solicitation in whole or part.

_____

_____

_____

If DBE and company will enter into a Joint Venture, please describe the terms of the relationship and attach a copy of the contract between the parties.

_____

_____

_____

It is the present intent of the Respondent to utilize the specific DBE firms identified in this proposal in the execution of this contract. If for any reason, one or more of the DBE identified here are unable or unwilling to participate, the Respondent will make good faith efforts to replace the DBE with a similar DBE. The Authority DBE Good Faith Procedures are provided in this package and apply to this proposal.

Respondent's Name: _____

State Registration No.: _____

Federal Tax ID No.: _____

By: _____

Signature and Title Date

(SUBMIT THIS PAGE ON RESPONDENT'S LETTERHEAD)

Project No. _____

VOLUNTARY DISCLOSURE OF RESPONDENT DATA

For Title VI Compliance, we ask for **voluntary disclosure** of the following information:

Gender: Male

Female

Race: Caucasian

Black American

Hispanic American

Native American

Subcont. Asian American

Asian-Pacific American

Other (please specify) _____

(DO NOT SUBMIT THIS PAGE ON LETTERHEAD)

Information on All Firms that Provided Bids or Quotes to:

This requirement applies to all firms, regardless of whether they are subs or primes, regardless of the gender or race of their owners, and regardless of whether they are ultimately chosen to participate in the contract. Please list below the name, address, phone number and contact person for every firm that provided you a bid or a quote on this project – even if you ultimately decided not to use the firm in preparing your final bid. The first line should be used for the **prime contractor** on this project. All sections must be completed to the best of your ability.

MSCAA Proj./Bid No.: _____

Name of Firm	Selected? Y/N	Full Address of Firm	Point of Contact	Phone No.	DBE? Y/N	Firm Age	AGRR *
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	
						yrs	

*Footnote: Please enter the letter for the category that best identifies your annual gross revenue.
AGRR =Annual Gross Revenue Ranges:
A = Less than $500,000 **B** = $500,000 - $1 Million **C** = $1 - $2 Million **D** = $2 - $5 Million **E** = Over $5 Million

DIVISION 0 – SECTION 00490

ADDENDA AND MODIFICATIONS

1. INTERPRETATIONS - ADDENDA AND MODIFICATIONS

A. If, during the bidding period Bidder finds discrepancies, ambiguities, omissions, or is in doubt as to meaning or intent of Contract Documents, notify the Owner or Engineer not less than seven (7) days prior to Bid Date. All such necessary clarifications, information, interpretations or amendments shall be answered in the form of written addenda to Drawings and Specifications, and shall be issued simultaneously to all holders of complete sets of Documents.

B. No Addenda will be issued less than two days prior to the Bid opening date. Neither the Owner nor Engineer shall be responsible for oral interpretations or instructions during the bidding period.

C. All Addenda are incorporated by reference into the Contract. Failure of any Bidder or sub-bidder to receive any addenda shall not relieve the Bidder of any obligation with respect to the Bid.

D. All Addenda and Modifications to the Contract Documents shall be inserted and indexed in this location behind this page.

END OF SECTION 00490

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LUMP SUM CONSTRUCTION CONTRACT
FOR
GLYCOL MANAGEMENT PROGRAM – CONTROL FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

MSCAA PROJECT NO. 08-1260-05

THIS LUMP SUM CONSTRUCTION CONTRACT (hereinafter referred to as "Contract") is made and entered into as of _____, between MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY, a body politic and corporate under the laws of Tennessee (hereinafter referred to as **"Owner" or "Sponsor"**) doing business at 2491 Winchester Road, Suite 113, Memphis, Tennessee 38116-3856, and {insert **CONTRACTOR NAME**}, a {insert **LEGAL ENTITY TYPE and STATE**} doing business at {insert Contractor address}, (hereinafter referred to as "**Contractor**," "**Bidder**," or "**Offeror**"). Owner and Contractor may sometimes be referred to herein individually as "Party" or collectively as "Parties."

RECITALS

1. **WHEREAS,** the Owner desires to have constructed certain work in Memphis, Tennessee, more particularly described as Glycol Management Program – Control Facility - Construction, MSCAA Project No. 08-1260-05 (herein referred to as "the Project"); and

2. **WHEREAS,** the Contractor desires to enter into this Contract as an independent contractor and is ready, willing and able to construct the Project in accordance with the terms and subject to the conditions of this Contract; and

3. **WHEREAS,** the "Program Manager" is to act as the Owner's representative, and the Owner will advise the Contractor in writing of the name of the Program Manager; and

4. **WHEREAS**, the "Engineer" is the Owner's representative with responsibility for design of the technical specifications, and the Owner will advise the Contractor in writing of the name of the Engineer; and

NOW, THEREFORE, in consideration of good and valuable consideration, received or to be received, the sufficiency of which the Parties acknowledge, the Parties agree as follows:

ARTICLE 1

SCOPE OF THE WORK AND TERM OF AGREEMENT

Section 1.01. Scope of the Work. The general scope of the work is more particularly described in Exhibit A, which is attached hereto and incorporated herein by reference. Contractor agrees that the Project shall be constructed in accordance with the terms of this Contract and the "Contract Documents" as defined in Article 2 of this Contract. The term "Work" includes, but is not limited to, all labor, materials, supplies, tools, equipment and services necessary to construct the Project as described in the Contract Documents, whether or not all materials and equipment are incorporated or will be incorporated in the Project; and all Work deemed necessary to fully close the Project including demobilization.

.Section 1.02. Term of Agreement and Completion. The term of this Agreement shall commence upon Owner's issuance of the Notice to Proceed pursuant to Section 3.01 and shall continue until the Work is completed in accordance with the Contract Documents, unless earlier terminated by the provisions set forth in Section 23 of this Agreement.

ARTICLE 2

CONTRACT DOCUMENTS

Section 2.01. Definition. The "Contract Documents" include this Contract, the Legal Notice, Instructions to Bidders, the Proposal, the Proposal Guaranty, the drawings and the specifications, the Federal Aviation Authority ("FAA") General Provisions ("GP"), all addenda, and exhibits or modifications to any of them, issued prior to or after execution of this Contract. The Contract Documents are more particularly described in Exhibit B, which is attached hereto and incorporated herein by reference. As used in this Contract, a "modification" is either:

(a) a written and signed Contract Amendment to this Contract; or

(b) an accepted Request for Proposal ("RFP"); or

(c) an Engineer's Supplemental Instruction ("ESI"); or

(d) a Construction Change Directive (as defined in Section 9.02(c) of this Contract).

Section 2.02. Intent of Contract Documents. The intent of the Contract Documents is to include all design, architecture and engineering, except as otherwise expressly provided in the Contract Documents, materials, appliances, labor and services of every kind necessary for the proper execution of the Work and the terms and conditions of payment for the Work. The Contract Documents are to be considered as one document, and whatever is called for by any one of the Contract Documents shall be as binding as if called for by all.

Section 2.03. Coordination of the Contract, Plans and Specifications. This Contract, the plans, specifications, and all referenced standards cited in the Contract Documents are essential parts of the Contract requirements. A requirement occurring in one of the Contract Documents is as binding as though occurring in all. They are intended to be complementary and used to describe and provide for a complete project. In case of dimensional discrepancies, calculated dimensions will govern over scaled dimensions. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

(a) This Contract.

(b) The Addenda, with those of later date having precedence over those of earlier date.

(c) The Technical Specifications.

(d) The Plans.

(e) Cited standards for materials or testing and cited FAA General Provisions and advisory circulars.

Section 2.04. Errors in Contract Documents. Prior to commencing the Work, the Contractor shall review all of the Contract Documents for the purpose of identifying any error, inconsistency, omission, discrepancy or variance that may be contained therein. If the Contractor finds any error, inconsistency, omission, discrepancy or variance in the Contract Documents, it shall notify the Owner at least ten (10) days before beginning the affected portion of the Work. The Owner shall make any correction, interpretation or clarification promptly, basing its decision on the intent of the Contract Documents. Failure of the Contractor to timely notify the Owner of any such error, inconsistency, discrepancy or variance within the time provided by this paragraph shall bar the Contractor from making any claim for additional time or compensation caused by any such error, inconsistency, discrepancy or variance even if the error, inconsistency, discrepancy or variance caused the Contractor to incur additional expense or time of performance.

ARTICLE 3

PROGRESS OF THE WORK

Section 3.01. Commencement and Completion. The Contractor shall commence the Work upon receipt of the written Notice to Proceed, as defined in Section 01100 of the Specifications, from the Owner and shall achieve substantial

completion of the Work, as defined in Section 01100 of the Specifications. The Contractor warrants that it will deliver the Project to the Owner free from any and all mechanics' liens or other encumbrances. Contractor further agrees to promptly (which is defined for purposes of this paragraph as no more than three (3) days from receipt of any lien or other notice) notify the Owner of the existence of any and all mechanics' liens filed by any subcontractors, materialmen, suppliers or sub-subcontractors. If any mechanics' liens are filed, Contractor shall, at its expense, bond off any such mechanics' liens within three (3) days from receipt of a written request of Owner to do so. Time is of the essence, and the substantial completion date may be altered only as provided in this Contract. Substantial completion shall occur when the Work is sufficiently complete in accordance with the Contract Documents, so the Owner can occupy or utilize the Work for its intended use, and when only minor punch list work remains to be done and a certificate of occupancy has been issued. The Owner will, upon written request of the Contractor, issue a certificate establishing the substantial completion date at any time after substantial completion has occurred.

Section 3.02. The Progress Schedule. Contractor shall fully comply with the requirements for scheduling the Work as set forth in Section 01100 and Section 01320 of the Specifications. The Owner reserves the right to reschedule the Work, or the sequence of the activities of the Contractor, for no additional compensation should Owner deem such rescheduling to be in its best interest. At least fifteen (15) days prior to the due date of the first payment to be made hereunder by the Owner and thereafter on a monthly basis, the Contractor shall submit to the Owner a cash flow projection depicting the projected monthly cash flow for the entire Project.

Section 3.03. Extension of Substantial or Final Completion Date.

(a) Except as otherwise expressly provided herein, the "Substantial Completion Date" or "Final Completion Date" shall be extended only for such number of calendar days that the Work is actually delayed by a casualty, a fire, or a Contract Amendment (hereinafter referred to as "Excusable Delays"). No extensions to the Substantial Completion Date shall be granted due to the negligence or fault of the Contractor or its subcontractors, non-availability of materials or non-availability of labor. No extension to the Substantial Completion Date shall be granted for the period of time during a delay in the performance of the Work which is caused in part by the Owner, the Engineer , and in part by the Contractor or one for whom the Contractor is responsible ("Concurrent Delay"). A request for a time extension based upon inclement weather shall be governed by the provisions of Section 01320 (3.05) of the Specifications.

(b) In order to obtain an extension of the Final Completion Date or the Substantial Completion Date due to an Excusable Delay, the Contractor in each instance shall give written notice to the Owner within seven (7) days after the occurrence of each Excusable Delay. If the Contractor fails to issue written notice to the Owner, its right to an extension, if any, will be deemed waived. The Owner shall render a written decision, which shall be made in good faith, granting or refusing the request of the Contractor for an extension within a reasonable time after receipt of the request for a time extension. If a Contract Amendment is agreed to by the Contractor and Owner, any extension of the Substantial Completion Date caused by the Contract Amendment work must be stated in the Contract Amendment and the Contractor will be barred from later seeking an extension to the Substantial Completion Date or Final Completion Date because of the Contract Amendment work. No extension to the Substantial Completion Date or the Final Completion Date shall be granted due to the aggregate number of Contract Amendments.

Section 3.04. No Damage for Delay. Contractor agrees to perform the Work and to require the subcontractors to perform the Work in a timely and proper method so as to meet the dates reflected on the progress schedule. In the event that the Contractor is delayed in the performance of the Work through no fault of the Contractor or its subcontractors, and for causes set forth in Section 3.03(a), and defined therein as Excusable Delay, then the Contractor may seek a time extension in accordance with the provisions of Section 3.03(b). Contractor agrees that such time extension is its sole and exclusive remedy for any damages regardless of the cause of such delays. Contractors also agrees that the Owner shall not be liable for any other monetary damages sustained by Contractor for acceleration, disruption, inefficiencies, suspension or resequencing of the Work or any other damages related to the progress schedule regardless of the cause of such damages. The Owner shall not be liable for consequential damages of any nature for any reason at any time.

Section 3.05. Liquidated Damages. Per Section 01100 of the Specifications, liquidated damages will be assessed for the Project. The Contractor shall proceed with the Work at such rate of progress to ensure full completion within the specified duration.

ARTICLE 4

PAYMENT

Section 4.01. Lump Sum Price. The Owner and Contractor agree that the Contractor shall be paid the following price **Thousand and 00/100 Dollars ($000.00)** ("Lump Sum Price") for all of the Work and other obligations to be performed by the Contractor in the base bids. The Lump Sum Price shall include all profit and overhead, including without limitation field overhead, general conditions and home office overhead of the Contractor. The Lump Sum Price also includes all allowances specified in the Contract Documents.

Section 4.02. Payment Procedures. As Work proceeds under the Agreement, payments ("Progress Payments") shall be made by the Owner to the Contractor in accordance with the following procedure:

(a) By the 1st day of each calendar month during the performance of the Work, the Contractor shall submit to the Owner an Application and Certificate for Payment, based on the Work completed during the previous month ("previous month" being defined for this Section only as the second calendar day of the prior month through the first calendar day of the current month), using a form approved by the Owner. Contractor shall not be paid any amounts exceeding the Lump Sum Price set forth in Section 4.01 of this Contract, unless modified by a properly executed written Contract Amendment in accordance with the provisions of Article 9 of this Contract.

(b) Each Application and Certificate for Payment shall be accompanied by: (1) lien waivers of the Contractor conditioned upon payment by the Owner of the amount sought in the Application; (2) other documentation as may be requested by the Owner for the proper review of the Application and Certificate for Payment; (3) a list of current subcontractors, sub-subcontractors and material suppliers; (4) the Business Diversity Monthly Compliance Reports; and (5) all documents required by the Owner Controlled Insurance Program ("OCIP") Manual, as applicable.

(c) The Owner or Engineer shall promptly review each Application and Certificate for Payment and recommend for approval such amount as is properly due under the Contract Documents.

(d) Payments by the Owner shall be made within thirty (30) days from the date on which an Application and Certificate for Payment has been submitted and approved by the Owner or the next working day if the thirtieth day is a Saturday, Sunday or holiday.

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Section 4.03. Mobilization. The work which is conducted in preparation for the construction activities, which includes but is not limited to, movement of personnel, equipment, stockpiles, supplies to the project site, (all as more particularly described in Article 3.01 of Section 01100 of the Specifications) shall be designated as "Mobilization." The Mobilization lump sum amount for this Contract shall be **Five Hundred Thousand and 00/100 Dollars ($500,000.00)** which is a fixed amount that shall not change for the Term of the Contract.

Section 4.04. Demobilization. The activities which are conducted by the Contractor in order to complete the work and conduct any closeout items, which includes but is not limited to, removal of personnel, equipment, Contractor owned stockpiles, supplies and incidentals from the project site, (all as more particularly described in Article 3.01 of Section 01100 of the Specifications) shall be designated as "Demobilization." The Demobilization lump sum amount for this Agreement shall be **Three Hundred Thousand and 00/100 Dollars ($300,000.00)**, which is a fixed amount and shall not change for the Term of the Contract.

Section 4.05. Payment for Material Stored On-Site.

(a) Payment for the actual unit cost of materials suitably stored on the site of the Work ("Work Site") and intended for incorporation in the Work will be made by the Owner to the Contractor subject to the provisions of Section 4.02 of this Contract, Section 90-07 of the FAA General Provisions, and the following conditions:

(1) The Contractor shall furnish supporting evidence satisfactory to the Owner evidencing the cost of the materials and shipment to the Work Site.

(2) The materials shall not be stored on the Work Site for more than ninety (90) calendar days before they are installed without the written consent of the Owner.

(3) The materials shall be stored on the Work Site in accordance with applicable recommendations of the manufacturer and the instructions of the Owner.

(4) A representative of the Owner or Engineer may inspect and inventory any stored materials.

(b) Payment will not be made for materials stored away from the Work Site without the written consent of Owner. In the event that the Owner consents to payment for materials stored off-site, such payment shall be conditioned upon submission by the Contractor of bills of sale or such other documentation satisfactory to the Owner to establish the title of the Owner to such materials or equipment, and the submission of satisfactory insurance certificates for the stored materials.

(c) Notwithstanding any provision herein to the contrary, if payments are to be made on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the Work Site, such payments shall be conditioned upon submission by the Contractor of bills of sale or such other documentation satisfactory to the Owner to establish the title of the Owner to such materials or equipment, and the submission of satisfactory insurance certificates for the stored materials to protect the interest of the Owner.

(d) Regardless of ownership or insurance, the Contractor shall remain the guardian and protector of all materials and equipment stored or incorporated into the Work.

Section 4.06. Use of Payments. The Contractor shall use all sums paid to it pursuant to this Contract for the performance of the Work in accordance with the Contract Documents. Upon the request of the Owner or Engineer, the Contractor shall furnish satisfactory proof of payment, including, but not limited to, partial release of liens and the Business Diversity Monthly Compliance Report, as to the disposition of any monies paid to the Contractor by the Owner.

Section 4.07. **Payment Not a Waiver.** Neither the approval or making of any payment to the Contractor, nor the partial or entire use or occupancy of the Work by the Owner, shall be deemed an acceptance of any portion of the Work.

Section 4.08. **Final Payment.**

(a) "Final Payment," by the Owner shall constitute a waiver of all claims by the Owner for performance of the Work except for claims of the Owner arising from unsettled liens, incomplete or defective workmanship, defective materials, failure to perform in accordance with the progress schedule, or for the breach of any guarantees of warranties provided or to be provided by the Contractor under this Contract. Acceptance of the Final Payment by the Contractor shall constitute a waiver and release of any and all claims which the Contractor may then have or in the future have against the Owner or the Engineer arising from the Work or this Contract.

(b) Final Acceptance of the Work shall occur only after all Work (including punch list items) provided for in the Contract Documents has been finally completed and accepted in writing by the Owner, and only after the Contractor has provided the Owner with instructions and operating manuals, parts lists, "record" drawings and all other items required by the Contract Documents.

(c) Within thirty (30) days after "Final Acceptance" of the Work, the Final Payment of amounts found properly due under the Contract Documents shall be paid to the Contractor.

(d) Final Payment shall not become due until the Contractor submits to the Owner the following:

(1) An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or its property might in any way be responsible, have been paid or otherwise satisfied; and

(2) A consent of surety to Final Payment; and

(3) Other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of liens arising out of the Work, to the extent and in such form as may be designated by the Owner or Engineer; and

(4) Any documents required by Article 6 of this Contract.

(e) The Owner shall issue a "Certificate of Final Completion" when, in its sole discretion, the Project has been completed and all conditions required by this Section 4.07 have been complied with by Contractor.

Section 4.09. **The Right of Owner to Withhold Payment.** The Owner may withhold or, on account of subsequent evidence, nullify, the whole or part of any Progress Payment, including the Final Payment, to such extent as may be necessary to reasonably protect itself from any of the following:

(a) unacceptable work as further described in Section 50-10 of the FAA General Provisions; or

(b) third-party claims filed or reasonable evidence indicating probable filing of such claims; or

(c) reasonable doubt that the Work will be substantially completed by the Substantial Completion Date; or

(d) failure of the Contractor to make payments properly to subcontractors or for equipment, materials, services or labor; or

(e) reasonable evidence of fraud, over-billing or overpayment; or

(f) failure of the Contractor to perform the Work in accordance with the Contract Documents; or

(g) a reasonable doubt that the Work can be completed for the unpaid balance of the Lump Sum Price; or

(h) damage to the Owner, or to another contractor, subcontractor or sub-subcontractor caused by the Contractor; or

(i) failure to provide certified payroll records; or

(j) failure to provide any documents required by the Owner Controlled Insurance Program (OCIP); or

(k) failure to keep the record drawings current each month in accordance with Article 6 of this Contract.

ARTICLE 5

EQUIPMENT AND MATERIALS

Section 5.01. Materials Provided by Contractor.

(a) Unless otherwise provided in the Contract Documents, the Contractor shall provide all equipment, materials, labor, services, water, and power to the Work Site, as well as all tools, equipment, lights, transportation, and other facilities necessary for the performance of the Work.

(b) All equipment, machinery, material, and articles incorporated in the Work shall be new and unused unless otherwise specified in the Contract Documents. When not specified in detail in the Contract Documents, the equipment, machinery, material, and articles incorporated in the Work shall be of the most suitable grade and quality for the purpose intended.

Section 5.02. Type of Equipment Used.

(a) When any equipment, machinery, material, or article is referred to by trade name, make, or catalog number followed by the words "or equal," the reference shall be regarded as establishing the minimum standard of quality and performance required and shall not be construed as limiting competition. The Contractor may, with the prior written approval of the Owner, use other equipment, machinery, materials, or articles which are at least equal in quality and performance to that named in the Contract Documents; provided, however, that in no event shall such approval be construed as a waiver of the right of the Owner to require equipment, machinery, materials, or articles which conform to the standard of quality and performance established by reference to the trade name, make, or catalog number of the equipment, machinery, materials, or articles for which the substitution has been approved. Any cost of redesign and additional expense resulting from the substitution shall be at the sole expense of the Contractor.

(b) The name of the manufacturer, model number, and other identifying information respecting the performance, capacity, nature, and rating of equipment, machinery, materials, and articles proposed in substitution of those specified in the Contract Documents shall be submitted to the Owner in sufficient time to avoid delays in the Work.

Section 5.03. Non-Conforming Materials.

(a) Equipment, machinery, materials or articles installed or used in the Work which do not comply with the requirements of the Contract Documents, and which have not been previously approved in writing by the Owner shall be installed or used at the risk of the Contractor of subsequent rejection by the Owner.

(b) The Contractor shall be fully and solely responsible for quality control for all equipment, machinery, materials or articles used in the performance of the Work.

Section 5.04. Owner Furnishing Equipment or Fixtures. The Owner may directly furnish any and all of the equipment or fixtures required for the Project. In the event the Owner elects to do so, the Lump Sum Price shall be reduced by the amount which was to be charged by Contractor for such equipment or fixtures as set forth and included in the Contract Documents. A Contract Amendment reducing the Lump Sum Price for that item of Work shall be executed by Owner and Contractor to reflect a reduction in the Lump Sum Price for that item of Work and that the Owner is to furnish the equipment or fixtures. The Contractor shall assume responsibility for and be fully responsible for the care, custody, and control of all Owner furnished equipment or fixtures after said equipment or fixtures arrives on the Work Site or in any approved offsite storage facility, as set forth in Section 60-08 of the FAA's General Provisions.

ARTICLE 6

RECORD DRAWINGS AND DATA

Section 6.01. Record Drawings. A complete set of drawings shall be maintained by the Contractor at the Work Site for the purpose of accurately indicating all record conditions. The drawings shall be kept up-to-date and marked each day to show all changes and variations and each entry shall be dated and verified as made. At the completion of the Work and prior to Final Payment, a complete set of marked record drawings shall be furnished by the Contractor to the Owner. If the record drawings are not kept current each month, the Owner shall have no obligation to pay the Contractor until the record drawings are made current.

Section 6.02. Operation and Maintenance Data.

(a) The Contractor shall furnish complete and necessary data for the operation, repair, and maintenance of each operating component of the Work (hereinafter referred to as "the Data"). The Data shall include prints of shop drawings, "as-installed" conditions, sources of equipment and principal materials, specified tests and performance data, repair and maintenance data, lubrication instructions and recommendations, parts lists, and other catalog data or information required to operate and maintain any part of the Work. Care shall be taken to include all pertinent data and to exclude inapplicable or duplicative information.

(b) Prior to Final Payment, a set of Data shall be furnished to the Owner in an electronic PDF format. In addition, three (3) complete sets of the Data in a form directed by the Owner shall be provided to the Owner, indexed alphabetically by components, grouped together and securely bound in a durable folder or binder that is labeled and indexed to show its contents.

(c) Installation information for all machinery and equipment also shall be kept on the site of the Work during construction but used or marked prints or data sheets are not to be used in assembling the final maintenance and operating manuals described in paragraph (b) of this Section 6.02.

(d) Operations and maintenance demonstrations by the manufacturer of all machinery and equipment shall be complete in all respects and shall specify the appropriate and inappropriate uses of the machinery and equipment.

Section 6.03. Information from Suppliers. The Contractor shall make it a requirement or condition of purchase from its suppliers of equipment and/or materials: (1) to furnish complete and adequate operating and maintenance data pertaining to their equipment and/or materials; (2) to assign to the Owner any warranty, express or implied, furnished by the manufacturer of the equipment and/or materials; and, (3) to assign to the Owner any customary maintenance or repair

service, spare parts supply service, or personnel support service furnished by the manufacturer of the equipment and/or materials. If the terms and conditions of any warranty, maintenance or repair service, spare parts supply service, or personnel support service furnished by manufacturer of the equipment and/or materials are negotiable, they shall be negotiated by the Owner and the manufacturer.

ARTICLE 7

SUBCONTRACTS

Section 7.01. Definition.

(a) As used in the Contract Documents, a "subcontractor" is a person or organization that has a contract with the Contractor to perform any portion of the Work or to furnish any equipment or materials to the Project.

(b) As used in the Contract Documents, a "sub-subcontractor" is a person or organization that has a contract with a subcontractor to perform any portion of the Work or to furnish any equipment or materials to the Project.

Section 7.02. No Contractual Relationship with Owner. Nothing contained in the Contract Documents or otherwise shall create any contractual relationship between the Owner and any subcontractor or sub-subcontractor, and no subcontract or sub-subcontract shall relieve the Contractor of its responsibilities and obligations should any subcontractor or sub-subcontractor fail to perform its work in a satisfactory manner. The Contractor agrees to be as fully responsible to the Owner for the acts and omissions of its subcontractors and their sub-subcontractors and of persons either directly or indirectly employed by them as it is for the acts and omissions of persons directly employed by Contractor.

Section 7.03. Award of Subcontracts.

(a) Unless the Owner gives its written approval to Contractor, the Contractor shall not enter into a subcontract or purchase order with any entity that is a party in any litigation, arbitration, or other dispute resolution proceeding with the Owner. The Contractor shall request written confirmation from any potential subcontractor or supplier prior to the execution of any subcontract or purchase order that there is no pending litigation, arbitration, or other dispute resolution proceeding where the Owner and the potential subcontractor or supplier are parties. Such written confirmation shall be sent to the Owner within seven (7) days from the receipt of bids.

(b) If the Owner refuses to accept any subcontractor or material supplier (or sub-subcontractor) or person or organization because of such pending litigation, arbitration, or other dispute resolution proceeding, the Contractor shall submit an acceptable substitute at no additional cost to Owner.

Section 7.04. Change of Subcontractors. The Owner may require a change of any subcontractor. The Lump Sum Price shall be adjusted accordingly due to the Owner's requiring a change of any subcontractor, sub-subcontractor, or material supplier previously approved in writing by the Owner, unless the change was required because the subcontractor, sub-subcontractor or material supplier was unable to timely or properly perform its work in accordance with the Contract Documents.

Section 7.05. No Substitution of Subcontractors. The Contractor shall not make any substitution for any subcontractor nor allow the substitution of any sub-subcontractor who has been accepted by the Owner, unless the substitution is required and previously approved by the Owner. Acceptable reasons for substitution (other than where required by the Owner) shall be limited to the following:

(a) Inability of the subcontractor or sub-subcontractor to provide bonds, if required; or

(b) Failure of the subcontractor or sub-subcontractor to perform according to approved schedules or other provisions of the Contract Documents; or

(c) Other reasons which would reasonably render the subcontractor or sub-subcontractor unable to perform its work according to the Contract Documents as evidenced in writing by the Contractor.

Section 7.06. Subcontract Terms. All portions of the Work performed by a subcontractor or sub-subcontractor shall be pursuant to an appropriate agreement between the Contractor and the subcontractor (and where appropriate between subcontractors and sub-subcontractors) which shall contain provisions that:

(a) Preserve and protect the rights of the Owner under the Contract Documents, including, but not limited to, the obligation to indemnify the Owner as set forth in Article 21 of this Contract with respect to the portion of the Work to be performed under the subcontract (or sub-subcontract) so that the subcontracting will not prejudice such rights; and

(b) Require that such Work be performed in accordance with the requirements of the Contract Documents; and

(c) Require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party; and

(d) Require that all requests for additional compensation, extensions of time or otherwise with respect to subcontracted portions of the Work be submitted to the Contractor (via any subcontractor or sub-subcontractor where appropriate) in sufficient time so that the Contractor may comply in the manner provided in the Contract Documents for like requests by the Contractor upon the Owner; and

(e) Name the Owner as an additional insured under all applicable insurance policies; and

(f) Require compliance with the federal Disadvantaged Business Enterprise ("DBE") requirements, including, but not limited to, non-discrimination and prompt pay provision.

Section 7.07. Subcontractor Relations Requirements. By appropriate written agreement, the Contractor shall require each subcontractor, to the extent of the Work to be performed by the subcontractor, to be bound by the obligations, terms and conditions of this Contract and the Contract Documents, and to assume toward the Contractor all the obligations, terms, conditions and responsibilities which the Contractor, by this Contract and the Contract Documents, assumes toward the Owner and the Engineer. Each subcontract agreement shall preserve and protect the rights of the Owner and the Engineer under this Contract and the Contract Documents with respect to the Work to be performed by the subcontractor so that subcontracting thereof will not prejudice the rights of the Owner or the Engineer. The Contractor shall require each subcontractor to enter into similar agreement with sub-subcontractors. The Contractor shall make available to each proposed subcontractor, prior to the execution of the subcontract agreement, copies of this Contract and the Contract Documents to which the subcontractor will be bound. Subcontracts shall similarly make copies of this Contract and the Contract Documents available to their respective proposed sub-subcontractors.

ARTICLE 8

PAYMENT TO SUBCONTRACTORS

Section 8.01. Payments to Subcontractors from the Contractor. The Contractor shall pay each subcontractor an amount equal to the percentage of completion allowed to the Contractor on account of the work of each subcontractor. The Contractor shall also require each subcontractor to make similar payments to its sub-subcontractors.

Section 8.02. Withholding of Payment by the Owner. If the Owner withholds monies for any cause which is the fault of the Contractor and/or the fault of a particular subcontractor, the Contractor shall pay all other subcontractors, in accordance with the terms of their applicable subcontract, if not in conflict with this Contract and applicable law, any time after the progress payment by the Owner should otherwise have been issued, for its Work to the extent completed. Notwithstanding this Section 8.02, Contractor may withhold funds from any subcontractor that is not performing its work in accordance with the Contract Documents.

Section 8.03. Independent Obligation to Pay. The obligation of the Contractor to pay its subcontractors (and their obligation to pay sub-subcontractors) is an independent obligation from the obligation of the Owner to make payment to the Contractor. The Owner shall have no obligation to pay or to see to the payment of any monies to any subcontractor or sub-subcontractor. The provisions of this Contract are solely intended for the benefit of the Owner and Contractor and not for any other person. Nothing in this Contract is intended to create any third party rights against the Owner.

Section 8.04. **Payments to Sub-Subcontractors**. This Contract is governed by federal prompt pay provisions

where applicable and as set forth in Exhibit "E" to this Contract. To the extent that Tennessee statutes are not superseded by applicable federal statutes in this area, state statutes also will apply. Contractor agrees to require each of its subcontractors (1) to pay their subcontractors for invoices submitted or normal progress payments for work completed satisfactorily pursuant to its contract with each subcontractor and (2) to make such payments to their respective subcontractors no later than ten (10) days after any such subcontractors receive payment from the prime contractor or their respective subcontractor, as applicable.

ARTICLE 9

CHANGES

Section 9.01. Changes in the Work.

(a) The Owner, without invalidating this Contract, may order extra work or make changes by altering, adding to or deducting from the Work by executing a Contract Amendment or a Construction Change Directive in a form provided by the Owner or Engineer. All Work performed pursuant to a valid Contract Amendment or a Construction Change Directive shall be performed under the conditions of this Contract and the Contract Documents.

(b) The Owner shall have authority to make changes in the Work not involving extra cost, not involving an extension to the Substantial Completion Date, and not inconsistent with the purposes of the Work, but otherwise, no extra Work or change in the Work shall be made unless pursuant to a Contract Amendment or a Construction Change Directive and no claim by Contractor for additional cost or fee or any extension of the Substantial Completion Date shall be valid unless so ordered in a written Contract Amendment or a Construction Change Directive.

(c) Engineer's Supplemental Instructions (ESI) are written instruments prepared by the Owner or Engineer to issue additional instructions or interpretations or to order changes in the Work not involving extra costs or fees, or any extension of the scheduled Substantial Completion Date. Contractor shall give prompt written notice to Owner if it believes that the contents of an ESI require extra costs or fees or affect the Substantial Completion Date.

Section 9.02. Construction Change Directive.

(a) A Construction Change Directive is a written order prepared by the Owner, Program Manager, or Engineer and signed by the Owner, Engineer or Program Manager directing a change in the Work and stating a proposed basis for adjustment, if any, in the Lump Sum Price or the Substantial Completion Date, or both. The Owner may, by Construction Change Directive, without invalidating this Contract, order changes in the Work consisting of additions, deletions, or other revisions.

(b) A Construction Change Directive shall be used in the absence of an agreement on the terms of a Contract Amendment.

(c) If the Construction Change Directive provides for an adjustment to the Lump Sum Price, the adjustment shall be based on one of the following methods:

(1) Mutual acceptance of a lump sum properly itemized and supported by sufficient documentation to permit evaluation; or

(2) Unit prices stated in the Contract Documents or subsequently agreed upon; or

(3) Cost to be determined in a manner agreed upon by the Parties and a mutually acceptable fixed or percentage fee; or

(4) As provided in paragraph (f) of this Section 9.02.

(d) Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Owner of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Lump Sum Price or the Substantial Completion Date.

(e) A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment in the Lump Sum Price, the Substantial Completion Date or the method of determining the adjustment. Such agreement shall be effective immediately and shall be recorded as a Contract Amendment.

(f) If the Contractor does not respond promptly or disagrees with the method for adjustment in the Lump Sum Price, the method and the adjustment shall be determined by the Owner on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Lump Sum Price, a reasonable allowance for overhead and profit. In such case, the Contractor shall keep and present, in such form as the Owner may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purpose of this paragraph shall be limited to the following:

(1) The actual cost for labor, including social security and unemployment insurance, fringe benefits required by agreement, and workers' or workmen's compensation insurance; and/or

(2) The actual cost of materials, supplies, machinery, and equipment, including cost of transportation, whether incorporated or consumed; and/or

(3) The actual cost of subcontractors and sub-subcontractors; and/or

(4) The actual cost of premiums for all bonds and insurance, permit fees and sales, use or similar taxes related to the Work; and/or

(5) The actual additional costs of supervision and field office personnel, if any, directly attributable to the change.

(g) Pending final determination of cost to the Owner, amounts not in dispute may be included in Certificates and Applications for Payment. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Lump Sum Price shall be actual net cost, as confirmed by the Owner. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be calculated on the basis of net increase, if any, with respect to that change.

Section 9.03. Contract Amendment Procedure. If the Owner desires extra Work or changes in the Work, the Owner shall submit a Request for Proposal ("RFP") to the Contractor. The Contractor shall furnish to the Owner a statement setting forth in detail the proposal of the Contractor for performing the extra Work or changes and the effect of the extra Work or changes, if any, in the Lump Sum Price and the Substantial Completion Date attributable to the extra Work or changes set forth in the request of the Owner. If the Owner approves in writing the proposal of the Contractor, a Contract Amendment in the form provided by the Owner shall be executed by the Parties and the Lump Sum Price and the Substantial Completion Date shall be adjusted accordingly. In preparing Lump Sum quotes in response to an RFP, the Contractor shall prepare a cost breakdown that provides sufficient detail for the Owner or Engineer to determine that the quoted costs are reasonable and allowable and to verify that markups are properly calculated according to the terms of this Contract.

Section 9.04. Changes in the Lump Sum Price. Any increase or decrease in the Lump Sum Price attributable to a Contract Amendment performed by the Contractor or any of its subcontractors shall be governed by the provisions of Section 90-05 of the FAA's General Provisions.

Section 9.05. Time and Materials. In the event that the Owner and the Contractor cannot agree on the amount or time extension, if any due, to the Contractor for a Contract Amendment, the Owner may, in writing, direct the Contractor to proceed with the performance of such Work. The Contractor agrees to comply with any such directive issued by the Owner. If any additional compensation is due to the Contractor as a result of a directive, it will be calculated pursuant to the provisions of Section 150-90 of the FAA General Provisions Addendum.

Section 9.06. Unconditional Obligation to Proceed. Notwithstanding anything herein to the contrary, the Contractor will proceed with the Work so as to complete the Work on or before the Substantial Completion Date even if it has a dispute with the Owner concerning a Construction Contract Amendment, a Construction Change Directive or any extension of time which is or could be due to the Contractor pursuant to a Contract Amendment, a Construction Change Directive or otherwise.

Section 9.07. Request for Additional Compensation. If for any reason the Contractor believes that additional compensation is due for work not clearly provided for in the Contract Documents, the Contractor shall provide written notice to the Owner at least three (3) days before beginning the work which is not clearly provided for in the Contract Documents. If such notification is not given, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor shall not in any way be construed as proving or substantiating the validity of the request for additional compensation. When the work, which is the basis for the Contractor's request for additional compensation, has been completed, the Contractor shall, within ten (10) calendar days, submit evidence of costs incurred by the Contractor and a narrative which provides the basis for the request for additional compensation.

ARTICLE 10

THE UNDERSTANDING OF THE CONTRACTOR

Section 10.01. Examination of Work Site. The Contractor acknowledges that it has, by careful examination, satisfied itself as to the nature and location of the Work, the conformation of the ground conditions, the character, quality and quantity of the materials, equipment, supplies, machinery, and facilities needed preliminary to and during the performance of the Work, the general and local conditions, and all other matters which can in any way affect the Work.

Section 10.02. Sufficiency of Contract Documents and Representations of Contractor.

(a) The Contractor acknowledges that the Contract Documents are sufficient to enable it to determine the cost of all of the Work and that the Work can be completed in accordance with the Contract Documents for the Lump Sum Price.

(b) The Contractor acknowledges that any observed errors, discrepancies, omissions, ambiguities, or conflicts in the Contract Documents will be brought to the attention of the Owner, as set forth in Section 2.04 of this Contract, and in a timely manner in order to ensure substantial completion of the Work by the Substantial Completion Date. The Contractor shall be responsible for using its best efforts to discover and observe errors, discrepancies, omissions, ambiguities, or conflicts in the Contract Documents. In addition, the Contractor acknowledges that the Owner has not made nor shall it be deemed to have made any warranties, guarantees, or representations of any kind whatsoever regarding the sufficiency of the Contract Documents or any conditions relating to the Work.

(c) Contractor represents that it has reviewed and checked all information and data shown or indicated on the Contract Documents with respect to existing underground use facilities at or contiguous to the Work Site and, subject to the provisions of Section 10.03 of this Contract, assumes responsibility for the accurate location of said underground use facilities. No additional examinations, investigations, explorations, tests, reports, studies or similar information or data in respect of said underground use facilities are or will be required by Contractor in order to perform and furnish the Work for the Lump Sum Price and substantially complete the Work by the Substantial Completion Date. However, notwithstanding anything herein to the contrary, the Contractor may, at its sole expense after receiving written permission from the Owner, and subject to any limitations specified by the Owner or Engineer, conduct any additional testing it deems necessary.

Section 10.03. Differing Work Site Conditions. If conditions are encountered at the Work Site that are: (1) subsurface physical conditions, which differ materially from those indicated in the Contract Documents; or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing Party shall be given to the other Party promptly before conditions are disturbed and in no event later than seven (7) days after the first observance of the conditions. The Owner or Engineer will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost, or time required, for performance of any part of the Work; will recommend an equitable adjustment in the Lump Sum Price or the Substantial Completion Date, or both. However, any equitable adjustment in the Lump Sum Price shall not include additional general conditions costs. If the Owner determines that the conditions at the Work Site are not materially different from those indicated in the Contract Documents and that no change in the terms of this Contract is justified, the Owner shall so notify the Contractor in writing, stating the reasons. Claims by either Party in opposition to such determination must be made within fourteen (14) days after the Owner has given notice of the decision.

Section 10.04. No Oral Modification. No oral agreement or conversation with any officer, agent or employee of the Owner or its representatives, including the Engineer, either before or after the execution of this Contract, shall affect or modify any of the terms or obligations contained in this Contract or the Contract Documents.

ARTICLE 11

SUPERVISION OF THE WORK; SAFETY AND SECURITY

Section 11.01. The Superintendent of the Contractor. The Contractor shall designate in writing to the Owner and keep on the Project during its progress a competent employee who has responsibility to oversee the Work ("Superintendent"). The Superintendent shall be satisfactory to the Owner. The Superintendent shall be changed upon written request of the Owner but shall not be changed by the Contractor except with the consent of the Owner, unless the Superintendent ceases to be in its employ. The Superintendent shall represent the Contractor, and all directions given to him by the Owner shall be as binding as if given to the Contractor directly. The Superintendent shall devote his full time to the Work and shall maintain an office on the Work Site. The Superintendent shall direct, coordinate and supervise all Work, inspect all materials delivered to the Work Site to ascertain whether or not they comply with the requirements of the Contract Documents, and reject all non-conforming materials or workmanship.

Section 11.02. Order and Discipline. The Contractor shall at all times be responsible for enforcing strict discipline and good order among its employees, and all employees of its subcontractors and sub-subcontractors. If any person on the Work Site shall appear to be incompetent, disorderly, or intemperate, in any way disrupts or interferes with the Work, or is in any other manner not qualified for or unfaithful to the job entrusted to him, such person shall be discharged from the Project immediately and shall not again be employed on the Work Site without the prior written consent of the Owner.

Section 11.03. Cleaning Up.

(a) During the performance of the Work, the Contractor shall keep the Work Site clean and free of all rubbish, waste materials, debris and other materials in accordance with the instructions set forth in the Contract Documents. At the end of each working day, the Contractor shall remove all waste materials, rubbish, debris, and other materials from and about the Work Site as well as all surplus materials and shall leave the Work Site clean in accordance with the Contract Documents.

(b) The Contractor shall establish an active ongoing program to eliminate any foreign objects from the Work Site that may cause damage to aircraft or cause personal injury to other persons.

(c) The Contractor shall pay particular attention to haul routes used to and from the Work Site to prevent any construction debris from being dropped or tracked that may present a hazard.

(d) The Contractor, upon written notice from the Owner, shall promptly cut the grass and clean debris around the Work Site. If the Contractor fails to clean up any debris which is deposited as a result of construction operations, the Owner will, after notice, immediately do so. The cost thereof will be charged to the Contractor at actual cost per hour, but not less than the minimum rate of Two Hundred Fifty Dollars ($250.00) per hour. The Contractor shall assume full responsibility for failure to perform cleanup operations required by this Section 11.03.

(e) All materials delivered to the Work Site shall be stored and handled so as to preclude inclusion of any foreign substances, and to prevent any discoloration or damage which might reduce its effectiveness as part of the Work.

Section 11.04. Safety and Security.

(a) The Contractor shall be solely responsible for and oversee all safety orders, precautions, and programs necessary for the safety of the Work. The Contractor shall take the precautions set forth in the Contract Documents in order to ensure the safety of all persons involved in the Work, all other persons whom the Work might affect, all equipment and materials incorporated in the Work, all property on the Work Site and adjacent to it, and the Owner's business operations which are functioning on the Work Site or in the vicinity of it.

(b) The Contractor shall keep an accurate record of all persons who are on the Work Site and shall provide a copy of such list to the Owner with each monthly Application and Certificate for Payment. The Contractor, its subcontractors, their sub-subcontractors, and all employees of same, shall comply with all security rules made by the Owner and the Federal Aviation Administration. In addition, Contractor shall comply with the construction safety and health guidelines which are set forth in Exhibit D.

(c) The Contractor shall conform to Owner's rules and regulations for airport operations.

(d) Prior to the commencement of the Work, the Contractor shall provide to the Owner a list of all of its employees who will perform any portion of the Work.

Section 11.05. Observation of the Work.

(a) The Engineer, the Owner and persons designated by the Owner, shall at all times have access to the Work Site whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for observation. If the Owner or the Engineer discovers any defective Work in connection with any observation, it shall be reported to the Contractor in writing and the Contractor shall correct it.

(b) If the Contract Documents, the written instructions of the Owner, laws, ordinances, rules or regulations, or any public authority require any of the Work to be specifically tested or inspected, the Contractor shall give the Owner timely notice of its readiness for inspection and testing, and of the date set for such test or inspection. Inspections by the Owner or Engineer shall be promptly made. If any of the Work should be covered up without the approval or consent of the Owner, the Engineer or any public authority, it shall be uncovered for examination, if required by the Owner, the Engineer, or such other public authority, at the sole expense of the Contractor.

(c) Re-examination of questioned Work that has been previously tested or inspected by the Engineer or the Owner may be ordered by the Engineer or the Owner and, if so ordered, the questioned Work shall be uncovered by the Contractor. If such Work is found to be in compliance with the Contract Documents, the Owner shall pay the actual cost of the re-examination. If such Work is found not to be in compliance with the Contract Documents, the Contractor shall bear the costs of the re-examination.

(d) The Contractor shall not be required to provide professional services which constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, then the Contractor shall promptly and at its expense secure such services. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, shop drawings and other submittals prepared by such professional. Shop drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Owner or Engineer. The Owner and the Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals.

ARTICLE 12

PERMITS, LICENSES, LAWS AND REGULATIONS

Section 12.01. Contractor to Secure All Permits. The Contractor shall secure and pay for all construction related permits, including the building permit. The Contractor shall be responsible for all inspections required by governmental authorities in conjunction with the issuance of said permits. Contractor shall secure and pay for all governmental fees, licenses and other permits necessary for the lawful and proper execution and completion of the Work.

Section 12.02. Compliance with Laws. The Contractor shall give all notices and shall comply with all laws, ordinances, rules, regulations and orders of any public authority having jurisdiction over the Work, which have any bearing on the execution of the Work. If the Contractor observes that any of the Contract Documents are at variance in any respect with any such laws, ordinances, rules, regulations, and orders, it shall promptly notify the Owner and the Engineer in writing and any necessary changes shall be made by the Contractor. If the Contractor fails to give such notice or executes any of the Work in a manner contrary to any such laws, ordinances, rules, regulations or orders, the Contractor shall bear all resulting costs to correct said Work to comply with such laws and regulations and be liable for any resulting fines, penalties, judgments or damages imposed on or incurred by the Owner.

ARTICLE 13

TAXES AND OTHER FEES AND COSTS

Section 13.01. Payment of Taxes by Contractor.

(a) Any and all taxes, excises, duties, and assessments in any manner levied, assessed, or imposed by any government or subdivision or agency having jurisdiction over the Work shall be the sole responsibility and liability of the Contractor.

(b) The Contractor shall promptly pay and discharge when due, unless the validity or application is being contested by the Contractor in good faith, any and all taxes, excises, duties and assessments, together with any interest and penalties, if any, the responsibility and liability for which the Contractor has assumed pursuant to the provisions of paragraph (a) of this Section 13.01, unless any such tax, excise, duty or assessment is levied, assessed or imposed upon the Owner, in which case the Owner shall promptly give the Contractor notice of such levy, assessment or imposition, whereupon the Contractor shall promptly pay and discharge the same. Upon the written request and at the sole expense of the Contractor, the Owner shall assist the Contractor in contesting the validity or application of any such levy, assessment or imposition, and in the event a refund of all or any part of any tax, excise, duty or assessment (including interest and penalties, if any), said refund shall be refunded to the Contractor (less the amount of expenses associated with such contest not previously reimbursed by the Contractor to the Owner).

(c) The Contractor shall pay all applicable fees, and for all damage to sidewalks, streets, Owner's property, and other public property or to any public utilities caused by the performance of this Contract.

Section 13.02. Damage to Owner Property. Contractor agrees to promptly notify Owner of any damage caused to Airport property arising from Contractor's activities at the Airport. Contractor also agrees to comply with any request made by the Owner for reimbursement of costs associated with any damage to Airport property arising from work performed at the Airport by Contractor or any of Contractor's representatives, managers, employees, agents, contractors, subcontractors, licensees, or invitees or from the conduct of same. This provision shall survive the termination of this Contract.

ARTICLE 14

SHOP DRAWINGS AND SAMPLES; MATERIAL TESTING

Section 14.01. Definitions.

(a) As used in this Contract, "shop drawings" are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by the Contractor, any subcontractor, sub-subcontractor, manufacturer, supplier, or distributor, and which illustrates some portion of the Work.

(b) As used in this Contract, "samples" are physical examples furnished by the Contractor to illustrate materials, equipment, or workmanship.

Section 14.02. Submissions.

(a) Contractor shall submit to Owner all shop drawings in electronic format or as hard copies in accordance with the specifications. Contractor shall review, stamp with its approval, and submit, in orderly sequence so as to cause no delay in the Work or the work of any other contractor, all shop drawings and samples required by the Contract Documents or subsequently by the Owner or Engineer. Shop drawings and samples shall be properly identified as specified in the Contract Documents or as the Engineer or Owner may require. At the time of submission, the Contractor shall inform the Engineer and the Owner by separate written correspondence of any deviation in the shop drawings or samples from the requirements of the Contract Documents.

(b) By approving and submitting shop drawings and samples, the Contractor represents that it has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and other data, and that it has checked and coordinated each shop drawing and sample with the requirements of the Work and the Contract Documents.

Section 14.03. Review of the Engineer.

(a) The Engineer will review and act upon shop drawings and samples with reasonable promptness so as to cause no unreasonable delay in the Work, but only for conformance with the design concept of the Work and with the information given in the Contract Documents. The review of the Engineer or its agents of a given item shall not indicate approval of an assembly in which the item functions.

(b) The approval of the Engineer of shop drawings or samples shall not relieve the Contractor of its responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Engineer and the Owner by separate written letter of such deviation at the time of submission and the Owner or Engineer has given written approval of the specific deviation, nor shall the approval of the Engineer relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

Section 14.04. Corrections Made by Contractor. The Contractor shall make any corrections required by the Owner or Engineer and shall submit the required number of corrected copies of shop drawing or new samples until approved by Owner. The Contractor shall direct specific attention in writing or on resubmitted shop drawings or samples to revisions other than the corrections requested by the Engineer or the Owner on previous submissions.

Section 14.05. Prior Approval Required. No portion of the Work requiring a shop drawing or sample submission shall be commenced until the submission has been approved by the Owner or Engineer. All such portions of the Work shall be performed in accordance with approved shop drawings and samples and the Contract Documents.

Section 14.06. Submittal Schedule. Within seven (7) days after execution of this Contract, the Contractor shall provide the Owner and the Engineer with a preliminary submittal schedule of the dates that each shop drawing or sample will be submitted for approval. Within thirty (30) days after execution of this Contract, the Contractor shall provide the Engineer and the Owner with a final schedule of the dates that each shop drawing or sample will be submitted for approval. The sequence of the submittals of the Contractor shall be scheduled so as to permit an orderly review by the Engineer. The schedule shall allow reasonable added time according to the number or complexity of shop drawings or samples in each submittal for the checking, correction, and rechecking of corrections, as well as for return of approved or rejected shop drawings and samples to the Contractor. The submittal schedules shall allow not less than fourteen (14) calendar days for the Engineer to review any shop drawing or sample.

Section 14.07. Material Testing.

(a) If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested, or approved, the Contractor shall give the Owner timely notice of its readiness so the Owner or Engineer may observe such inspection, testing or approval. The Contractor shall bear all costs of such inspections, tests or approvals required by public authorities. Unless otherwise provided, the Owner shall bear all costs of other inspection, tests, or approvals.

(b) If the Owner or Engineer determines that any Work requires special inspection, testing or approval which paragraph (a) of this Section 14.07 does not include, the Owner or Engineer will instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided in paragraph (a) of this Section 14.07. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Owner's or Engineer's additional services made necessary by such failure; otherwise, the Owner shall bear such costs and an appropriate Contract Amendment shall be issued.

(c) Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered to the Owner.

(d) If the Owner or Engineer is to observe the inspections, tests or approvals required by the Contract Documents, they will do so promptly.

ARTICLE 15

THE RIGHT OF THE OWNER TO INSPECT AND AUDIT

Section 15.01. Right to Audit. The Contractor shall keep full and accurate records of all costs incurred and items billed in connection with any Work which records shall be open to audit by the Owner, or any authorized representative of the Owner, including but not limited to the Federal Aviation Administration and the Comptroller General of the United States during the course of the Project and until four (4) years after the final payment by the Owner to the Contractor. In addition, the Contractor shall make it a condition of all subcontracts and sub-subcontracts entered into in furtherance of the Work that any and all subcontractors and sub-subcontractors will keep accurate records of costs incurred and items billed in connection with the subcontract (or sub-subcontract) and that such records shall be open to audit by the Owner, or any authorized representative of the Owner, including but not limited to the Federal Aviation Administration and the Comptroller General of the United States during the course of the Work and until four (4) years after final payment by the Owner to the Contractor.

Section 15.02. Review of Subcontracts. Upon request of the Owner or Engineer, the Contractor shall provide the Owner with an executed copy of all subcontracts, sub-subcontracts and purchase orders entered into in furtherance of the Work.

ARTICLE 16

SEPARATE CONTRACTS

Section 16.01. The Right of the Owner to Award Separate Contracts. The Owner reserves the right to award other contracts in connection with work at or in the vicinity of the Work and the Contractor agrees to cooperate fully and not to unreasonably interfere with the work of such other contractors.

Section 16.02. Cooperation. The Contractor shall afford the other contractors of Owner the opportunity for the introduction and storage of their materials and equipment to their work sites and for the execution of their work. The Contractor shall properly connect and coordinate the Work with work of any other contractors of the Owner.

Section 16.03. Inspection of Work of Other Contractors. If any part of the Work depends, for proper execution or result upon, the work of another contractor of Owner, the Contractor shall inspect and promptly report to the Engineer and the Owner any discrepancies or defects in such work that render it unsuitable for such proper execution or results. Failure of the Contractor to so inspect and report shall constitute an acceptance of the Work of the other contractor as fit and proper to receive the Work.

Section 16.04. Responsibility for Damage. Should the Contractor cause damage to the work or property of any other contractor of the Owner, including, but not limited to, delay, disruption, suspension of work and/or acceleration damages, the Contractor shall settle all claims with such other contractor if the other contractor will so settle. If such other contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall notify the Contractor who shall defend such proceedings at the expense of the Contractor, or provide counsel of Owner's choice for Owner at the expense of Contractor, and if any judgment or award against the Owner results, the Contractor shall pay or satisfy it and shall reimburse the Owner for all attorney's fees and other litigation costs which the Owner has incurred.

ARTICLE 17

WARRANTIES OF THE CONTRACTOR

Section 17.01. Warranty of Title. The Contractor warrants and guarantees that title to all Work, materials and equipment covered by an Application and Certificate for Payment, whether incorporated in the Work or not, will pass to the Owner, free and clear of all liens, claims, security interests or encumbrances (hereinafter "Liens") and that none of the Work, materials or equipment covered by an Application and Certificate for Payment will have been acquired by the Contractor, or by any other person performing any part of the Work or furnishing materials and equipment for the Work, subject to an agreement under which a Lien is retained by the seller or supplier.

Section 17.02. Special Warranties. When special guarantees or warranties are required by the Contract Documents for specific parts of the Work, the Contractor shall procure certified copies of such guarantees or warranties,

countersign them and submit them to the Owner in triplicate. Delivery of such guarantees or warranties will not relieve the Contractor from any obligations assumed under any provision of this Contract or the Contract Documents.

Section 17.03. Assignment of Warranties. The Contractor hereby assigns to the Owner any and all existing assignable warranties, service life policies and patent indemnities of manufacturers of materials, equipment or items incorporated in the Work. Upon the request of the Owner or the Engineer, the Contractor shall give the Owner assistance in enforcing the rights of the Owner arising under such warranties, service life policies and patent indemnities. At the request of the Owner or the Engineer, the Contractor shall give notice (with copies to the Owner) to any such manufacturers of the assignment of such warranties, service life policies and patent indemnities.

Section 17.04. General Warranty and Correction of Work.

(a) In addition to any special guarantees or warranties contained in the Contract Documents, the Contractor warrants to the Owner that all materials and equipment furnished in performance of the Work will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All work not so conforming to these standards shall be considered defective.

(b) The Contractor shall promptly correct all defective Work to comply with the Contract Documents whether observed before or after the substantial completion date and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting defective Work.

(c) If, within one (1) year after the substantial completion date, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee or warranty required by the Contract Documents, any of the Work is found to be defective and not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner, or the Engineer, to do so.

(d) All defective or non-conforming Work shall be removed from the site of the Work if necessary, and the Work shall be corrected to comply with the Contract Documents without cost to the Owner. The Contractor also shall bear the cost of making good all work of other contractors destroyed or damaged by removal or correction of the defective Work of Contractor.

(e) If the Contractor fails to timely and properly correct defective Work, the Owner may correct it and hold the Contractor liable for all costs, expenses and damages, including attorney's fees and litigation costs incurred by Owner in correcting it.

(f) In addition to the foregoing warranty, a warranty period of one (1) year shall apply under the same terms and conditions as the original warranty, to any work, supplied in correction of defective work under warranty pursuant to the provisions of this Section 17.04 and the Contractor shall assign to the Owner any warranties, including extended warranties, which are available in connection with the performance of such correction of defective Work. The warranty period shall commence on the date the Owner accepts the corrective Work of the Contractor.

ARTICLE 18

RIGHT OF THE OWNER TO DO WORK

Section 18.01. Right of the Owner to do Work. If the Contractor should neglect to perform the Work properly or fails to do anything required by the Contract Documents, and the Contractor does not correct the untimely or improper performance within seven (7) days after written demand is made, the Owner may, without prejudice to any other remedy it may have under this Contract or at law or in equity, make good any deficiencies in the Work, including, but not limited to, supplementing the workforces of the Contractor and deduct all costs of doing so from the payment then due or thereafter due the Contractor. The Owner shall not be required to give multiple notices to the Contractor in order to exercise its rights under this paragraph.

Section 18.02. Deduction for Uncorrected Work. If the Owner deems it inexpedient to correct deficiencies in the Work pursuant to Section 18.01 of this Contract, the Owner may deduct the reasonable cost of correcting the deficiencies, including any attorney's fees and additional fees and expenses of the Engineer, from the payment then due or thereafter due to the Contractor, but the making of such a deduction shall in no way be deemed an election of remedies by the Owner.

Section 18.03. Correction of Work before Final Payment.

(a) The Contractor shall promptly remove from the Work Site all materials, equipment or other items rejected by the Engineer or the Owner as failing to conform to the Contract Documents, whether incorporated in the Work or not, and the Contractor shall promptly replace and re-execute its original work to comply with the Contract Documents without expense to the Owner. In addition, the Contractor shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

(b) If the Contractor does not remove rejected material, equipment or other items within a reasonable time (as fixed by written notice from the Owner, or the Engineer), the Engineer or the Owner may remove such items and store them at the expense of the Contractor, or dispose of such material, equipment or other items at the sole discretion of the Owner. If the Contractor does not pay the expense of such removal or storage within ten (10) days, the Owner may, upon ten (10) days written notice, sell such items at auction or at private sale and shall account for the net proceeds of such sale, after deducting all the costs and expenses of removal that should have been borne by the Contractor.

ARTICLE 19

INSURANCE

Section 19.01. Insurance Requirements. The Contractor shall fully comply with all requirements relating to insurance for the Project as set forth in this Article 19.

Section 19.02. Owner Controlled Insurance Program. The Owner has established an Owner Controlled Insurance Program (OCIP). To the extent required by the Owner, Contractor shall fully participate in and comply with all requirements of the OCIP. A copy of the OCIP Manual is attached hereto as Exhibit C and incorporated herein by reference. However, if the OCIP is not used, Contractor agrees to meet the requirements for Insurance coverage referenced in Section 19.03. A copy of the Construction Safety and Health Guidelines is attached hereto as Exhibit D and incorporated herein by reference.

Section 19.03. Contractor Provided Insurance Coverage. During the Term of this Agreement, Contractor shall comply with the insurance requirements set forth in Exhibit C ("Insurance Requirements").

Section 19.04. Survival. The insurance provisions of this Article 19 shall survive any termination of this Contract.

ARTICLE 20

SURETY BONDS

Section 20.01. Surety Bonds Required. The Contractor shall furnish and keep in force throughout the performance of the Work a separate performance bond and separate labor and material payment bond, each in the amount of the total of the Lump Sum Price (as the same may be modified from time to time) conditioned upon the faithful performance of the Work by the Contractor and payment of all obligations arising in connection with the Work by the Contractor. The bonds shall also guarantee to the Owner that the Work shall be free of all liens. The bonds shall name the Owner as obligee and shall be in such form and with such sureties as the Owner may approve prior to commencement of the Work.

ARTICLE 21

INDEMNIFICATION

Section 21.01. Indemnification of the Contractor.

(a) Without limiting any insurance required herein and to the fullest extent permitted by law, Contractor, on behalf of itself, its subcontractors, their agents, their employees or any entity or person for which the Contractor is or may be responsible (hereinafter collectively referred to as "Indemnitors"), shall fully defend, indemnify, save and hold the Owner, the Board of Commissioners of the Owner, the Program Manager, the Engineer, their agents, employees, officers, directors, partners and related entities (hereinafter collectively referred to as "Indemnitees") harmless from and against all liability,

damages, loss, claims, demands, actions and expenses of any nature whatsoever, including, but not limited to reasonable attorney's fees which arise out or are connected with: (1) any negligent act, error or omission by any Indemnitor, or (2) the failure of the Indemnitor to comply with any applicable laws, statutes, ordinances, rules or regulations of any governmental or quasi-governmental authority, or (3) the material breach of any term or condition of this Contract by any of the Indemnitors.

(b) Without limiting the generality of the foregoing, the indemnity set forth in this Article 21 shall include all liability, damages, loss, claims, demands, and actions on account of personal injury, death, or property loss to any third party, any Indemnitees, any of the Indemnitees' employees, agents, licensees, or invitees relating to the Project and which results from the negligent act, error, or omission of Contractor.

(c) When the Contractor is obligated to provide the Owner a defense hereunder, it shall do so with qualified counsel that is selected by the Contractor and approved by the Owner. Such approval shall not be unreasonably withheld. In light of the Owner and Contractor's continuing relationship, however, the potential for conflicts of interests exists if the same counsel represents both the Owner and Contractor when the Contractor accepts the Owner's tender of defense under the indemnity provision of this Agreement. Therefore, the Owner retains the right to select its own counsel from a list of qualified attorneys provided by Contractor or Contractor's insurer. The selected counsel's fees and expenses shall be paid for by Contractor or its insurer, and the counsel shall be different from that selected by Contractor to represent it in the same matter.

(d) The indemnity set forth in this Article 21 shall survive any termination of this Contract.

Section 21.02. Labor Indemnity. The Contractor shall indemnify, defend and hold harmless the Owner, the Board of Commissioners of the Owner, the Program Manager, and the Engineer, their agents, employees, officers, directors, partners and related entities, from any and all administrative and judicial actions (including reasonable attorney's fees related to any such action), incurred by the Owner, the Program Manager, or the Engineer in connection with any labor related activity arising from the wrongful acts or omissions of the Contractor or its subcontractors in the performance of the Work of the Contractor. As used in this Contract, "labor related activity" includes, but is not limited to, strikes, walk-outs, informational or organizational picketing, use of placards, or distribution of hand-outs or leaflets at or in the vicinity of any facility where the Owner conducts business. The Owner shall advise the Contractor if any labor related activity occurs and the Contractor shall arrange for the legal representation necessary to protect the Owner, the Program Manager, and the Engineer provided such representation is previously approved by Owner.

Section 21.03. Royalties and Patents. The Contractor shall pay all royalties and license fees in anyway relating to the Work, shall defend all suits or claims for infringement of any patent or copyrights, and shall indemnify and hold the Owner, the Board of Commissioners of the Owner, their agents, officers, directors, partners and related entities, harmless from loss on account of such suit or claim.

Section 21.04. Attorney's Fees. In the event it becomes necessary for Owner to employ an attorney to enforce any provision of this Contract or to defend against any claim or litigation initiated by the Contractor, then the Contractor shall be liable for all attorney's fees and litigation expenses of Owner.

ARTICLE 22

RIGHT TO OCCUPY BY OWNER

Section 22.01. Early Occupancy by Owner. The Owner has the right to occupy or use ahead of schedule, at no additional cost nor obligation to Owner, all or any substantially completed or partially completed portion of the Work when such occupancy and use are in its best interest, notwithstanding the time of completion for all of the Work. Maintenance of occupied portion will remain the Contractor's responsibility.

Section 22.02. Corrections after Occupancy. After the Owner has taken occupancy of all or any portion of the Work, the Contractor shall not disrupt the use and occupancy of the Owner to make corrections in the Work.

ARTICLE 23

DEFAULT: RIGHT TO TERMINATE BY OWNER

Section 23.01 Breach of Contract Terms. (Required by FAA) Any violation or breach of terms of this contract on the part of the contractor or its subcontractors 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.

Owner will provide Contractor written notice that describes the nature of the breach and corrective actions the Contractor must undertake in order to avoid termination of the contract. Owner reserves the right to withhold payments to Contractor until such time the Contractor corrects the breach or the Owner elects to terminate the contract. The Owner's notice will identify a specific date by which the Contractor must correct the breach. Owner may proceed with termination of the contract if the Contractor fails to correct the breach by deadline indicated in the Owner's notice.

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.

Section 23.02. Default and Termination by Owner. (Required by FAA)

(a) The Contractor shall be considered in default of his or her Contract and such default will be considered as cause for the Owner to terminate the Contract for any of the following reasons if the Contractor:

(1) Fails to begin the Work under the Contract within the time specified in the Notice to Proceed, or

(2) Fails to perform the Work or fails to provide sufficient workers, equipment and/or materials to assure completion of Work in accordance with the terms of the Contract, or

(3) Performs the Work unsuitably or neglects or refuses to remove materials or to perform anew such Work as may be rejected as unacceptable and unsuitable, or

(4) Discontinues the execution of the Work, or

(5) Fails to resume Work which has been discontinued within a reasonable time after notice to do so, or

(6) Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

(7) Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or

(8) Makes an assignment for the benefit of creditors, or

(9) For any other cause whatsoever, fails to carry on the Work in an acceptable manner.

Should the Engineer consider the Contractor in default of the Contract for any reason above, the Engineer shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the Contract.

(b) If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the Engineer of the facts of such delay, neglect or default and the Contractor's failure to comply with such notice, have full power and authority without violating the Contract, to take the execution of the Work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the Work and are acceptable and may enter into an agreement for the completion of said Contract according to the terms and provisions thereof or use such other methods as in the opinion of the Engineer will be required for the completion of said Contract in an acceptable manner.

(c) All costs and charges incurred by the Owner, together with the cost of completing the Work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the Contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

Section 23.03. Termination for Convenience by Owner. (Required by FAA) The Owner may terminate this Contract without cause at any time by providing fifteen (15) days prior written notice to Contractor. Upon receipt of a written notice of termination, except as explicitly directed by the Owner, the Contractor shall immediately proceed with the following obligations regardless of any delay in determining or adjusting amounts due under this clause:

(a) Contractor must immediately discontinue work as specified in the written notice;

(b) Terminate all subcontracts to the extent they relate to the work terminated under the notice;

(c) Discontinue orders for materials and services except as directed by the written notice;

(d) Deliver to the Owner all fabricated and partially fabricated parts, completed and partially completed Work, supplies, equipment and materials acquired prior to termination of the Work and as directed in the written notice;

(e) Complete performance of the Work not terminated by the notice; and

(f) Take action as directed by the Owner to protect and preserve property and work related to this Contract that Owner will take possession.

Owner agrees to pay Contractor for:

(1) Completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;

(2) Documented expenses sustained prior to the effective date of termination in performing Work and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work;

(3) Reasonable and substantiated claims, costs and damages incurred in settlement of terminated contracts with Subcontractors and Suppliers; and

(4) Reasonable and substantiated expenses to the Contractor directly attributable to Owner's termination action.

Owner will not pay Contractor for loss of anticipated profits or revenue or other economic loss arising out of or resulting from the Owner's termination action.

The rights and remedies this clause provides are in addition to any other rights and remedies provided by law or under this Contract.

Section 23.04. Suspension by the Owner.

(a) The Owner may order the Contractor in writing to suspend, delay, or interrupt the Work in whole or in part for such period of time as the Owner may determine (hereinafter referred to as "Suspension").

(b) Provided the Suspension lasts for more than ninety (90) days, an adjustment to the Lump Sum Price ("Adjustment") shall be made as set forth in paragraph (c) of this Section 23.02. The Substantial Completion Date shall be extended by written Contract Amendment to the extent that substantial completion is actually delayed by this Suspension. No Adjustment shall be made to the extent:

(1) That performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is in full or in part responsible; or

(2) That an equitable adjustment is made or denied under another provision of this Contract.

(c) The amount of the Contractor's compensation for a Suspension pursuant to this Section 23.02 shall be limited to any properly documented costs of maintaining personnel and equipment in the field provided such costs are pre-approved by the Owner in writing. The Owner shall not be liable at any time for home office overhead or consequential damages. At

the Owner's option, the Contractor may be ordered to demobilize its forces because the Project is suspended. In such event, the Owner will reimburse the Contractor for the reasonable cost of demobilization and remobilization.

Section 23.05. Assignment of Subcontracts. In the event of termination by the Owner pursuant to this Article 23 or Exhibit E to this Contract, the Owner may require the Contractor to promptly assign to it all or some of the subcontracts, materials, tools, and equipment to be installed under this Contract, or rental agreements, and any other commitments which the Owner, in its sole discretion, chooses to take by assignment. In such event, the Contractor shall promptly execute and deliver to the Owner written assignments of such commitments.

ARTICLE 24

HAZARDOUS MATERIALS

Section 24.01. Hazardous Materials Covenants.

(a) Contractor hereby represents and warrants to and for the benefit of Owner that the Project or Work Site will not be used or operated in any manner that will result in the storage, use, treatment, manufacture or disposal of any Hazardous Materials (hereinafter defined) upon the Project or Work Site or any portion thereof or which will result in Hazardous Materials Contamination (hereinafter defined). For purposes of this Article 24, the term "Hazardous Materials" shall mean and refer to: (1) any "hazardous waste" as defined by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. § 6901 *et seq.*), as amended from time to time, and regulations promulgated thereunder; (2) any "hazardous substance" as defined by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (42 U.S.C. § 9601 *et seq.*) ("CERCLA"), as amended from time to time, and regulations promulgated thereunder; (3) asbestos; (4) polychlorinated biphenyls; (5) urea formaldehyde; (6) any substance the presence of which on the premises is prohibited by any applicable environmental laws or regulations ("Laws") or by any other legal requirements affecting the Project or the Work Site; (7) petroleum based materials (with the exception of tires affixed to vehicles); and, (8) any other substance which is defined as hazardous, toxic, infectious or radioactive by any Laws or by any other legal requirements affecting the Project or Project site. For purposes of this Article 24, the term "Hazardous Materials Contamination" shall mean and refer to the contamination of the Project or Project site, soil, surface water, ground water, air, or other elements on, or of, the buildings, facilities, soil, surface water, ground water, air, or other elements on or of any other property as a result of Hazardous Materials at any time emanating from the Project or Work Site.

(b) In addition to and without limiting the generality of any other provision of this Contract, Contractor shall and hereby does indemnify and hold Owner, the Board of Commissioners of the Owner, the Program Manager, the Engineer, their agents, employees, officers, directors, partners and related entities harmless from and against any and all losses, damages, expenses, fees, claims, demands, causes of action, judgments, costs and liabilities, including, but not limited to, attorney's fees and costs of litigation, and costs and expenses of response, remedial and corrective work and other cleanup activities, arising out of or in any manner connected with: (1) the "release" or "threatened release" (as those terms are defined in CERCLA and the rules and regulations promulgated thereunder, as from time to time amended) by Contractor or Contractor's employees, agents, delegees, invitees, licensees, concessionaires, subcontractors or representatives, of any Hazardous Materials; or (2) any occurrence of Hazardous Materials Contamination affecting the Project or Work Site caused by or resulting from, in whole or in part, the operations of the Contractor or Contractor's employees, agents, delegees, invitees, licensees, concessionaires, subcontractors or representatives. The provisions of this paragraph shall survive any payment or satisfaction of this Contract and such provisions shall remain in full force and effect.

(c) When use or storage of hazardous materials or equipment or unusual methods of construction are necessary, the Contractor shall obtain prior written approval from the Owner. The use of explosives is strictly prohibited provided, however, powder activated fasteners are permitted.

(d) If Contractor encounters on the Work Site any substance or material reasonably believed by Contractor to be hazardous, Contractor immediately shall (i) stop work in the area affected, (ii) take measures appropriate to the condition to keep people away from the suspected Hazardous Material and, (iii) report the condition to Owner in writing. If the Work is so stopped and Hazardous Material is found, the Work in the affected area shall not thereafter be resumed except by the issuance of a Construction Change Directive pursuant to Section 9.02 of this Contract. Any such Construction Change Directive shall be limited to, an adjustment to the Substantial Completion Date appropriate. If no Hazardous Material is found after the Work is stopped, no Construction Change Directive is required to resume the Work in the affected area.

ARTICLE 25

MISCELLANEOUS

Section 25.01. No Waiver. No consent or waiver, express or implied, by either party to this Contract or of any breach or default by the other in the performance of any of its obligations hereunder shall be deemed or construed to be a consent or waiver to or of any other breach or default by such party. Failure on the part of the Owner to complain of any act or failure to act of the Contractor or to declare the Contractor in default, irrespective of how long such failure continues, shall not constitute a waiver of the rights of Owner.

Section 25.02. Assignment. This Contract shall not be assigned, delegated or transferred in whole or in part by the Contractor nor shall the Contractor assign any monies due or to become due to it without the prior written consent of the Owner.

Section 25.03. Governing Law. This Contract is entered into in Tennessee and shall be governed by and construed according to the laws of Tennessee. Any and all disputes arising out of this Contract, and/or the Project shall be decided by a state or federal court of competent jurisdiction in Memphis, Shelby County, Tennessee.

Section 25.04. Execution of Contract. The parties hereby agree and express their intent to execute this Contract electronically if Owner has a designated information processing system. The parties also hereby agree that this Contract may be executed in counterparts, each of which shall be deemed to be an original, but all of which, taken together, shall constitute one and the same agreement.

Section 25.05. Article and Section Headings. Article and section headings contained in this Contract are for ease of reference only and shall not affect the interpretation or meaning of this Contract.

Section 25.06. Parties in Interest. This Contract shall inure to the benefit of and be binding upon the Parties and their respective successors, assigns and legal representatives. It is specifically agreed between the Owner and the Contractor that the Parties do not intend to create any third-party beneficiary rights by the execution of this Contract.

Section 25.07. Severability. If any one or more of the provisions contained in this Contract shall for any reason be held invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability shall not affect any other provision of this Contract, but it shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

Section 25.08. Written Notices. Whenever by the terms of this Contract notice shall be given either to Owner or to Contractor, such notice shall be in writing and shall be sent by regular United States Postal Service, by hand-delivery, by registered or certified mail, by a nationally recognized overnight delivery service or by electronic mail with a delivery receipt . Notice intended for Owner shall be addressed to the Vice President of Operations as follows with a copy to Owner's General Counsel at the address for regular mail:

If to the Owner, address to:

Regular Mail or Hand Delivery
Vice President of Operations
Memphis-Shelby County Airport Authority
2491 Winchester Rd., Suite 113
Memphis, Tennessee 38116-3856

Certified Mail or Overnight Delivery
4150 Louis Carruthers Drive
Memphis, TN 38118
(901) 922-8000

If to the Contractor, address to:

_____
_____
_____
_____

Either Party, from time to time, may change its address by giving written notice to the other Party.

Section 25.09. Exhibits. All exhibits described in this Contract shall be deemed to be incorporated into and made a part of this Contract. If there is any inconsistency between this Contract and the provisions of any exhibits, the provisions of this Contract shall control to the extent of the inconsistency.

Section 25.10. Entire Contract. This Contract, together with the exhibits and the other Contract Documents, constitutes the entire agreement between the Owner and the Contractor and supersedes all prior written or oral agreements, understandings, representations, negotiations, and correspondence between the Parties. This Contract shall not be supplemented, amended, or modified by any course of dealing, course of performance or usage of trade and may only be amended or modified by a written instrument duly executed by officers of both Parties.

Section 25.11. Non-Federally Assisted Projects. Regardless of the funding source for the Project, Contractor hereby agrees to comply with all nondiscrimination provisions of this Contract.

Section 25.12. Disadvantaged Business Enterprise Participation.

(a) The Project is subject to the requirements of Owner's Business Diversity Development Program (BDDP) and Small Business Participation Program (SBPP). It is the responsibility of the Contractor to see that all requirements of the BDDP and SBPP are met. The Disadvantaged Business Enterprise (DBE) participation goal for the Project is **Twenty-Five Percent (25%).** This percentage is defined as the dollar value of subcontracts awarded to certified DBEs divided by the base bid or alternate amount. To qualify, a firm must be included on the Owner's list of certified DBE firms.

(b) Proposed changes to the designated participating DBEs during performance of the Work must be submitted to the Owner. Contractors must make every effort to replace a DBE subcontractor with another certified DBE, based on said DBEs' availability. All substitutes for DBE subcontractors or joint ventures require prior approval of the Owner, such approval not to be unreasonably withheld; and said approval may be granted for reasons including, but not limited to, the following: (1) subcontractor requests that its subcontract or joint venture agreement with the prime contractor be voided; (2) subcontractor is unable to perform the Work; and/or (3) subcontractor has consistently performed unacceptable work.

(c) A determination by the Owner that the Contractor has either failed to comply with this Section 25.12, to timely submit to Owner requested documentation related hereto, to cooperate with Owner, or to answer inquiries truthfully shall subject the Contractor to any or all of the following penalties:

(1) Withholding from the Contractor all future payments under this Contract until the Contractor is in compliance; and/or

(2) Cancellation, termination, or suspension of this Contract, in whole or in part; and/or

(3) Payment by the Contractor to the Owner of an amount equal to the difference in the DBE dollar value achieved in documented DBE participation or any lesser amount or penalty as deemed appropriate by the Owner, which dollar value shall be considered liquidated damages for failure to perform the requirements of this Contract and for which the Contractor and all of its subcontractors agree to be bound.

(d) A violation of this provision shall be considered a material breach of this Contract. If, in the opinion of the Owner, the Contractor has made significant deviations from the DBE program commitments, such deviations shall be considered a breach of this Contract.

Section 25.13. No Financial Benefit. Contractor understands and agrees that no Owner employee or member of the Board of Commissioners, Memphis City Council or Shelby County Commission shall receive any financial benefit arising out of this Contract, either directly or indirectly. Further, any fees paid to any person or entity by Contractor for assistance in obtaining this Contract with Owner must be fully disclosed to Owner. Notwithstanding any term, condition, obligation or provision in this Contract, any other writing, any other agreement, any oral understanding or agreement, or any conduct or failure to act by the Owner, Contractor stipulates and agrees conclusively that Contractor has against

the Owner no right, entitlement or claim for any payment, compensation, cost or remuneration of any type other than pursuant to the terms of this Contract.

ARTICLE 26

FEDERAL AVIATION ADMINISTRATION (FAA) REQUIRED CONTRACT PROVISIONS

Section 26.01. FAA Required Provisions. Federal laws and regulations require that specific contract provisions be included in certain contracts and subcontracts. All such provisions are set forth in Exhibit E, which is attached hereto and incorporated herein by reference. Contractor hereby agrees to insert these provisions in each contract and subcontract (to the extent applicable) related to the performance of this Contract and to require each of its subcontractors to do the same. Contractor also hereby agrees to incorporate these provisions by reference for work done under any purchase order, rental agreement or other agreement for supplies or services related to the performance of this Contract. Contractor further agrees to be responsible for compliance with these provisions by any subcontractor, lower-tier subcontractor or service provider. Contractor acknowledges that the FAA prevents any modification to these provisions that creates a conflict with federal laws and regulations or changes the intent of the required provision.

ARTICLE 27

STATE REQUIRED CONTRACT PROVISIONS

Section 27.01. State of Tennessee Laws and Regulations - Grant Contract Provisions. State laws and regulations require that specific contract provisions be included in certain contracts and subcontracts. All such provisions are set forth in Exhibit F, which is attached hereto and incorporated herein by reference.

The remainder of this page intentionally left blank.
[Signature page to follow.]

IN WITNESS WHEREOF, the Parties have made and executed this Contract as of the day and year first above written.

MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY	**CONTRACTOR**
By: _____	By: _____
Title: President and CEO	Title: _____

Approved as to Content:

By: _____

Title: Vice President of Operations

Approved as to Form and Legality:

By: _____

Title: General Counsel

Reviewed and Approved:

By: _____

Title: Director of Development

EXHIBIT A
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
GLYCOL MANAGEMENT PROGRAM – CONTROL FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

SCOPE OF WORK

The "Work" of this Contract is defined in the Contract Documents to include, but not be limited to, site preparation, site drainage, water main installation, sanitary sewer, concrete and asphalt paving driving services, and fencing. Building Work consists of concrete and steel structural members, masonry, glazing, drywall, acoustical tile ceilings, carpentry, painting, electrical, plumbing, HVAC, fire protection, data cabling, camera and door security, and specialty equipment as detailed in the construction documents.

EXHIBIT B
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
GLYCOL MANAGEMENT PROGRAM – CONTROL FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

CONTRACT DOCUMENTS

NON-TECHNICAL SPECIFICATIONS

Division 0

00001	Project Title Page
00007	Professional Seals
00010	Table of Contents
00015	List of Drawings
00100	Legal Notice to Bidders
00200	Instructions to Bidders/Proposers
00405	Proposal
00410	Proposal Guarantee
00445	Disadvantaged Business Enterprise (DBE) Requirements
00490	Addenda and Modifications
00500	Construction Contract
00605	Certificate of Secretary
00610	Performance Bond & Labor and Material Payment Bond
00630	Application for Payment
00640	Business Diversity Monthly Compliance Report
00765	Supplemental Provisions
00801	Airport Construction Safety Requirements
00802	Airport Security Requirements

General Provisions

Section 10	Definition of Terms
Section 20	Proposal Requirements and Conditions
Section 30	Award and Execution of Contract
Section 40	Scope of Work
Section 50	Control of Work
Section 60	Control of Materials
Section 70	Legal Regulations and Responsibility to Public
Section 80	Execution and Progress
Section 90	Measurement and Payment
Section 150	FAA General Provisions Addendum

General Construction Items

C-100	Contractor Quality Control Program CQCP
C-102	Temporary Air and Water Pollution, Soil Erosion, and Siltation Control
C-105	Mobilization

Division 1

01100	Summary of Work, Sequence of Construction & Liquidated Damages
01210	Allowances
01230	Alternates
01250	Amendment Procedure
01310	Preconstruction Conference & Progress Meetings
01320	Schedules and Reports
01321	Construction Surveying
01322	Aerial Photographs
01325	Delays and Extension of Time
01330	Submittals
01351	Storage and Protection
01353	Radio Communications
01455	Quality Control and Quality Assurance Testing Programs
01500	Construction Facilities and Temporary Controls
01600	Product Requirements
01630	Product Substitution Procedures
01700	Field Engineering
01720	Project Record Documents
01730	Cutting and Patching
01741	Cleaning
01770	Close-Out Procedures
01771	Affidavit of Contractor
01772	Final Waiver and Release of Lien: PRIME
01774	Contractor Warranty Form
01775	Consent of Surety Company to Final Payment
01783	Electrical Characteristics, Capacities, and Wiring Diagrams
01784	Manufacturer's Supervision

TECHNICAL SPECIFICATIONS (dated 7/2/2021)

Civil Specifications	See Plans

Division 03	**Concrete**
03 10 00	Concrete Forming and Accessories
03 20 00	Concrete Reinforcing
03 30 00	Cast-In-Place Concrete

Division 04	**Masonry**
04 10 00	Mortar
04 20 25	Brick Veneer
04 22 00	Concrete Unit Masonry

Division 05	**Metals**
05 12 00	Structural Steel Framing
05 21 00	Steel Joist Framing
05 31 00	Steel Decking
05 50 00	Metal Fabrications

Division 06	**Wood, Plastics, And Composites**
06 10 00	Rough Carpentry
06 41 00	Architectural Wood Casework

Division 07	**Thermal And Moisture Protection**
07 11 13	Bituminous Dampproofing

07 21 00	Thermal Insulation
07 21 10	Roof Insulation
07 41 14	Standing Seam Metal Roof
07 42 13	Metal Wall Panels
07 42 57	Prefabricated Metal Sunscreens
07 42 65	Prefabricated Metal Canopies
07 42 93	Vented Metal Soffit Panels
07 52 10	Modified Bituminous Membrane Roofing
07 62 00	Sheet Metal Flashing And Trim
07 68 80	Fm Global Checklist
07 72 00	Roof Accessories
07 72 33	Roof Hatch Rail System
07 90 05	Joint Sealers

Division 08	**Openings**
08 11 13	Hollow Metal Doors and Frames
08 30 50	Access Doors
08 33 23	Overhead Coiling Doors
08 42 20	Cab Windows
08 43 13	Aluminum Framed Storefronts
08 71 00	Door Hardware
08 80 00	Glazing
08 83 00	Mirrors

Division 09	**Finishes**
09 05 61	Common Work Results for Flooring Preparation
09 21 16	Gypsum Board Assemblies with Metal Stud Framing
09 30 00	Tiling
09 51 00	Acoustical Ceilings
09 65 80	VCT & LVT, Resilient Base and Transition Accessories
09 68 13	Tile Carpeting
09 69 00	Access Floor System
09 90 00	Painting
09 97 24	Concrete Sealer

Division 10	**Specialties**
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10 21 15	Stainless Steel Toilet Compartments
10 28 00	Toilet Accessories

Division 11	**Equipment**
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11 24 00	Roof Fall Protection Equipment

Division 12	**Furnishing**
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12 52 40	Seating
12 59 10	Desk System
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12 59 30	Lockers

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21 05 18	Escutcheons for Fire-Suppression Piping
21 05 48	Vibration and Seismic Controls for Fire-Suppression Piping and Equipment

21 13 13	Wet-Pipe Sprinkler Systems

Division 22	**Plumbing**
22 05 13	Common Motor Requirements for Plumbing Equipment
22 05 16	Expansion Fittings and Loops for Plumbing Piping
22 05 17	Sleeves and Sleeve Seals for Plumbing Piping
22 05 18	Escutcheons for Plumbing Piping
22 05 19	Meters and Gages for Plumbing Piping
22 05 23	General-Duty Valves for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 11 16	Domestic Water Piping
22 11 19	Domestic Water Piping Specialties
22 13 16	Sanitary Waste and Vent Piping
22 13 19	Sanitary Waste Piping Specialties
22 13 23	Sanitary Waste Interceptors
22 33 00	Electric, Domestic-Water Heaters
22 34 00	Fuel-Fired Domestic Water Heaters
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22 47 00	Drinking Fountains and Water Coolers

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23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 05 48	Vibration and Seismic Controls for HVAC Piping And Equipment
23 05 53	Identification for HVAC Piping and Equipment
23 07 13	Duct Insulation
23 11 23	Facility Natural Gas Piping
23 31 13	Metal Ducts
23 33 00	Air Duct Accessories
23 34 23	HVAC Power Ventilators
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23 82 39	Unit Heaters

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26 05 29	Hangers and Supports for Electrical Systems
26 05 33	Raceway and Boxes for Electrical Systems
26 09 23	Lighting Control Devices
26 09 43	Network Lighting Controls
26 22 00	Low-Voltage Transformers
26 24 16	Panelboards
26 27 26	Wiring Devices
26 36 00	Transfer Switches
26 41 13	Lightning Protection for Structures
26 43 13	Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits
26 51 00	Interior Lighting

26 56 00	Exterior Lighting

Division 27	**Fire Alarm**
27 05 00	Common Work Results for Fire Alarm Systems
27 15 00	Fire Alarm Horizontal Cabling

Division 28	**Fire Alarm**
28 31 00	Digital Addressable Fire Alarm System

Division 34	**Transportation**
28 31 00	Impact Resistant Bollards

Division 41	**Cranes & Hoists**
41 22 00	Bridge Crane

Appendices
MSCAA Design Guide - Construction Standards
MSCAA Comprehensive Storm Water Pollution Prevention Plan
Geotechnical Report Dated March 30, 2021

LIST OF DRAWINGS

DRAWINGS, Entitled Glycol Management Program - Control Facility - Construction, Issued for Bid, dated 07/02/2021, with revisions, as noted on the drawing sheets:

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010	LS1.4	PARTITION DETAILS
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023	C-GN-06	TDOT AND MEMPHIS STANDARD DRAWINGS
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EXHIBIT C
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
GLYCOL MANAGEMENT PROGRAM – CONTROL FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

OWNER CONTROLLED INSURANCE PROGRAM

C.1. Owner Controlled Insurance Program

The Owner has elected to implement an Owner Controlled Insurance Program (OCIP) that will provide **Workers' Compensation, Employer's Liability, Commercial General Liability, Excess Liability and Builders' Risk insurance** for Contractors and Subcontractors of every tier who have been properly enrolled and are providing direct labor to the Project. A general summary of coverage provided by the OCIP is included in the MSCAA OCIP Manual, (hereinafter called the Manual), a copy of which is attached hereto and made a part of this Agreement and should be attached to and incorporated in every subcontract. All terms and conditions of Exhibit C will apply during the term of the contract. The Owner agrees to pay all premiums associated with the OCIP.
While the OCIP provides uniform coverages and reasonable limits, the OCIP is not intended to meet all the insurance needs of the Contractor and eligible Subcontractors who have been properly enrolled. In addition to any insurance provided by Owner, the Contractor and all Subcontractors working on the Project will be responsible for providing certain insurance as specified in paragraph C.2. Contractors and eligible Subcontractors should discuss the OCIP with their insurance agent or consultant to assure that other proper coverages are maintained. Contractor and eligible Subcontractors enrolled in the OCIP agree that the insurance company policy limits of liability, coverage terms and conditions shall determine the scope of coverage provided by the OCIP.

C.1.1. Applicability of the OCIP

Participation in the OCIP by the Contractor and all eligible Subcontractors is mandatory but not automatic. The Contractor and each eligible Subcontractor (as defined below) must follow the enrollment procedures shown in the Manual. The Contractor shall comply with all requirements of the OCIP as outlined in the OCIP Manual and shall require all eligible Subcontractors to comply with requirements of the OCIP manual. The Manual may be updated and revised during the course of construction to reflect any changes in State Law, Rules and/or Regulations or Procedures that may be necessary or appropriate, and said revisions will replace all previous versions. Copies of any revised Manual will be distributed by the OCIP Administrator.

- If the Contractor or any eligible Subcontractor fails to enroll any of its eligible Subcontractors of any tier, it will be subject to a penalty charge of the full and complete deduct as shown in C.1.2.c or 3% of the subcontract cost, whichever is greater. Note: Collection of the penalty charge of any non-enrolled contractor(s) of any tier does not provide automatic coverage in the program.
- If any Contractor or any eligible Subcontractor enrolls in the OCIP more than 30 days after its start date, it will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation.

Eligible Subcontractor includes all Subcontractors providing or subcontracting for direct labor on any Designated Project (see definition of ineligible Subcontractors below).

Ineligible Subcontractor includes (but is not limited to) subcontractors performing any type of environmental remediation work (example: asbestos or underground tank removal), consultants, suppliers (that do not perform or subcontract installation), vendors, materials dealers, guard services, janitorial services, truckers (including trucking to any Designated Project where delivery is the only scope of work performed), employee leasing companies, temporary labor services and other temporary project services. However, such Employee leasing and temporary labor service companies can be insured

by the OCIP but must be submitted for review to the OCIP administrator prior to acceptance.
A Designated Project is a project designated and approved by the Owner as a Designated Project and, enrolled by the OCIP Administrator with the insurance company. This project is a Designated Project. A Designated Project includes operations necessary or incidental to the Work. The Contractor's/Subcontractor's regularly established workplace, plant, factory, office, shop, warehouse, yard or other property even if such operations are for fabrications of materials to be used at the job site or training of apprentices will be considered off-site and not covered by the OCIP.
Unless otherwise directed by the Owner, the Contractor, eligible Subcontractors and all Subcontractors not enrolled in the OCIP, will be required to maintain at least the insurance coverages set forth in paragraph C.2 and are required to participate in the MSCAA OCIP Safety Program. Contractor will promptly furnish the Owner, or their designated representative, certificates of insurance giving evidence that all required insurance is in force.

C.1.2. Contractor Insurance Cost Identification

The Contractor and eligible Subcontractors will exclude their cost for all insurance coverages to be provided by the Owner for the work at any Designated Project from their bid. The Contractor and each Subcontractor of any tier warrant that all insurance premium calculations for work performed at the Designated Project Site have been correctly identified and removed from their bids.

C.1.3. Change Order Pricing

Contractor and all enrolled Subcontractors will price each change order to exclude the cost of insurance.

C.1.4. Assignment of Return Premiums

The Owner will be responsible for the payment of all premiums associated solely with the OCIP and will be the sole recipient of any dividend(s) and/or return premium(s) generated by the OCIP. In consideration of the Owner's provision of said coverages under the OCIP program, the Contractor and eligible Subcontractors agree to:

1) Exclude all applicable insurance costs for coverage provided by the Owner associated with their contract work and excluded from their bid; and cooperate with the OCIP Administrator in the administration of the OCIP.
2) Irrevocably assign to and for the benefit of the Owner, all return premiums, premium refunds, premium discounts, dividends, retentions, credits, and any other monies in connection with the OCIP insurance. Contractor also assigns its right of cancellation of all insurance policies provided by Owner. Contractor agrees to evidence such assignment by executing and delivering the Form-2. Contractor further agrees to require each eligible Subcontractor to execute the assignment on the Form-2, for the benefit of the Owner.

C.1.5 Audit of Contractor and/or Subcontractor Payroll

For insurance purposes, the Contractor and all tiers of Subcontractors agree to keep and maintain accurate and classified records of their payroll for operations at any Designated Project. Contractor and all eligible Subcontractors agree to furnish a copy of the Monthly Payroll Reporting Form, Form 5, to the OCIP Program Administrator by the 20th of each month and attach a copy of the Form-5, to their monthly pay application. If this report (Form-5) is not attached to the monthly pay application, payment may be held until the report is received.

The Contractor and all eligible Subcontractors will permit the Owner and its representative to examine and/or audit its books and records pertaining to any Designated Project. Contractor and eligible Subcontractor will also provide any additional information to the Owner or its appointed representatives as may be required. At the end of each contract, an audit may be performed of the reported payroll by the OCIP Carrier.

Upon Final Completion of each contract, the Contractor and eligible Subcontractors will furnish a completed and signed Form-4 - Notice of Anticipated Completion Form (a copy of which is attached hereto as "Form-4") to the OCIP Administrator, together with all required documentation.

Demobilization payments will not be released until all closeout documentation has been received and approved.

C.1.6. OCIP Deductibles

General Liability:
If a claim arises under the Owner provided Commercial General Liability OCIP policy from the partial or sole negligence of a Contractor or Subcontractor, or for violation of any OCIP Safety Requirements, such Contractor or Subcontractor shall be responsible for reimbursing the Owner's deductible to the extent of their respective negligence, as determined solely by owner, up to a maximum of $10,000 per occurrence per Contractor.

Builders Risk:
The Contractor shall be responsible for a deductible of $25,000 for each and every loss.

C.1.7. Termination/Modification of the OCIP

The Owner reserves the right to terminate or to modify the OCIP or any portion thereof. To exercise this right, the Owner will provide thirty (30) days advance written notice of termination or material modification to the Contractor and all eligible Subcontractors covered by the OCIP. In such event, the Contractor will promptly obtain appropriate replacement insurance coverage acceptable to the Owner. Written evidence of such insurance will be provided to the Owner prior to the effective date of the termination or modification of the OCIP coverages. The reasonable cost of such replacement insurance will be reimbursed by the Owner to the Contractor.

SPECIAL NOTE: The Contractor and eligible Subcontractors who have completed their work at any Designated Project and whose insurance as provided by MSCAA OCIP has been terminated, and who returns to the site to perform warranty work does so under its own insurance coverages and not under those provided by MSCAA OCIP.

C.2 Contractor Provided Coverages

All insurance obtained by the Contractor pursuant to this Agreement shall be written by insurance companies licensed to do business in Tennessee and acceptable to Owner.
Prior to the commencement of any operations by or on behalf of the Contractor relating to the Project, and with respect to any and all such operations, the Contractor shall procure, maintain and provide to Owner and the Program Manager:

1) Evidence of Contractor's **Commercial Automobile Liability Insurance**. A certificate of insurance and copy of endorsement shall be provided as evidence of:
   a) Coverage for Owner, their officers, directors and employees as additional insureds.
   b) Coverage to apply to all liability arising out of the ownership or use of all vehicles owned by, hired by, or used on behalf of the Contractor.
   c) Waiver of Subrogation to be provided in favor of the Owner, the Design Professional, the Program Manager and their officers, directors, and employees.
   d) If hazardous materials or waste are to be transported, the policy will be endorsed with the MCS-90 endorsement in accordance with the applicable legal requirements.

   This insurance shall be for an amount not less than $1,000,000 combined single limit liability.

2) Evidence of Contractor's **Workers' Compensation and Employer's Liability Insurance**. A certificate of insurance or, at Owner's request, a certified policy copy shall be provided as evidence of:
   a) Coverage for claims for damages arising out of bodily injury, occupational sickness or disease or death of Contractor's employees under any applicable workers' compensation statute or any other applicable employers' liability law. Certificate of insurance or policy must clearly identify that coverage applies in the state of Tennessee.
   b) A waiver of subrogation by the insurer against the Owner the Design Professional, the Program Manager and their officers, directors and employees.
   c) This insurance shall include Employer's Liability limits of not less than $1,000,000 bodily injury each accident, $1,000,000 bodily injury by disease each employee and $1,000,000 bodily injury by disease in the aggregate.
   d) All Enrolled Contractors must provide Workers' Compensation and Employer's Liability insurance covering all employees for injuries that occur AWAY from the Designated Project Site or after OCIP termination, expiration, or cancellation.
   e) Ineligible subcontractors or subcontractors not enrolled must provide coverage for ALL operations.

3) Evidence of Contractor's **Commercial General Liability Insurance**. Certificate of insurance and copies of endorsements to Contractor's primary commercial general liability policy and shall be provided as evidence of:
   a) Coverage for Owner and the Design Professional, Program Manager, their officers, directors and employees as additional insureds as respects claims or liabilities arising from or connected with Contractor's work, operations and completed operations. The additional insured endorsements shall be at least as broad as the ISO CG 2010 (1001) during the course of construction and CG2037 (1001) until the expiration of the statute of repose, or its carrier equivalent.
   b) Coverage shall be primary and non-contributing with any coverage Owner maintains in its own name and on its own behalf.
   c) Coverage shall be written on an occurrence coverage form, with coverage at least as broad as that provided under the current edition of the ISO Commercial General Liability coverage form, CG 0001. Other than standard exclusions applicable to pollution, asbestos, mold, employment practices, ERISA and professional liability, there shall be no limitations or exclusions beyond those contained in the standard policy forms which apply to property damage, products and completed operations, contractual liability or construction defects. In addition to procuring and maintaining this insurance during the duration of the contract, contractor agrees to continue to procure and maintain products and completed operations liability insurance coverage for a minimum of six (6) year(s) after the date the contract is completed or terminated or in accordance with the applicable statute of limitations under state law, whichever is longer.
   d) Waivers of subrogation by insurers against Owner, Design Professional, Program Manager and their officers, directors and employees.
   e) Contractual Liability Insurance applicable to the indemnification agreement contained in Section 21.01 of this Agreement.
   f) The required amounts of primary Commercial General Liability Coverage in the amount of:

$1,000,000	Bodily Injury and Property Damage Limit for each occurrence
$1,000,000	Personal & Advertising Injury
$2,000,000	General Aggregate (Annual)
$2,000,000	Products/Completed Operations Aggregate (annual)

   The general aggregate limit shall apply separately to each project.

   g) All Enrolled Contractors must provide General Liability insurance covering third-party losses that occur AWAY from the Project Site (including products liability for any product manufactured, assembled or otherwise worked upon away from the Designated Project Site) or after OCIP termination, expiration or cancellation.
   h) Ineligible contractors or subcontractors not enrolled must provide coverage for ALL operations.
   i) The policy will be endorsed to exclude any "Designated Project" for onsite coverage only, if you are a participant in the OCIP.

4) Evidence of Contractor's **Excess or Umbrella Liability Insurance**. Certificate of insurance and copies of endorsements to Contractor's Excess or Umbrella liability policy and shall be provided as evidence of this excess liability or umbrella insurance with an annual an aggregate amount of not less than $25,000,000 for the Contractor and $1,000,000 limits required of subcontractors unless otherwise stated in the Contract Documents, and shall be excess and follow form over primary coverages included herein. Such coverage will be excess and "drop down" for defense and indemnity in the event of exhaustion of the underlying insurances of Commercial, Automobile, Liability, Employer's Liability and the Commercial General Liability policies.

5) Evidence of **Professional Liability Insurance** (If Applicable): $1,000,000
   Per Claim and in the Aggregate:
   All professional services firms must provide professional liability insurance appropriate for their profession. Architectural and engineering firms must provide coverage for liability arising out of design errors and omissions. The policies shall provide a three (3) year extended reporting period.

6) Evidence of **Contractors Pollution Liability Insurance** (If Applicable):
   Each Occurrence Limit and in the Aggregate: $3,000,000
   Coverage applies to third-party bodily injury and property damage claims (including natural resource damage), and clean-up costs, caused by pollution conditions which result from covered operations performed by, or on behalf of, contractors and subcontractors of all tiers at the Designated Project Site. Coverage shall apply to claims for mold and

fungus damage that result from the work as well as gradual and sudden and accidental pollution incidents arising from activities of the contractors working at the project site.
Coverage must be evidenced for on-site and off-site transportation which may result in a pollution incident/event and non-owned disposal site coverage (if applicable to the project).
The policy shall be endorsed to provide a Waiver of Subrogation in favor of the Owner, Design Professional and Program Manager. In addition, the Owner, their officers, directors and employees shall be included as Additional Insureds.

7) Evidence of **Contractor's Equipment Insurance**:
The Contractor is responsible for their tools and equipment including, but not limited to, construction trailers and their contents and temporary scaffolding at the project site, whether owned, leased, rented or borrowed. Contractor acknowledges and agrees that the Owner will not be responsible for any loss or damage to their tools and equipment. If insured, the Contractor's insurance policies covering tools and equipment will include a waiver of subrogation and any other rights of recovery in favor of the Owner. If uninsured, the Contractor will hold harmless the Owner, Program Manager and Design Professional for loss or damage to their tools and equipment.

8) **Aircraft/Aviation Liability Insurance** (If Applicable): Not Applicable
Each Occurrence Limit and in the Aggregate (including passenger liability):
The operator of an aircraft of any kind, whether manned or unmanned, must maintain liability insurance covering bodily injury and property damage on a Combined Single Limit basis. If non-employee passengers are carried, there cannot be a per-passenger sublimit.
Prior to commencing operations, the operator must provide the Owner with a certificate of insurance naming the Owner, their officers, directors and employees as additional insureds on a primary and non-contributory basis. Operator and their insurer(s) must hold the Owner harmless and waive subrogation with respect to damage to the aircraft
If aircraft is to be used to perform lifts at the Designated Project Site, a "slung cargo" endorsement must be included to cover the full replacement value of any equipment being lifted.

NOTE: If the Contractor and / or eligible Subcontractor participating in the OCIP choose(s) to have the policy endorsed to include any "Designated Project" site during the construction period, coverage should be Excess and/or Difference in Conditions (DIC) of the OCIP and this cost should not be passed back to the Owner. Inclusion of any "Designated Project" Site on such insurance policies shall not replace the OCIP coverage or otherwise affect the cost identification requirement in paragraph C.1.2.

C.2.2. Contractor's Insurance Primary.

Any coverage applicable to Owner under Contractor's insurance policies shall be primary and non-contributing with any insurance maintained by Owner in its own name and on its own behalf. Copies of endorsements to Contractor's policies shall be provided to Owner.

C.2.3. Cancellation.

All such insurance shall be in form and substance satisfactory to the Owner and shall provide that not less than thirty (30) days' notice of cancellation or non-renewal, other than non-payment of premium which shall be ten (10) days' notice, be provided to Owner. If unavailable, Contractor must provide Owner with thirty (30) days' advance written notice of cancellation, other than non-payment of premium, which shall be ten (10) days' notice. Contractor must notify Owner of any material change or reduction in coverage to the Contractor's insurance policies.

C.2.4. Certificates of Insurance - Contractor Provided Insurance Coverage Requirements

As shown in Section C.2
Description of Operations for contractors participating in the OCIP shall read:
Workers' Compensation and Commercial General Liability coverages shown above do not apply to any Designated Project at the Memphis International Airport.

Additional Insured Wording for Contractors shall read:
Memphis-Shelby County Airport Authority, Program Manager, Design Professional and their officers, commissioners,

agents and employees as now or hereafter exist as respect to the services / work to be performed under this Agreement, for coverages as required by contract.

Additional Insured Wording for Subcontractors shall read:
For Subcontractors participating in the OCIP
The Memphis-Shelby County Airport Authority, Program Manager, Design Professional and their officers, commissioners, representatives, agents and employees ATIMA are additional insureds for coverages as required by contract 08-1260-05.
For Subcontractors not participating in the OCIP
The Memphis-Shelby County Airport Authority, Program Manager, Design Professional and their officers, commissioners, representatives, agents and employees ATIMA and Awarding Contractor are additional insureds as respect to the services / work to be performed under this Agreement for coverages as required by contract 08-1260-05.

IN THE EVENT THAT THE LAW OF THE STATE IN WHICH THE PROJECT IS LOCATED (OR APPLICABLE LAW) LIMITS THE ADDITIONAL INSURED COVERAGE THAT OWNER MAY REQUIRE FROM CONTRACTOR AND SUBCONTRACTORS, THEN CONTRACTOR AND SUBCONTRACTORS SHALL BE REQUIRED TO OBTAIN ADDITIONAL INSURED COVERAGE TO THE FULLEST EXTENT OF COVERAGE AND LIMITS ALLOWED BY APPLICABLE LAW AND THIS CONTRACT SHALL BE READ TO CONFORM TO SUCH LAW.

Filing of Certificates
Certificates of insurance acceptable to the Owner shall be filed with the Owner by furnishing to the OCIP Administrator, prior to commencement of the Work. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment.
A sample is provided of a certificate of insurance is provided in the OCIP Manual.

MSCAA OCIP
c/o Willis Towers Watson National Project Insurance Practice.
Attn: OCIP Administrator
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001

C.2.5. The Right of the Owner to Maintain Insurance.

In the event the Contractor fails to furnish and maintain the required insurance or to furnish certificates of insurance, the Owner shall have the right, at its option, to terminate this Agreement or to take out and maintain such insurance and hold the Contractor liable for the cost. Compliance by the Contractor with the requirements of this Article shall in no way relieve the Contractor from liability under any provision of this Agreement or the Contract Documents.

C.2.6. Other Insurance

Any type of insurance or any increase of limits of liability not described in this section which the Contractor or any Subcontractor requires for their own protection or on account of any statute will be their own responsibility and their own expense. Any type of insurance or any increases of limits of liability not described herein that the Contractor or any Subcontractor requires for its own protection or on account of statute shall be its own responsibility and its own expense. If the Contractor or the Subcontractors maintain any insurance policies covering owned, leased or borrowed, equipment, such policies shall contain a waiver of subrogation against the Owner. Each item must be shown as a line item and approved by the Owner.

C.2.7. Deductibles

The Contractor shall be responsible for the payment of the deductible amounts for any insurance in force pursuant to this Agreement whether such insurance is furnished by the Owner or the Contractor.

C.2.8. Insurance for Project Property While outside the United States and Canada.

If any project property is in transit or is located outside the continental United States or Canada for any reason, Contractor shall arrange to insure such property for its full replacement value separate from the other insurance described herein.

C.2.9. Subcontractors Flow-Down Clause.

Subcontractors of all tiers are subject to the same insurance requirements as Contractor. Contractor shall cause each Subcontractor employed by Contractor to purchase and maintain such insurance and upon request, must promptly furnish Owner with copies of certificates of insurance evidencing coverage for each Subcontractor.

C.2.10. No Representation of Coverage Adequacy.

In specifying minimum Contractor insurance requirements, Owner does not represent that such insurance is adequate to protect Contractor for loss, damage or liability arising from its work. Contractor is solely responsible to inform itself of the types or amounts of insurance it may need beyond these requirements to protect itself. The insurance requirements set forth in minimum amounts shall not be construed to relieve Contractor for liability in excess of such coverage, nor shall it preclude Owner from taking such other actions as is available to it under any other provision of the contract.

C.2.11. Contractor Responsibilities

The Contractor will cooperate with and will require all eligible Subcontractors to cooperate with The Owner and/or the OCIP Administrator with regards to the administration and operation of the OCIP. The Contractor and eligible Subcontractors responsibilities will include, but not be limited to:

1) Compliance with all rules and regulations of the applicable State Insurance Bureau/Board; failure to meet state requirements may result in fines being assessed, and, if this occurs, the Owner shall deduct from monies due or to become due under the provisions of this contract for any applicable fines that are assessed against the Owner, the Contractor or any eligible Subcontractor;
2) Compliance with applicable Construction Safety Program;
3) Provision of necessary contract, operations and insurance information, including verification of current Worker's Compensation Experience Modifier;
4) Cooperation with any insurance company or OCIP Administrator with respect to requests for claims, payroll or other information required under the program;
5) The Contractor and all eligible Subcontractors shall adhere to and perform all reporting requirements as set forth in the Claims Procedures portion of the OCIP Program Manual.

C.2.12. Contractor's Responsibility for its Subcontractors.

The Contractor will include this Exhibit and the Manual with the bid documentation. The Contractor will require that all eligible Subcontractors participate in the OCIP and comply with all rules and procedures as outlined in MSCAA Enrollment Process Summary. It will be the Contractor's responsibility to submit to The Owner and its designated representative all bid documentation for approval. If Contractor fails to comply with this section and any eligible Subcontractors do not enroll in the program, the Owner has the right to retain the 3% of subcontracted work as a penalty from the awarding Contractor/Subcontractor as set out in C.1.2.c.

C.2.13. Approval of Forms and Companies

All insurance described in this Section will be written by an insurance company or companies satisfactory to the Owner and licensed to do business in Tennessee and will be in a form and content satisfactory to the Owner. No party subject to the provisions of this contract will violate or knowingly permit to be violated any of the provisions of the policies of insurance described herein.

C.2.14. Coverage to be provided by Contractor during Warranty Period

During the period following the final acceptance date and prior to expiration of the warranty period hereunder, Contractor

will maintain in full force and effect all insurance as specified in paragraph C.2 covering all Work performed during such period.

C.3. Waiver of Subrogation and Waiver of Rights of Recovery

Owner Controlled Insurance Program
Except as respects any deductibles identified above, Owner waives all rights of subrogation and recovery against the Contractor and all Subcontractors of all tiers to the extent of any loss or damage, which is insured under the OCIP. Except as respects the deductibles identified above, Contractor waives all rights of subrogation and recovery against the Owner, Design Professional and Program Manager, other Contractors and Subcontractors of all tiers to the extent of any loss or damage, which is insured under the OCIP. The Contractor and each Subcontractor will require all Subcontractors to similarly waive their rights of subrogation and recovery in each of their respective construction contracts with respect to their work on any Designated Project.

Contractor Provided Coverages
Contractor waives all rights of subrogation and recovery against the Owner, Design Professional and Program Manager, to the extent loss or damage is insured under the Contractor's policies. The Contractor and each Subcontractor will require all Subcontractors to similarly waive their rights of subrogation and recovery in each of their respective construction contracts with respect to their work on any Designated Project.

C.4. Project Safety Administration
It is the responsibility of the Contractor to maintain total control of safety to ensure that its employees and the general public will be provided an environment free of recognized hazards during construction activities. In carrying out this policy it is clear the only accepted level of performance is to be "Incident Free" on this project each and every day.

A. Project Safety Manual
The safety requirements of any Designated Project Safety Manual are a supplementary document to all Government rules, codes and regulations. It is understood that the ultimate responsibility for providing a safe place to work rests with each individual Contractor. All Contractors are responsible for full compliance with the requirements and standards referenced in the manual.

B. New Employee Orientation
Each new Contractor or Subcontractor employee will be required to attend an orientation program. This orientation is designed to communicate all project specific safety policies, procedures, and expectations of "the Safety Team" in regard to the construction of any Designated Project.

C. Contractor Safety Program Review
To proactively monitor the safety, health and environmental performance of Contractors and Subcontractors the Owner and/or his Representative, will be conducting a periodic review of Contractor or Subcontractor safety programs. This will be a formal process, which will be done with or without advanced notice. Upon completion of the Safety Program Review, a list of recommendations will be provided to the Contractor or Subcontractor. There will be a timeline developed and agreed upon for the purpose of abating any deficiencies in the Contractor or Subcontractor safety program.

C.5. No Release
The provision of the OCIP by The Owner will in no way be interpreted as relieving the Contractor or any Subcontractor of any other responsibility or liability under this agreement or any applicable law, statute, regulation or order.

C.6. CIP Exclusion Limitation
If any party's insurance includes an exclusion tied to Controlled Insurance Programs (a.k.a. "wrap-ups" or "CIPs") or other project-specific insurance, it may apply only to the extent of coverage available to that party under the CIP or other Sponsor-provided insurance. Such exclusion may not be broader than what the CIP or such other Sponsor-provided insurance actually covers.

MSCAA OCIP IV

An Owner Controlled Insurance Program Manual for Construction Projects

Revision	Revision Summary	Date
0	First Issue for OCIP IV Projects	4-26-17
1	Update to Zurich Claims Team	4-5-18
2	Update to Zurich Claims Team	10-18-18

MSCAA OCIP – ENROLLMENT SUMMARY

Contract Bid – All Contractors/Subcontractors

Bid package will be furnished to bidders
1. All eligible Contractors/Subcontractors of every tier will exclude their cost of insurance for coverage provided by the Owner from their bid. Contractors and eligible Subcontractors should discuss the OCIP with their insurance agent or consultant to assure that the OCIP insurance identification cost is accurate.
2. Contractors and Subcontractors at any tier shall not charge any eligible Subcontractor for its participation in the OCIP.
3. Workers' Compensation – Tennessee Payroll Rules are applicable to WC payroll. First dollar coverage is given to all Contractors on WC.
4. General Liability – Mandatory deductible not to exceed $10,000 will apply to any loss as described in the OCIP manual. 5% credit will be applied to Contractor's premium for this deductible

Contract Award

Once notification of contract award has been received, all eligible Contractors/Subcontractors of every tier will complete and submit Form 2 with the required certificate of insurance. Any Contractors or Subcontractors who enroll in the OCIP 30 days after their start date will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation. The OCIP Administrator will:

1) Assign a location code for this contract, forward the **Form 2** to the insurance carrier for enrollment into program
2) Issue a certificate of insurance which will reflect all OCIP coverages. The original copy will be sent to the enrolled contractor/Subcontractor with a copy to their awarding contractor.

Change Order

Contractor and all enrolled Subcontractors will price each change order to exclude the cost of insurance provided by the Owner.

Monthly Payroll Reporting

The Enrolled Contractor/Subcontractor will receive a Payroll Request e-mail from the following email address "On behalf of Willis Admin(noreply-144@servmax.com)" at the beginning of each month during construction reminding them to complete their payroll report via the link in the email by the payroll due date. The payroll link will expire in 30 days. If the payroll link expires please contact your Willis Towers Watson CIP Administrator or call the toll free number (844) 260-9015 to receive an updated link.

If Contractor/Subcontract receives additional contracts

Once the contractor/Subcontractor has enrolled in the OCIP, all additional contract bids must also exclude the Contractor's cost of insurance for coverage provided by the Owner. **Form 2** must be submitted to the OCIP Administrator to receive confirmation of enrollment in the OCIP for the additional contract. (Contact the OCIP Administrator if you have questions). The OCIP Administrator will:

1) Assign a location code for this contract, forward the **Form 2** to the insurance carrier for enrollment into program
2) Issue a certificate of insurance which will reflect all OCIP coverages. The original copy will be sent to the enrolled contractor/Subcontractor, a copy to their awarding contractor.

When Contractor/Subcontract reaches Substantial Completion

Notice of Anticipated Completion - **Form 4** – Prior to completion of all work being performed under the contract. This will initiate Closeout Procedures. Payroll and Receipts may be audited.

When Contractor/Subcontractor has completed the Work

Contractor should notify their insurance agent/broker to remove any exclusion for this Designated Project from their primary policies.

Claims

All Contractors/Subcontractors must follow claims rules and procedures outlined in the MSCAA OCIP Manual.

Safety

All Contractors/Subcontractors must follow safety rules and procedures outlined in the MSCAA OCIP Site Specific Safety Plan.

Notice to All Contractors/Subcontractors

Failure to follow the Enrollment or Claims procedures outlined in MSCAA OCIP Manual may result in fines being assessed by the State Bureau/NCCI, State's Workers' Compensation Commission or the Owner against the Contractor or Subcontractor. If the Owner or Carrier is assessed fines due to Contractor's or Subcontract's failure to follow State rules or regulations, the Owner will deduct from monies due or to become due for any applicable fines.

CHANGES TO ANY OCIP REQUIREMENT OR PROCEDURE MUST BE APPROVED BY THE OWNER AND OCIP ADMINISTRATOR. NO CONTRACTOR OR SUBCONTRACTOR HAS THE AUTHORITY TO AMEND THE OCIP REQUIREMENTS.

INTRODUCTION

This manual identifies, defines, and assigns responsibilities related to the administration of the Memphis-Shelby County Airport Authority (MSCAA) Owner Controlled Insurance Program (OCIP).

This manual:

- Describes the OCIP and details the insurance-related responsibilities of the various parties involved.
- Provides a basic description of the OCIP structure and operation, with an overview of coverage provided by the OCIP and guidelines for carrying out specific administrative and audit procedures.
- Provides answers to questions that are likely to arise during the course of the project.

Because it is impossible to anticipate every question or situation that may arise, the directory lists those involved in the administration of the OCIP and their areas of expertise. Please feel free to call with any questions.

This Manual will be updated as changes dictate during the course of this project.

NOTE

- This Manual does not, and is not intended to, provide coverage interpretations or complete information about coverages.
- The terms and conditions of the insurance policies govern how coverage is applied.
- The information herein is not intended to alter any provisions of the actual contract documents of the Contractors, and if any such conflict occurs, the contract documents will govern.

CHANGES TO ANY OCIP REQUIREMENT OR PROCEDURE MUST BE APPROVED BY THE SPONSOR AND OCIP ADMINISTRATOR. NO CONTRACTOR OR SUBCONTRACTOR HAS THE AUTHORITY TO AMEND THE OCIP REQUIREMENTS.

ADMINISTRATION

Program Management

OCIP Program Coordinator

Willis Towers Watson
John Shorten
8285 Tournament Drive, Suite 130
Memphis, TN 38125

Phone: (901) 248-3102
Fax: (901) 248-3101
E-mail: john.shorten@willistowerswatson.com

OCIP Program Unit Manager

Willis Towers Watson National Project Insurance Practice
Becky Hubert
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Phone: (972) 715-6239
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OCIP Administration

Willis Towers Watson National Project Insurance Practice
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On-Site Safety

Willis Towers Watson
Wes Shelby
4225 Airways Blvd.
Memphis, TN 38116

Phone: (901) 344-1659
Fax: (901) 345-6636
Cell: (901) 604-2136
E-Mail: wes.shelby@willistowerswatson.com

Claims Management

Zurich North America

PO Box 968077
Schaumburg, IL 60196-8077

FAX NUMBER FOR REPORTING CLAIMS: **(877) 967-2567**
GENERAL CLAIMS FAX NUMBER: **(615) 872-1303**
GENERAL PHONE NUMBER: **(800) 366-8366**

Leadership	Title	Phone	Email
Tammy Fike	GL Sr. Specialist	(404) 851-3616	tammy.fike@zurichna.com
Ginny Howard	WC Team Manager	(615) 872-1315	ginny.howard@zurichna.com
Karen Kingo	WC Pension Manager	(847)413-5868	karen.kingo@zurichna.com
Vea Storey	WC Claims Specialist	(615) 872-1241	veatrice.storey@zurichna.com
Patricia Painter	WC Claims Specialist	(615) 391-7501	patricia.painter@zurichna.com
Nat Woodruff	Claims Customer Service Executive	(404) 851-3278	nathaniel.woodruff@zurichna.com

Insurance Policy References

Workers Compensation

Insurance Company: Zurich American Insurance Company
Master Policy Number: WC 0183275-00

Each Contractor and/or Subcontractor will be issued their own Workers' Compensation Policy

Part One - Workers' Compensation	TN State Limits
Part Two - Employers' Liability	
Bodily Injury by Accident – Each Accident	$1,000,000
Bodily Injury by Disease – Policy Limit	$1,000,000
Bodily Injury by Disease – Each Employee	$1,000,000
Part Three – Other States Insurance	
All States except those listed in Part One and Monopolistic States (OH,ND,WA,WY)	

Commercial General Liability

Insurance Company: Zurich American Insurance Company
Master Policy Number: GLO 0183276-00

General Aggregate Limit (Other than Products – Completed Operations)	$4,000,000
Product-completed Operations Aggregate Limit	$4,000,000
Personal and Advertising Injury Limit (Any One Person or Organization)	$2,000,000
Each Occurrence Limit	$2,000,000
Fire Legal Liability (Any One Fire)	$250,000
Medical Expense Limit (Any One Person)	$10,000

Umbrella Liability

Insurance Company: ACE Property and Casualty Insurance Company
Master Policy Number: XCQ G46622029 001
Limits: $25,000,000 excess of primary

Excess Liability – Layer 1

Insurance Company: Allied World National Assurance Company
Master Policy Number: 0310-6256
Limits: $25,000,000 excess of $25,000,000

Excess Liability – Layer 2

Insurance Company: Endurance Risk Solutions Assurance Co.
Master Policy Number: XSC30000293300
Limits: $25,000,000 excess of $50,000,000

Excess Liability – Layer 3

Insurance Company: Westchester Fire Insurance Company
Master Policy Number: G46621116001
Limits: $25,000,000 excess of $75,000,000

Program Definitions

Owner Controlled Insurance Program (OCIP)	The Insurance Program under which Workers' Compensation, Employer's Liability, Commercial General Liability and Excess Liability are procured or provided on a project "wrap-up" basis for Contractors/Subcontractors(s) of any tier, who have been properly enrolled, while performing operations on a designated Project Site for Memphis-Shelby County Airport Authority.
Insured	The Memphis-Shelby County Airport Authority, Contractors(s) and Subcontractors of any tier who are enrolled in the OCIP and who have been named in a policy, certificate of insurance, or advice of insurance.
Enrolled Contractors	"Enrolled Contractors", mean "Eligible Contractors" who, prior to the commencement of their work on the covered project, have completed the appropriate enrollments documents for the "designated project site".
Insurer	Insurance Company, as identified in the Insurance Policy Reference section.
OCIP Coordinator and Administrator	The firms responsible for the insurance broker and administration of the OCIP.
OCIP Safety Consultants	These representatives are employees of the Insurer and Willis Towers Watson who will provide safety consulting services to MSCAA and its contractors enrolled in the OCIP.
Project Description	All Designated Projects identified and approved by the Owner and on file with the Insurance Company.
On-Site Activities/ Designated Project	Zurich's designated project means: "The project shown in this Schedule, including operations on the project site or location that are necessary or incidental to the project as described in contract documents. "Designated Project" includes the work site(s) associated with such "designated project(s)" and any offsite staging areas, as long as they are dedicated solely to the "designated project(s)" and the sponsor agrees to provide coverage. Also included are those areas immediately adjacent to the "designated projects", including boundaries of local streets or public easement, in which the enrolled subcontractors at any tier perform work under their respective contracts." The OCIP does not provide insurance coverage for permanent yards or other locations of any Contractors/Subcontractors, except as specifically requested by Contractors and, if accepted by insurer, endorsed to the policy.
Eligible Contractors	**Insured by the OCIP**: Eligible Contractors include all contractors providing direct labor on the Designated Project (see definition of ineligible contractors below). Temporary labor services and leasing companies are to be treated as subcontractors.
Ineligible Contractors	**Not insured by the OCIP**: Includes (but is not limited to) contractors performing any type of environmental remediation work (example: asbestos or underground tank removal), consultants, suppliers (that do not perform or subcontract installation), vendors, materials dealers, guard services, janitorial services, truckers (including trucking to any Designated Project where delivery is the only scope of work performed), Blasting Contractors or Any Person or organizations that manufactures or fabricates products or components outside the designated project that does not also install the product or component at the designated project, employee leasing companies, temporary labor services and other temporary project services. However,

such Employee leasing and temporary labor service companies can be insured by the OCIP but must be submitted for review to the OCIP administrator prior to acceptance.

Certificate of Insurance Written evidence of the existence of coverage terms of a particular insurance policy.

COVERAGE SUMMARY

The OCIP coverage applies only to work performed under the Agreement at any Designated Project Site for eligible enrolled contractors. Contractor and Subcontractors must provide their own insurance as detailed in the contract.
Through a combination of insured and self-insured insurance programs the Owner, at its sole expense, will provide and maintain in force the types of insurance listed in subsection (1) through (4) below as a part of the OCIP for Contractor and eligible Subcontractors who have been enrolled. Contractor and eligible Subcontractors enrolled in the OCIP agree that the insurance company policy limits of liability, coverage terms and conditions shall determine the scope of coverage provided by the OCIP.
This section provides a brief description of the coverages provided under the OCIP. The Contractor shall refer to the actual policies for details concerning coverages, exclusions and limitations. Policies are available for review upon request.
While the OCIP is intended to provide uniform coverages and reasonable limits, the OCIP is not intended to meet all the insurance needs of the Contractor and all eligible Subcontractors who have been properly enrolled. Contractor and eligible Subcontractors enrolled in the OCIP agree that the will discuss the OCIP with their insurance agent or consultant to ensure that proper coverages are maintained. It is the contractors' responsibility to notify their agent that the work performed on-site will be insured under an OCIP.

1) **Workers' Compensation and Employers' Liability Insurance** (Off-site operations are excluded unless locations are scheduled & approved by the Owner and OCIP insurance carriers) with Statutory Limits with All States Endorsement and minimum Employer's Liability Limits will be provided as follows:
   a) $1,000,000 Bodily Injury with Accident - Each Accident;
   b) $1,000,000 Bodily Injury by Disease - Policy Limit
   c) $1,000,000 Bodily Injury by Disease - Each Employee; and

   Each Enrolled Contractor will be issued a separate Workers' Compensation policy. The premium and loss experience on the Project Site will be reported to the appropriate rating authorities in the normal manner for use in calculating Enrolled Contractors' future experience modifiers. OCIP loss experience will impact Contractor's future insurance costs and, therefore, compliance with the project safety guidelines will directly benefit all Contractors.
2) **Commercial General Liability Insurance**, (Off-site operations are excluded unless locations are scheduled & approved by the Owner and OCIP insurance carriers) will be provided on an "occurrence" form under a single liability policy. Certificates of insurance will be provided to the Contractor and all tiers of eligible Subcontractors reflecting the following Limits of Liability, Coverages, and Terms:
   a) Limit of Liability: Limits of Liability Shared by all Enrolled Contractors

General Aggregate Limit (Other than Products – Completed Operations)	$4,000,000
Product-completed Operations Aggregate Limit	$4,000,000
Personal and Advertising Injury Limit (Any One Person or Organization)	$2,000,000
Each Occurrence Limit	$2,000,000
Fire Legal Liability (Any One Fire)	$250,000
Medical Expense Limit (Any One Person)	$10,000

   b) Coverage and Terms:
      i) Occurrence Basis;
      ii) Products;
      iii) Contractual Liability specifically designating the indemnity provision of this agreement as an insured contract;
      iv) Completed Operations (Six Year Term);
      v) Independent Contractor/Subcontractor's Liability;
      vi) Personal Injury; Explosion, Collapse, and Underground (X, C, U) exclusion deleted;
      vii) Coverage limited to any Designated Project;
      viii) General Aggregate Limits will apply per project and annually;
      ix) Products and Completed Operations Aggregate Limit applies once or all projects and applies once for the policy period and extended completed operations period combined; and

x) Policy Exclusions include (but are not limited to) asbestos, pollution, mold, professional liability, employment practices, EIFS, impaired property and work or operations performed away from any Designated Project Site.

c) If a claim arises under the Owner provided Commercial General Liability OCIP policy from the partial or sole negligence of a Contractor or Subcontractor, or for violation of any OCIP Safety Requirements, such Contractor or Subcontractor shall be responsible for reimbursing the Owner's deductible to the extent of their respective negligence, as determined solely by owner, up to a maximum of $10,000 per occurrence per Contractor.

d) The limits of liability detailed under 2) a) apply to construction operations within the property boundary of the applicable Airport under the management of MSCAA and as per the issued policies' definitions.

3) **Umbrella and Excess Liability Insurance** (Off-site operations are excluded)
   a) Limits of Liability Shared by all Enrolled Contractors
      i) $100,000,000 per Occurrence
      ii) $100,000,000 Aggregate
      iii) $100,000,000 Products / Completed Operations Aggregate

4) **Builder's Risk Insurance** will be provided on "All-Risk" coverage on a replacement cost basis, subject to the limits of the insurance policy. This insurance will include the interests of the Owner the Contractor and all tiers of Subcontractors in the Work. The Builders Risk policy will not provide coverage against loss by theft or disappearance of any materials (unless the materials are to be incorporated into the Project), tools, or equipment of the Contractor or any tier of Subcontractor, or any other person furnishing labor or materials for the Work. The Contractor shall be responsible for a deductible of $25,000 for each and every loss.

ACCIDENT REPORTING AND CLAIMS PROCEDURES

When accidents happen, everyone needs to work together. Even though the Contractors and each Subcontractor has instituted tough safety measures, work-related accidents are bound to occur. When they do, the OCIP Insurers stand ready to serve the Contractors and Subcontractors, but they need help if they are to perform this service in the most effective and efficient manner.

Each Contractor/Subcontractor should have the claims procedures and emergency numbers posted on the jobsite and in all vehicles.

The Insurer will have a claims adjuster available to handle all Commercial General Liability and Workers' Compensation claims.

The Insurer will arrange for legal counsel to handle all lawsuits emanating from the project.

Never discuss any accident or claim with anyone except authorized representatives of MSCAA, Contractor, the Insurer(s), and the Owners Insurance Broker or Law Enforcement agencies.

MSCAA Emergency Procedures (Serious Injuries)

1. Contact MSCAA Emergency Dispatch at **(901) 922-8333 (DO NOT call 911)**. Specific directions should be given to the accident scene. If the accident occurred in the SIDA area, give location in relation to an active taxiway/runway. If outside the SIDA, give location relative to a street or construction gate. Explain the extent of injuries.
2. Notify the on-site OCIP Safety Coordinator, Wes Shelby, (901) 604-2136 (cell).
3. Methodist South Hospital Emergency Room, 1300 Wesley Drive, Memphis, TN, will be used (901) 516-3700, the decision on the treating medical facility will be made by the EMT, in serious cases, the Med Trauma Center may be used.
4. Contractors must have currently qualified First Aid personnel on site at all times. First Aid supplies must be readily available and maintained, including rubber gloves to protect First Aid personnel against blood borne pathogens, etc.
5. After the call for emergency unit is made to MSCAA, the contractor should send escorts to all locations where the emergency unit could enter the site.
6. If the injured employee does not speak English, send a good interpreter to the treating medical facility.
7. The Contractor should provide the Medical Facility with a completed Authorization For Treatment form (sample provided in the OCIP Manual).

A. Workers' Compensation Claims

1. Seek immediate medical attention for the injured person(s).
2. Immediately notify your supervisor and project manager of the situation.
3. Notify the on-site OCIP Safety Coordinator, Wes Shelby, (901) 604-2136 (cell). If you cannot reach Wes, please leave a voice mail message.
4. Complete a **First Report of Injury form** and the **Claim Reporting Cover Sheet** (include appropriate Location Code) and forward to **Zurich Insurance Company** via fax **877-967-2567** or email usz_carecenter@zurichna.com immediately. If not possible, then send before the end of the business day.
5. MSCAA the Contractor's safety representative or designated person will transport the injured worker to

Concentra Medical Center
2831 Airways Boulevard
Suite 102
Memphis, TN 38132
Phone: (901) 348-0200
Hours: 8a.m. to 8p.m. (Mon. – Fri.)

If accident occurs and Concentra Medical Center is not open:

Methodist South Hospital
1300 Wesley Drive
Memphis, TN 38116
Phone: (901) 516-3700
24 Hours, 7 days per week

Or

Baptist Memorial Hospital DeSoto
7601 Southcrest Parkway
Southaven, MS 38671
Phone: (662) 349-4000
24 Hours, 7 days per week

6. Complete the **Accident Investigation Form** and forward it along with the **Claim Reporting Cover Sheet** to Wes Shelby, OCIP Safety Coordinator (e-mail: Wes.Shelby@willis.com, fax: (901) 345-6636, or mail: 4225 Airways Blvd., Memphis, TN 38116 before the end of the day.
7. Receipt of Acknowledgement of Claim and claim number from Zurich Insurance Company will be sent to the contact person provided on the Claim Reporting Cover Sheet and to Wes Shelby, OCIP Safety Coordinator. The claim number should be used for future reference.
8. All medical bills, hospital bills, etc. should be forwarded to Zurich Insurance Company identifying the injured employee and claim number.

After Hours / Close of Business Claims Reporting

1. Call Zurich Insurance Company at (800) 987-3373.
2. Tell the Zurich representative that an injury just occurred and that you need to be routed to the on call specialist to authorize treatment.
3. You will either be placed directly in touch with the on-call person or the on-call person will be paged and will return your call within two hours.
4. If hospital needs to speak with Zurich directly, the contractor will have to supply the hospital name and phone number to Zurich and they will call the hospital directly.

B. Commercial General Liability Claims

Any occurrence involving Bodily Injury or Property Damage to members of the public that is NOT caused by an automobile accident.

1. Seek immediate medical attention for any injured person(s).
2. Immediately notify your supervisor and project manager of the situation.
3. Notify the on-site OCIP Safety Coordinator, Wes Shelby, (901) 604-2136 (cell). If you cannot reach, please leave a voice mail message.
4. Complete the **Claim Reporting Cover Sheet** (include appropriate Location Code) and forward to Zurich Insurance Company via fax **(866) 691-7068** or email usz_carecenter@zurichna.com immediately. If not possible, then send before the end of the business day.
5. Complete the Accident Investigation Form and Claim Reporting Cover Sheet (include appropriate Location Code) and forward to Wes Shelby, OCIP Safety Coordinator, (e-mail: wes.shelby@willis.com, fax: (901) 345-6636, or mail: 4225 Airways Blvd., Memphis, TN 38116.
6. Receipt of Acknowledgement of Claim and claim number from Zurich Insurance Company will be sent to the contact person provided on the Claim Reporting Cover Sheet and to Wes Shelby, OCIP Safety Coordinator. The claim number should be used for future reference.
7. All investigation reports, pictures, medical bills, hospital bills, etc should be forwarded to Zurich Insurance Company identifying the injured individual, claimant and claim number.

C. Duties in the event of a claim or suit

1. Follow the claims reporting procedures above.
2. You must see to it that the OCIP Safety Coordinator, Wes Shelby, is notified promptly of an “occurrence” which may result in a claim. Notice should include:
    a. How, when and where the “occurrence” took place, and;
    b. The names and addresses of any injured persons and witnesses.
3. If a claim is made or “lawsuit” is brought against any insured, you provide written notice of the claim or “lawsuit”.
4. You and any other involved insured must:
    a. Cooperate with the Insurer in their investigation, settlement or defense of the claims or “suit”; and
    b. Assist the Insurer, upon their request, in the enforcement of any right against any person or organization which may be liable to the insured because of injury or damage to which this insurance may also apply.
5. No Insureds will, except at their own cost, voluntarily make a payment, assume any obligation or incur any expense, other than for first aid, without Insurer’s consent.

D. Automobile Claims

Even though no Automobile Liability or Physical Damage coverage is provided under the OCIP, the Contractor/Subcontractor must notify Wes Shelby, OCIP Safety Coordinator, in writing of any automobile accident which could be related to the project. This should be done as soon as possible following the accident.

E. Contractor's Equipment Claims

Even though no coverage is provided under the OCIP for loss of or damage to Contractor's or Subcontractor's owned equipment the Contractor/Subcontractors must notify Wes Shelby, OCIP Safety Coordinator, in writing, of any loss or damage to their equipment at the project. This should be done as soon as possible, following first knowledge of loss or damage.

F. Miscellaneous Claims Notes

1. Any incident that involved injury to persons or property is to be reported to Wes Shelby, OCIP Safety Coordinator's office immediately.
2. Any claims adjuster representing a Contractor/Subcontractor's normal insurer who seeks to come onto Any Designated Project site must obtain written authorization from Wes Shelby, OCIP Safety Coordinator, prior to coming on the site. There will be no exceptions to this stipulation.

FORMS

Zurich Claim Reporting Cover Sheet

Incident Investigation Report

Workers' Compensation Referral Slip for Injured Employees

Authorization to Treat

Form 1 – Notice of Sub-contract Award

Form 2 – Enrollment Form

Form 4 – Notice of Anticipated Completion

Certificate of Insurance

ZURICH CLAIM REPORTING COVER SHEET

Email to: USZ_CARECENTER@ZURICHNA.COM

OR

Fax to: (866) 691-7068

Account Name: **Memphis Shelby County Airport OCIP IV**

Master WC policy #: **WC 0183275-00**
Master GL Policy #: **GLO 0183276-00**

Project Location:_____

Subcontractor/Employer:_____

Subcontractor/Employer Policy Number:_____

Contact Name:_____

Contact Phone Number:_____

Contact Fax Number: _____

Location Code:_____

Injured Worker:_____

Attention Zurich Representative – Please fax the receipt and claim number immediately to the contact above.

Incident Investigation Report

(To be completed within 24 hours by Supervisor at time of incident)

INJURED EMPLOYEE INFORMATION

Employee Name _____ Male ___ Female ___ Date of Birth _____ Ht. ___ Wt. ___

Employee Address _____

Street City State Zip Code Home Phone

Employer Name _____ Address _____

Date of Incident _____ Time _____ AM/PM Jobsite/Area _____

Employee Job Title _____ Length of Employment _____

Weather Condition _____ Shift _____ Supervisor _____

UNSAFE ACTS

What actions caused or contributed to the incident?

- ___ Operating equipment without authority
- ___ Failure to warn/signal
- ___ Failure to secure/lock out/tag out
- ___ Reaching into/servicing equipment in operation
- ___ Making safety devices inoperable
- ___ Used defective equipment
- ___ Took unsafe/improper position
- ___ Horseplay, disruptive actions
- ___ Improper lifting or movement
- ___ Other: _____
- ___ No unsafe action

What actions caused or influenced above unsafe acts?

- ___ Unaware of job hazards
- ___ Inattention to hazards
- ___ Unaware of safe method/procedure
- ___ Tried to gain or safe time
- ___ Influence of fatigue/illness
- ___ Influence of emotions/stress
- ___ Defective vision/bodily defects
- ___ Under influence of alcohol or drugs
- ___ Failure to enforce procedures/rules
- ___ Other:

UNSAFE CONDITIONS

What conditions of tools, equipment, or environment contributed to incident?

- ___ Inadequate guard/barrier/safety device
- ___ Inadequate/improper protective equipment
- ___ Inadequate warning system
- ___ Defective or work tools/equipment materials
- ___ Congestion or restricted area
- ___ Fire or explosion hazard
- ___ Hazardous storage method
- ___ Unsecured against movement
- ___ Lighting/noise/visual obstruction
- ___ Environmental/atmospheric conditions
- ___ Other:
- ___ No unsafe condition

What caused or influenced above unsafe condition?

- ___ Defective/worn from normal use
- ___ Defective/worn from abuse/misuse
- ___ Housekeeping/cleaning failure
- ___ Lack of preventative maintenance
- ___ Inadequate maintenance
- ___ Exposure to environment
- ___ Inadequate purchasing
- ___ Safety inspection failure
- Other:
- ___ Unknown

INJURY/ILLNESS DATA

Describe the nature and extent of injury/illness (body part affected, type of injury, etc.) _____

Was first aid administered? Yes ___ No ___ | If yes, what type and by whom _____

Was employee taken to hospital/clinic? Yes ___ No ___ | If yes, list name, address and phone number of hospital/physician/nurse attending

List any eyewitnesses to the incident and others who might provide information about the incident _____

INCIDENT/ILLNESS EVALUATION

How did the incident occur? Describe in detail the task the employee was doing when injured or became ill. Include specifics such as equipment, structure tools, materials, objects (size, shape, and weight), people involved in the task, positions, distances, rate of movement, sequence of events, etc.

(Attach any additional information comments, documentation of interviews, sketches, pictures, etc. as necessary)

Incident Investigation Report

Incident/Illness Evaluation (continued)

Type of exertion/body motion during injury: Pull ____ Lift ____ Bend ____ Reach ____ Twist ____ Other ____
Was this the employee's regular job? Yes ____ No ____ How much experience does this employee have on this job? ____
Was the employee trained in this job or task? Yes ____ No ____ When was last training on this task? ____
Was this the employee's first job-related injury or illness? Yes ____ No ____ If no, briefly describe previous injuries (date, nature, extent, etc.) ____

Hours of overtime worked in last 24 hours ____ Did this possibly contribute to incident? If so, describe ____

Does a safety rule or policy apply to this task? Yes ____ No ____ If yes, describe rule and how employee followed or violated

Does a specific procedure for task exist? Yes ____ No ____ If yes, describe procedure briefly and if it was followed ____

Is protective equipment required for this task? Yes ____ No ____ If yes, describe equipment, if it was used, if it was adequate/functioned properly, and if the employee(s) were trained on it. ____

Is there possibly any third party which contributed to the incident? (Other contractors, employee, etc.) Yes ____ No ____
If yes, describe. ____

Did any unsafe physical/environmental conditions exist? Yes ____ No ____ If yes, describe conditions (physical , mechanical, electrical, etc.) which contributed to the incident

Is material handling equipment required for this task? Yes ____ No ____ If yes, was it used and did it function properly? ____ ____

Possible actions to be taken to prevent reoccurrence

____ Reinstruction of employee(s) involved	____ Do/revise Job Safety Analysis	____ Repair/replace/modify equipment
____ Preventative instruction of others who do job	____ Revise/establish safety rule	____ Improve clean-up procedure
____ Training of employee(s)	____ Reassign employee to another job	____ Improve inspection procedure
____ Action to improve enforcement	____ Require/replace protective equipment	____ Eliminate/reduce congestion
____ Reprimand/discipline of employee(s) involved	____ Install safety guard device	____ Improve design/construction
		____ Improve environmental conditions

CORRECTIVE ACTION(S) TAKEN OR PLANNED

What was/will be done	By Whom	Estimated Completion Date	Completion Confirmed Date	Completion Confirmed Initials

Incident discussed with employee to prevent reoccurrence? Yes ____ No ____ Date ____
Any disciplinary action taken? Yes No If yes, describe what type.

FOLLOW UP COMMUNICATION

YES ____ NO ____ Incident site reviewed by supervisor with employee (and safety coordinator if applicable.)
YES ____ NO ____ Incident review meeting conducted. Attended by ____
YES ____ NO ____ Employee or supervisor reviewed incident with work group.
YES ____ NO ____ Employee reviewed injury with safety committee
YES ____ NO ____ Project Safety informed of incident

Date of Report _____ Prepared by _____ Title _____

Signature

Reviewed by _____ Superintendent _____

MSCAA OCIP IV

4225 Airways Blvd.
Memphis, TN, 38116

WORKER'S COMPENSATION REFERRAL SLIP
FOR INJURED EMPLOYEES

On-Site EMT: **(901) 922-8333**

Authorized Clinic: *Concentra Medical Center*

2831 Airways Boulevard
Suite 102
Memphis, TN 38132
(901) 348-0200 (Phone)
(901) 348-0046 (Fax)

Clinic Hours: **8 a.m. to 8 p.m. (Mon. – Fri.)**

Authorized After-Hours Clinics:

Methodist South Hospital

1300 Wesley Drive
Memphis, TN 38116
(901) 516-3700

Baptist Memorial Hospital DeSoto

7601 Southcrest Parkway
Southaven, MS 38671
(662) 349-4000

Employee Name: _____ Date:_____

Employer: _____ Employer Policy Number: _____

Location Code (if known): _____ Claim Number (if known): _____

Account Name: **Memphis Shelby County Airport Authority OCIP IV**
Insurer: **Zurich**
Master Policy Number: **WC 0183275-00**

Instructions for medical facility:
The person listed above has been injured on the job. Please provide the employee with medical treatment per OCIP protocol.

MSCAA OCIP IV
Authorization to Treat

Local Office Information
Company Name: _____
Designated Representative: _____
Address: _____
Phone: _____ **Fax:** _____ **E-mail:** _____

Billing Information for Drug Screens

Company Name: ***Zurich North America***
Address: PO Box 968077
Schaumberg, IL 60196-8077

Phone: (800) 366-8366 Fax: (615) 872-1303

Insurance Information for Work Comp Carrier

Company Name: Zurich American Insurance Company **Master Policy #: WC 0183275-00**
Address: PO Box 968077
Schaumberg, IL 60196-8077

Phone: (877) 928-4531 Fax: (866) 691-7068

Services Required

Worker's Comp Injuries _____

Drug Screen Required For (employer to check necessary testing):

____ Pre-Employment
____ Probable Cause
____ Urine (collection only)
____ Test Cup (Cocaine, PCP, etc.)
____ Random
____ Post Accident
____ Breath Alcohol

Treating Medical Center: Please be advised if negative, DO NOT send out. Be sure to mark on the Chain of Custody (COC) the information for the employer:

Employer: _____ Fax: _____

Special Instructions: Use TEST CUP. Do NOT send out unless the test reads positive.

Fax results to designated employer listed above.

Company Authorized Signature: Date:

MSCAA OCIP IV

Notice of Subcontract Award and Request For Insurance

Willis Towers Watson National Project Insurance Practice
Rebecca Trejo
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001
Phone: (972) 715-6219
Fax: (972) 386-5561
e-mail: rebecca.trejo@willistowerswatson.com
Cc:
becky.hubert@willistowerswatson.com

RE: Project Name: _____

This is to inform you that we have awarded the following subcontract to the following Subcontractor:

Name of Firm: _____

Address: _____City: _____ State: _____ Zip: ___

_____

Phone: (____)_____ Fax: (____)_____

Office Contact: _____E-Mail: _____

Type of Work: _____ Job #_____Contract Value: $_____

Award Date: _____ Estimated Start Date: _____

Awarding Contractor: _____

By: _____

Title: _____

Date: _____

Prime Contractor (if different) _____

DO NOT complete this form for your own company.

A Form-1 should be completed on each of your Subcontractors.

- **Award Date – date Notice to Proceed was given (Verbally or in Writing)**
- **Start date is mandatory – date shown will be the effective date of coverage.**

Any Contractors or Subcontractors who enrolls in the OCIP 30 days after their start date will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation.

☐ New Award
☐ Additional Contract
☐ Time & Material Contract
☐ Short Term (< 30 days)
☐ Small Contract (< $30,000)

MSCAA OCIP IV ENROLLMENT FORM

CONTRACTOR'S INFORMATION

Contractor: _____ Indv _____ Ptshp_____ Corp ____ J/V

Address: _____FEIN: _____

Office Contact: _____Phone: _____ Fax: _____ Email: _____

Site Contact: _____Phone: _____ Fax: _____ Email: _____

Safety Contact: _____Phone: _____ Fax: _____Email: _____

Insurance Contact: _____Phone: _____ Fax: _____ Email: _____

Payroll Contact: _____ Phone: _____ Fax: _____ Email: _____

Address (if different): _____

CONTRACT INFORMATION

Contract Value: $ _____

Job Name/Description:_____
Contract/JOB #: _____
Awarding Contractors: _____
Prime Contractors: _____
Award Date: _____Start Date: _____ Est Completion Date: _____Self Performed _____%,
$_____Subcontracted _____%; $_____Est. # of Subcontractors _____
Est. Man hours _____DBE/MBE/WBE: _____

CURRENT INSURANCE INFORMATION;

Contractors' Insurance Broker or Agent: ***PLEASE PRINT***

Company Name:_____ Contact:_____
City/State/Zip: _____ Phone: (_____)_____

WORKERS' COMPENSATION

Current Experience Modifier: ____ (Provide documentation confirming)

W.C. Classification	W.C. Class Codes	Estimated Payroll
1.		
2.		
3.		
4.		

It is each Contractor's responsibility to notify its own insurance carrier to exclude all work to be done under this contract from your current insurance program. Any Contractors or Subcontractors who enrolls in the OCIP 30 days after their start date will have to provide a No Known Loss Letter to the Carrier along with the enrollment documentation.

Contractor warrants that the insurance costs for coverages provided by the Owner have been removed from the bid and no eligible Subcontractor has been charged by the Contractor for its participation in the OCIP. The OWNER, or their Agent, is granted permission by Contractors to inspect the insurance and payroll records. At completion of the Work, Owner's Agent shall have the right to audit the project payroll records of Contractors. Any and all returns of premiums, dividends, discounts or other

adjustments to any OCIP policy, including rights of cancellation, is assigned, transferred and set over absolutely to OWNER. This assignment is valid for insurance policies whose premiums have been paid by the OWNER on behalf of such Contractors.

Signed _____Title _____Date _____

Send this Form to:

Willis Towers Watson National Project Insurance Practice
Rebecca Trejo
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001

Phone: (972) 715-6219
Fax: (972) 386-5561
E-Mail: rebecca.trejo@willistowerswatson.com
cc: becky.hubert@willistowerswatson.com

MSCAA OCIP IV
NOTICE OF ANTICIPATED COMPLETION
(to be submitted with Final Pay Request)

Willis Towers Watson National Project Insurance Practice
Rebecca Trejo
15305 North Dallas Parkway, Suite 1100
Addison, TX 75001
Phone: (972) 715-6219
Fax: (972) 386-5561
E-Mail: rebecca.trejo@willistowerswatson.com
cc: becky.hubert@willistowerswatson.com

Please be advised, we, _____ are scheduled to complete our work for:

Awarding Contractor: _____ Prime Contractor: _____

Project Description: _____ Actual Start Date: _____ Completion Date: _____

Reported Contract Value: _____ Final Contract Value: _____

Self Performed Work: _____ Subcontracted Work: _____

Estimated WC On Site Payroll: _____ Final WC On Site Payroll: _____

We used the following enrolled subcontractors, who will also complete their work on the date shown above:

Subcontractors	Reported Contract Value	Final Contract Value

This is our contract: YES ☐ NO ☐

We are still working on the following contracts:

Location Code	Awarding Contractor	Prime Contractor

Your Company's Name: _____
Date: _____
By: _____
Title _____

Final insurance audits may be made under the applicable policies. Please show who in your office (or another location if applicable) is responsible for this information:

Name: _____ Phone: _____ Fax: _____ E-Mail: _____

Address: _____ City: _____ State: _____ Zip _____

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Agent Company Name Address City, State ZIP Attn:	CONTACT NAME:	
	PHONE (A/C, No. Ext):	FAX (A/C, No):
	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	NAIC#
INSURED OCIP Enrolled Contractor	INSURER A : AM BEST Rating A- VII or better	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F:	

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN. THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYY)	POLICY EXP (MM/DD/YY)	LIMITS	
	GENERAL LIABILITY Applies to Off Site Risks	X	X				EACH OCCURRENCE	$1,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGES TO RENTED PREMISES(Ea occurrence)	$
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$1,000,000
							GENERAL AGGREGATE	$2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS-COMP/OP AGG	$2,000,000
	POLICY X PRO-JECT LOC							
	AUTOMOBILE LIABILITY Applies to Off and On Site Risks	X	X				COMBINED SINGLE LIMIT (Ea accident)	$1,000,000
	ANY AUTO						BODILY INJURY(Per person)	$
	X ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY(Per accident)	$
	X HIRED AUTOS / X NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	X UMBRELLA LIAB X OCCUR	X	X				EACH OCCURRENCE	$1,000,000
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$1,000,000
	DED RETENTION $							$
	WORKERS' COMPENSATION AND EMPLOYERS ' LIABILITY Applies to Off Site Risks Y/N	N/A	X				X WC STATU-TORY LIMITS / OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? **(Mandatory in NH)**						E.L. EACH ACCIDENT	$1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE – EA EMPLOYEE	$1,000,000
							E.L. DISEASE – POLICY LIMIT	$1,000,000
	OTHER							

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Workers' Compensation and Commercial General Liability coverages shown above do not apply to any Designated Project at the Memphis International Airport – only for off-site activities/operations. The Memphis-Shelby County Airport Authority, its officers, commissioners, representatives, agents and employees ATIMA and [AWARDING CONTRACTOR] are additional insureds applicable to the Auto Liability Insurance and off-site Commercial General Liability insurance policies including Excess Umbrella. 30 Day Notice of Cancellation or Non-Renewal other than 10 days for non-payment of premium is provided to MSCAA. Waiver of Subrogation in favor of MSCAA is provided by all policies.

CERTIFICATE HOLDER	CANCELLATION
MSCAA OCIP c/o Willis Towers Watson National Project Insurance Practice. Attn: Rebecca Trejo 15305 North Dallas Parkway, Suite 1100 Addison, TX 75001	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE

EXHIBIT D

TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
GLYCOL MANAGEMENT PROGRAM – CONTROL FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

CONSTRUCTION SAFETY AND HEALTH GUIDELINES

Memphis-Shelby County Airport Authority

Construction Safety and Health Guidelines

Revision	Date
1	11/30/2012
2	05/02/2016
3	02/06/2017

Confirmation of these Project Safety & Health Guidelines

It is the responsibility of the Contractor to maintain total control of safety to ensure that employees and the general public are provided with an environment free of hazards during construction and renovation activities. This program does not relieve the Contractor of their responsibilities regarding the safety of their employees, the employees of their Subcontractors and sub-subcontractors, protection of the general public and the preservation of property.

Contractors shall develop their own written site-specific safety and health plans for the Memphis-Shelby County Airport Authority. At minimum, the safety and health plan shall meet the requirements of 29CFR1926 – Federal OSHA Construction regulations and the requirements established in the **Memphis-Shelby County Airport Authority** Construction Safety Guidelines. In short, as required by law, each Contractor is responsible for protecting the health and safety of its employees and the employees of each subcontractor and sub-subcontractor while ensuring they have a safe and healthful place to work. The site-specific safety and health program shall be submitted for approval within fifteen (15) days after the Notice to Proceed for approval to the Project Safety Manager, Wes Shelby, 4225 Airways Blvd., Memphis, TN.

The Safety Requirements of these safety guidelines are a supplementary document to all Government rules, codes, and regulations. It does not negate, abrogate, alter, or otherwise change any provisions of these rules, codes and/or regulations, and is intended to supplement and enforce the individual program of each contractor and the overall safety effort. It is understood that the ultimate responsibility for providing a safe place to work rests with each individual Contractor.

In the event of a conflict between the provisions of these guidelines and applicable local, State or Federal safety and health laws, regulations and/or standards, contract documents or the Contractor's Safety Plan the more stringent shall apply.

By Signature, each individual confirms their understanding of the contents of this manual and shall conform to the standards of safety outlined in this manual.

_____	_____
Contractor – Project Manager	Contractor – Field Supervisor
_____	_____
Date	Date

POLICY STATEMENT

Memphis-Shelby County Airport Authority is committed that all construction workers have the best possible working environment while working on this project. It shall be the responsibility of each Contractor/Subcontractor to abide by the Safety and Health Provisions listed in OSHA 29 CFR 1926.

In addition, each Contractor, Subcontractor and Sub-Subcontractor shall abide by **Memphis-Shelby County Airport Authority** Construction Safety Guidelines, Federal Regulations, State laws and regulations, local and county laws and regulations which are applicable.

The primary goal established for the **Memphis-Shelby County Airport Authority** is to safely perform work with **"ZERO ACCIDENTS"**; totally free from lost time injuries for the mutual benefit of the worker, environment, and community.

The safety goals and objectives established for the Project can only be achieved when everyone commits to perform their tasks safely and efficiently. This commitment to achieve these goals will result in both increased productivity and the PREVENTION of job-related injuries and illnesses. This will be considered as *safe construction.*

Definitions

OCIP Team – Means the Owner **Memphis-Shelby County Airport Authority**, Willis Towers Watson and all applicable insurance carrier representatives or the representative of defined such agencies and firms working together to implement the OCIP insurance program.

Construction Managers – Means the Management Group or General Contractor that has direct contract with the Owner **Memphis-Shelby County Airport Authority** to provide the overall control of the construction at the project.

General Contractor – Means the Contractor that has direct contract with the owner or Construction Managers as bid for the project. The General Contractor is also the controlling contractor on the construction site when a Construction Manager is not present.

Subcontractor – Means the contractor and or contractors that carry contracts with the General Contractor or Construction Managers. Subcontractors bid portions of the scope of work to be completed.

Sub-Subcontractors – Means any subcontractors of a subcontractors working or contracted to do work on the project.

Critical Lift – A lift that exceeds 75% of the rated capacity of the crane or requires the use of more than one crane. Also, relates to the installation of equipment and or materials that are critical to the completion of the project and damage to such equipment and/or material could result in delays to the project.

The General Public – Is defined as all persons not employed by or under contract, subcontract or sub-subcontract to the **Memphis-Shelby County Airport Authority**.

PREFACE

From the inception of **Memphis-Shelby County Airport Authority** there has been a determination and commitment to provide a safe environment for all workers and for the public from hazards associated with the construction of the Project.

All Contractors shall implement measures that will create safety awareness, promote safe work practices at the job site and pursue the contract objectives in the safest possible manner. Each Contractor shall bear sole and exclusive responsibility for safety in all phases of their work. Nothing contained herein shall relieve such responsibility.

Each Contractor shall be responsible for all its subcontractors' and sub-subcontractors' compliance with the project safety requirements.

Contractors shall develop their own written site-specific safety and health plan for the MSCAA OCIP. At minimum,

the safety and health plan shall conform to the requirements addressed in the Occupational Safety and Health Act of 1970 and all additions and revisions thereto, and the requirements established in the **Memphis-Shelby County Airport Authority** Construction Safety Guidelines. In short, as required by law, each Contractor is responsible for protecting the health and safety of its employees while ensuring they have a safe and healthful place to work.

Contractor developed plans/program(s).
Programs will be reviewed and approved by OCIP Team. Example(s) of such OSHA mandated plans/programs are shown below.

Site Traffic Control Plan	Fall Protection Plan
Fire Protection Plan	Trench Safety Plan
Respiratory Protection Plan	Hazard Communication Program
Confined Space Entry	Scaffold Safety Program
Hearing Conservation Program	Ladder Safety Training
Dust Control Plan	

Emergency Procedures shall be made part of the Contractor's Safety Program. The following provisions shall be included in the emergency plan:

a. Highest ranking supervisor automatically becomes responsible for the handling any emergency that occurs during his working hours; they may call upon the assistance of any available worker. A responsible supervisor must be designated for each shift.
b. On a regular basis, at both supervisory and "weekly toolbox meetings" instruct and update all employees in any course of action for emergencies.
c. Establish teams to handle each of the various emergencies.
d. Following an emergency, ranking personnel shall secure the area as expediently as possible and provide access and an account of the emergency to authorized representative(s) of MSCAA. Questions from the media should be referred to MSCAA.

Emergency procedures that may occur during any 24-hour period in the following categories must be established by each contractor:

a. Fire
b. Employee injury
c. Pedestrian injury due to work activity of any kind
d. Property damage and damage to above ground and buried utilities
e. Public demonstrations
f. Bomb threats

On a regular basis, the Contractor shall review and, when necessary, update Emergency Procedures for maximum effectiveness. The contractor should provide MSCAA, the Construction manager, and the on-site safety rep a telephone list of key management personnel, for after-hours emergency contact.

Should a serious accident or emergency occur, the contractor shall contact the Construction Manager immediately. If an emergency requires the presence of an ambulance or the Fire Department, including nights, weekends and holidays, the contractor shall call MSCAA emergency dispatch at (901)922-8333. Non injury accidents need to be reported to the airport police at (901)922-8298. **DO USE 911**

Site Access

1. ***Use only designated haul routes/crossings.***
2. ***Stay in assigned work area as identified on plans and as defined by fences and barricades. Barricades/fences must not be crossed.***
3. ***Instructions from guards and escort personnel must be obeyed.***

Contractors, Subcontractors, and Sub-Subcontractors will be monitored for implementation and application of their respective safety programs at the work site. Members of the OCIP Team shall have the authority to stop work when either site conditions and/or work practices present an imminent danger until those conditions and/or practices are corrected. Contractors will be notified of any non-compliance and corrective action required. This notice, when delivered to the

contractor or their representative at the site of the work, shall be deemed sufficient notice of non-compliance and corrective action required. After receiving the notice, the contractor shall immediately take corrective action. If the contractor fails or refuses to take corrective action promptly, a stop work order may be issued. The cost to bring the work activity into compliance shall be incurred by the Contractor, Subcontractor or Sub-subcontractor. The Contractor, Subcontractor or Sub-Subcontractor shall not submit a request for extension of time or increased costs as a result of any such stop work order. Members of the OCIP Team shall not be liable for any damages experienced by the Contractor due to the work stoppage. Progress payments may also cease until the Contractor and/or its Subcontractor and Sub-Subcontractors is in full compliance with all applicable safety and health rules, standards and regulations.

Each Contractor and their subcontractors and sub-subcontractors shall establish and enforce an effective disciplinary program (Appendix B). Contractors shall discipline and/or dismiss employees who violate established rules and regulations. This includes immediate termination for serious violations, repeated violations, or the refusal to follow safety and health rules.

OCIP Team members shall have the authority to effectively remove from the site, any person (employees including supervisors and management of any contractor) who is regarded as a frequent violator of safe work practices, or who fails to ensure persons working under their supervision or in a work place they control are not exposed to serious work hazards. Any Competent Person assigned to identify existing and predictable hazards and authorized to eliminate them, which fails to perform this duty for any reason shall be replaced by the employer.

The Contractor shall not receive additional payment or reimbursement for safety items and procedures which have been identified as required by the Project Safety and Health Guidelines.

Failure to comply with the contract safety requirements will be considered as non-compliance with the contract and may result in remedial action including withholding of progress payments due the Contractor and/or termination of the Contractor from the site.

In the event the work or any portion thereof is shut down by either an outside agency or because of an unsafe condition as determined by the OCIP Team, the responsible Contractor shall bear the total cost caused by that shut down.

In no case shall the Contractor be relieved of overall responsibility for compliance with the requirements of federal, state and local safety and health laws for all work to be performed under the contract.

For any construction equipment working near operating right of way and in aircraft safety areas that could encroach into MSCAA's operating right of way and aircraft safety areas shall submit to MSCAA (and obtain approval from the MSCAA) a plan describing the use of such equipment, and the necessary precautions to be taken to preclude any accidental encroachment unto the right of way or aircraft safety area.

INTRODUCTION

Construction Safety and Health Guidelines, Purpose and Scope

These guidelines are established to aid in the prevention of job-related accidents and health problems during the construction of the **Memphis-Shelby County Airport Authority**. These guidelines set forth elements which all Contractors, subcontractors and sub-subcontractors shall include in their safety plan. This manual is not all-inclusive. Other elements may be added or conveyed individually to Contractors to whom they expressly apply. There are other essentials which some Contractors, by nature of the specific type of work being performed, must integrate within their own safety plan.

These guidelines set forth basic rules and regulations for all personnel involved in the construction of the Project. The intent of these guidelines is to enhance and supplement the safety and health standards which are required by law, in contract documents, and are applicable to the construction projects for which it is applied. These guidelines do not cover the full spectrum of published safety and health standards mandated by law, and Contractors shall not assume that they are responsible only for those which are referenced in this manual, nor that they are current and quoted as published. It is the responsibility of the Contractor and its employees to ensure that they are in compliance and their safety plan is in compliance with all safety directives required by law.

In the event of a conflict between the provisions of these guidelines and applicable local, State or Federal safety and health laws, regulations and/or standards, contract documents or the Contractor's Safety Plan the more stringent shall apply.

RESPONSIBILITIES

General

Each participant involved in the construction of the Project is individually responsible for conducting their activities to ensure compliance with all applicable safety and health requirements. Construction activities of the Contractor and their Subcontractors and sub-subcontractors will be monitored for compliance with FAA, MSCAA, Federal, State, County, and local safety and health regulations and contract safety and health requirements.

Contractors

The Contractor shall be responsible for the safety and health of employees, subcontractors, sub-subcontractors, visitors, and vendors in accordance with State, Local and Federal regulations, and the Contract Documents. Each Contractor shall establish and submit for review a written Safety and Health Plan which includes details commensurate with the work to be performed. The Contractor's Safety and Health Plan shall clearly describe the contractor's commitments for meeting its obligations to provide a safe and healthful work environment for its employees and subcontractor employees, to protect vendors, visitors, and members of the general public. The Contractor's Safety and Health Plan shall reference Federal OSHA standards, and any other rules or regulations applicable to construction activities.

Each Contractor shall designate an on-site Safety Representative who is charged with the responsibility of on-site safety management. The Safety Representative's sole duty shall be safety management and shall not have other collateral duties. At minimum the safety representative shall meet the requirements of a "competent person" as defined by OSHA for all phases of construction and have a minimum of three (3) years construction safety experience. A resume shall be provided that outlines such items as: work experience, education, training completed and professional organizations, etc. The safety representative shall remain on the Project until contract acceptance (full-term of contract). Safety representative must be knowledgeable on SC-230, SC-240, and other safety requirements as outlined in GP-200, the safety plan and site safety manual. The safety representative shall be interview by the OCIP Team.

As a condition of this contract, a safety improvement team shall be established for this project. The following guidelines (Appendix H) shall be followed.

As a condition of their contract, all Contractors shall submit to the Project Safety Manager or designee:

- A site-specific safety plan within fifteen (15) days after receipt of Notice to proceed and prior to start of any construction activities.
- The name and qualifications (resume) of designated on-site safety person;
- An immediate copy of all citations and/or warning of safety violations received from any state or federal jurisdiction, agency, insurance company, or by any of its subtier contractor.

The Contractor shall:

- Ensure that all employees, subcontractors' and sub-subcontractors' employees are given a comprehensive Safety and Health orientation. This orientation shall include general Safety and Health procedures and policies as well as the project specific rules, regulations and specific hazards. Employees shall be advised that disregard for these rules, or any other applicable Safety and Health regulations shall be subject to company disciplinary action and/or removal from the project. All workers shall complete an acknowledgment that indicates the worker has read, understood, and will abide by the rules and regulations. The following information shall be obtained from all employees: worker's name, date of orientation, Contractor's name and project name (Appendix A).
- Investigate all accidents and incidents that result in personal injury or illness to workers, damage to buildings or equipment and any incident with the general public.
- Conduct daily job inspections, identify unsafe conditions or work practices and assure they are corrected, and maintain documentation.
- Conduct weekly, documented, safety meetings with Contractor supervisory personnel.
- Attend monthly Safety committee meetings and participate.

- Assure that employees acting in a supervisory capacity understand and enforce all safe work practices. **Foreman and supervisors are required to have completed a 10-hour OSHA Outreach hazard recognition course within Two (2) years prior to directing work on the project.** Documentation must be made available for review.
- Assure that employees acting in a supervisory capacity understand and enforce all safe work practices. **Foreman and supervisors are required to have completed a 10-hour OSHA Outreach hazard recognition course within Two (2) years prior to directing work on the project.** Documentation must be made available for review.
- Assure a Competent Person is provided at work locations where required by OSHA.
- Assure that all Personal Protective Equipment (PPE) is available and being used as required.
- Assure all construction equipment and motor vehicles certification, inspection, repair, and controls are in compliance with the safety requirements of the project and OSHA. Annual crane certification shall be available for review for each to a crane on the project.
- Prior to making critical crane lift, detailed lift plan shall be submitted. (See Appendix C, "Critical Lift Checklist")
- Assure that all hand and power tools are in safe working order.
- Assure that all work areas are kept clear of debris and trash and that adequate trash barrels are placed throughout the work area and emptied frequently.
- Provide the appropriate number and types of sanitary facilities for employees.
- Assure that fall protection equipment is provided and used. Inspections of this equipment shall be documented and on file for review.
- Assure that all perimeter cables, barricades, or any other safety-related items are installed correctly and maintained. If another Contractor must remove a safety item, coordinate this activity with the Contractor who installed the device and other Contractors who may be exposed. **Safety devices shall be replaced by the Contractor removing them.** Warning signs, tags, or barricades shall be installed if other safety devices are removed.
- Assure that employees receive adequate training as required by the Project and OSHA. Additional training for foreman and safety representative may be required based on unique hazards involved in a task.

WORKPLACE SUBSTANCE ABUSE POLICY

The contractor shall submit as a part of their overall Safety and Health Plan a copy of their company Workplace Substance Abuse policy. This policy shall at minimum comply with Appendix D, "Substance Abuse".

The Contractor shall ensure that all subcontractors and sub-subcontractors are in compliance. The Contractor shall submit a monthly notarized letter stating they and their subcontractors are in compliance with the Project's Substance Abuse Policy.

Contractors should contact the State of Tennessee, at 1-800-332-2667, if there are questions concerning the Tennessee Drug Free Workplace Program. Contractors should also consult their own legal counsel.

INSTRUCTION AND TRAINING

Safety Orientation Program

Newly employed, promoted, and/or transferred personnel shall receive an orientation regarding the general safety and health rules and regulations as well as the site- specific policies and hazards prior to starting work on the construction site. The Contractor shall be responsible for the orientation of their employees, Subcontractors and sub-subcontractors, and visitors. Documentation of this orientation shall be maintained on file for review (Appendix A). Hard hat stickers (provided by the Project) are to be issued to an employee following their orientation, and then documented on training Log Sheet. It is the responsibility of the contractor to ensure that non-English speaking employees receive these same instructions in a language they understand. Safety orientation of all personnel shall include at a minimum the following topics Safety orientation of all personnel shall include at a minimum the following topics:

- Unique hazards of the project
- Employer/personnel responsibilities under OSHA Standards – location of required posters
- Personal protective equipment, including appropriate work attire
- Confined space entry
- 6-Foot fall rule - 100% continuous fall protection ***(including steel erection and scaffolds)***
- 100% eye protection, 100% hard hat protection

- Appropriate guarding and other warning devices
- Housekeeping
- Fire protection
- Accident reporting procedures - First-aid facilities - Emergency procedures
- Crane and lifting hazards
- Scaffolding tagging requirements
- Hazard communication/ Right-to-Know, location of MSDS's
- Substance abuse policy
- Disciplinary procedures
- Trenching & excavation
- Electrical hazards

PROTECTION OF THE PUBLIC

All necessary precautions to prevent injury to the public or damage to property of others shall be taken. The "Public" is defined as all persons not employed by or under contractor or subcontractor to **Memphis-Shelby County Airport Authority**. Installation of temporary barriers and/or fencing designated to protect the Public shall be reviewed and approved by the Owner and/or their representative. Precautions shall include but not be limited to the following:

1. Work shall not be performed in any area occupied by the Public unless specifically permitted according to the terms of the contract or in writing.
2. When necessary to maintain public use of work areas involving vehicular roadways, etc., the contractor shall protect the Public in accordance with the applicable regulations.
3. Appropriate warnings, signs and instructional safety signs shall be conspicuously posted where necessary. In addition, a signal person shall control the moving of motorized equipment in areas where the public might be endangered. All signage warnings and traffic control shall comply with the particular agency that takes judicial precedence.
4. Each project work area shall be protected by a fence constructed and erected per MSCAA requirements.
5. Barricades for the general public or public roadways shall be secured against accidental displacement and in place at all times, except when temporary removal is required. As such times, a flag person shall be assigned to control the unprotected area. Barricades used on the airfield will be reconstructed erected and maintained per MSCAA/FAA requirements.
6. Required signs and symbols shall be visible at all times when work is being performed and shall be removed or covered promptly when the hazards no longer exist.

Group Tours and Site Visitors

It is particularly important that a high degree of protection be afforded to all persons on the authorized tours of construction work-sites. The following instructions shall be complied with, as applicable, by the Contractor and those responsible for arranging such tours. The following procedures shall be followed:

a) Group tours shall be cleared through the site **Memphis-Shelby County Airport Authority** office, allowing maximum advance notice.
b) If visitors to the site will be on foot or out of the vehicle/bus, the individual or organization requesting the tour shall ensure that:
   - In all cases, the Construction Manager, MSCAA and the contractor shall be advised of any tour in a timely manner prior to the tour taking place.
   - Release and Hold Harmless Agreement – Each visitor shall be required to sign a release and hold harmless agreement prior to the commencement of the tour.
   - MSCAA will coordinate the tour arrangements and ensure notification to the Construction Manager.
   - Tour groups are limited to no more than (25) twenty-five persons.
   - Visitors are required to wear appropriate clothing and shoes.
   - Children under 18 years of age are not be permitted on the Project tours.
   - All visitors shall comply with Contractor safety requirements.
   - Site **Memphis-Shelby County Airport Authority** or designee personnel will escort Tours.

HARASSMENT-FREE WORK POLICY

Employee Harassment

It is the policy of **Memphis-Shelby County Airport Authority** to provide a workplace free from employee harassment on the basis of race, color, religion, sex, national origin, age, handicap, disability, etc. Improper interference with the ability of an employee to perform their work activities will not be tolerated. Harassment can appear in many forms, including derogatory comments, jokes, slurs, unwanted physical contact, derogatory drawings or threats.

Sexual Harassment

Unwanted sexual advances, requests for sexual favors and other verbal physical conduct of a sexual nature will not be tolerated. Sexual harassing conduct includes, but is not limited to:

- ❑ Unwelcome sexual flirtation, touching, advances or propositions
- ❑ Verbal abuse of a sexual nature, including graphic or suggestive comments about an individual's dress or degrading words used to describe and individual
- ❑ The display in the workplace of sexually suggestive objects or pictures, including nude photographs
- ❑ Other verbal or physical conduct of a sexual nature can affect an employee's work performance

Reporting of Harassment

It is the policy of **Memphis-Shelby County Airport Authority** to actively investigate any alleged incidence of harassment. Anyone who believes they have been harassed should contact the project manager. Any allegation or compliant will be held in the strictest confidence.

Any employee who commits a wrongful act of harassment shall be subject to disciplinary action, up to and including termination.

REPORTING, ACCIDENT INVESTIGATION, AND RECORDKEEPING

Contractors shall provide an American Red Cross and CPR Certified First Aid representative and designate an appropriate area for the first aid and medical care to treat injured employees at the job site. A copy of the First Aid Representative's qualifications shall be submitted to the Project Safety Manager.

The contractor must designate an individual to coordinate injury treatment with the workers' compensation carrier. The contractors' designated representative should also coordinate return to work and availability of modified work.

To coordinate medical services, the contractor will complete "Employee Medical Data Sheet" and "Company Drug Screen Request: forms.

Reporting

All accidents resulting in employee injury, property damage, or involving the general public shall be reported immediately to the designated project representative and the Project Safety Manager.

The Contractor and their subcontractors and sub-subcontractors shall complete a Supervisor's Incident Report Form (See Appendix E) and submit the report to the Project Safety Manager for all job-related accidents involving any of the following:

1. Any employee injury of the contractor, any subcontractor or sub-subcontractor.
2. Any injury and/or incident with the general public (including any alleged injuries reported by a member of the general public).
3. Equipment
4. Property

A formal accident investigation report and “First Report of Injury” shall be submitted within 24 hours. Pertinent facts that are not available within the above time shall be submitted as soon as available in a supplemental report.

A drug and alcohol test shall be administered to employee(s) injured and/or any employees in a work crew involved in an accident involving bodily injury.

Record-Keeping and Files

The Contractor and all Subcontractors and sub-subcontractors shall maintain a master or central file for safety and health related documentation on the jobsite. Files shall be maintained in such a manner that distinguishes each contractor and their subcontractors from other subcontractors and sub-subcontractors.

See Insurance manual for claim reporting procedures.

Accident Investigation

All accident/incidents shall be investigated by the contractor’s safety supervisor and/or their safety designee. An accident investigation report must be submitted to the Designated Project Representative, OCIP Administrator/Willis Towers Watson and OCIP Insurance Carrier within twenty-four (24) hours of the occurrence.

The accident investigation should generate appropriate recommendations for corrective actions to prevent recurrence of similar accidents. Depending upon severity of the accident, the foreman of the injured worker may be requested to appear at the job safety and coordination meeting to:

1. Describe the cause of accident.
2. Report as to what corrective action has been initiated to avoid future accidents.

The Contractor and all Subcontractors shall maintain a current OSHA 300 log. The log shall be available for review by any OCIP team member at any time.

The Contractor and all Subcontractors and Sub-Subcontractors shall submit on a monthly basis a monthly summary of accident/incidents for the project. The summary shall follow the format contained within (Appendix G).

Under the direction of MSCAA AD HOC Committee may be appointed for investigation of serious accidents that result in loss of life, injury to several workers on pedestrians or major property loss. The committee will submit a report to MSCAA at the conclusion of the investigation.

RETURN-TO-WORK

Under the OCIP Program, every effort shall be made to **return employees to work as soon as possible** after an accident and under the direction of the physician. The insurance carrier will be in contact with the physician to determine the employee’s physical demands and limitations.

A return-to-work program shall be developed and implemented by each Contractor to assist workers who are temporarily disabled due to an injury or illness. The Contractor and all subcontractors shall participate in the return-to-work program.

The Contractor, Subcontractor or Sub-subcontractor shall agree that their injured employees shall be treated by an authorized medical treating facility. The medical facility shall be utilized for initial treatment and evaluation of all injured employees. Follow-up care will be provided in accordance with applicable Workers' Compensation statutes.

When employees report a work-related illness or injury, they shall be taken to the approved medical facility for examination and/or treatment. If the doctor determines that the employee qualifies for "Return to Work" ("light-duty"), the doctor will complete appropriate forms indicating the restrictions and conditions for transitional work.

The Contractor, Subcontractor or Sub-subcontractor shall provide modified work until the employee is able to resume regular

duties. All modified work is temporary in nature and is designed to facilitate a return to regular duties as soon as possible. Modified duty positions may be offered at any location of the project or on any shift. Modified work can also be provided at other work locations of the Contractor with approval from the OCIP Team.

In no case shall an injured employee be laid-off or terminated from a "alternative work" position, unless first discussed with the Owner and it's representatives.

WORK PRACTICE CONTROL

Overview

The primary focus of these Safety and Health Guidelines is to provide guidance for Contractors. Each Contractor shall have on site and available for employee review a written safety and health plan. This plan shall cover work exposures the contractors work operations. It is a project requirement that each and every employee conduct their operations in accordance with OSHA and all other applicable standards for all project operations.

Memphis-Shelby County Airport Authority prohibits the use, possession, concealment, transportation, promotion, or sale of the following controlled items:

a. Firearms, weapons, and ammunition – except when authorized for security reasons.
b. Switchblades.
c. Unauthorized explosives, including fireworks.
d. Stolen or contraband.

Hazard Communication Program

The Contractor shall develop a written Hazard Communication Program that contains at minimum the following elements:

- The name of the program coordinator.
- A list of hazardous substances present within the Contractor's workplace.
- A written system that ensures MSDS's are obtained and made readily accessible to all employees, including lower tier subcontractor personnel, on each shift. In the event of an emergency, MSDS's shall be made available on an immediate basis.
- A labeling program that ensures that containers of hazardous substances in the workplace are properly labeled with the name of the substance and any applicable hazard warnings.
- A training program regarding hazards of substances that are used in the workplace and the protective measures that must be taken by the empl0oyee or any other persons potentially exposed to the hazardous substances.

The Contractor shall ensure that each employee, prior to working with, or being potentially exposed to hazardous substances, receives initial training on the Hazard Communication Program and the safe use of the hazardous substances. Additional training shall be provided to employees whenever new substances are introduced to the workplace.

Permanent records shall be maintained by the Contractor, describing all Hazard Communication Program training.

Record-Keeping and Files

The Contractor and all Subcontractors and sub-subcontractors shall maintain a master or central file for safety and health related documentation on the jobsite. Files shall be maintained in such a manner that distinguishes each contractor and their subcontractors from other subcontractors and sub-subcontractors.

Contractors shall submit and/or have available on site:

REPORT NAME	Annual	Immediately	24 Hr.	Weekly[1]	Monthly[2]	Per Occurrence	Per Request
Annual Crane Inspection	x						x
Chemical Inventory					x		x
Contractor Weekly Inspection				x			x

Critical Lift Checklist						x	x
First Report of Injury		x				x	
Incident Investigation		x				x	
MSDS's					x		x
OSHA 300 Log					x		x
OSHA Citations		x				x	
Safety Observation				x			
Safety Plan of Action or JSA[3]				x		x	x
Safety Statistics					x		x
Safety Training					x		x
Substance Abuse Policy compliance notarized letter					x		x
Toolbox Safety Meetings				x			x
Daily equipment / Vehicle Inspections							x

Daily -- Daily inspections are required on all equipment / vehicles.
[1] Weekly – Weekly reports are due the following Tuesday morning
[2] Monthly – Monthly reports are due by the 6th of the following month.
[3] Safety Action Plan or JSA – As required by contract or specification

The Owner and it's Representatives shall have the right to review all documentation at any time upon request. The Contractor shall give full cooperation during these reviews.
The following documentation shall be in the safety files:

- A written project site specific Safety & Health Plan
- Hazard Communication Program, including current MSDS's. A project specific MSDS file shall be maintained on-site for employee review
- Site emergency plans
- All required safety & health permits
- Weekly safety meeting reports - including meeting topic(s) and employee attendance sheets
- Specific job hazard worker training
- Daily jobsite safety inspection reports - including documentation of corrective measures
- Equipment inspection reports
- Crane inspection reports - daily and monthly (annual certification reports required prior to equipment operation)
- Employee orientation training records
- Accident investigation reports, including near-misses
- Job hazard analysis
- Competent person qualifications
- Written safety violations
- Noise and air quality monitoring

Job Safety Analysis (JSA)

In order to provide Contractor employees with a safe workplace through pre-planning hazardous work, a Job Safety Analysis (JSA) shall be prepared. JSA's shall be required when thorough pre-job planning, it is determined that the process, equipment or procedure indicates potential for serious injury and/or property damage. The Contractor shall also prepare a JSA upon request by an OCIP Team member. . JSA's will be done daily. JSA's should be kept in the work area, possibly at the toolbox and/or where they are readily available to the workers. JSA's will be also be on file with the contractor.

The JSA shall be used by Contractors to analyze the jobs they perform, to identify the existing and potential hazards associated with each job step and establish controls for them. These JSA's shall be used as a task specific training tool to instruct employees, inspectors, and visitors of potential hazards and required safety precautions. Each employee working on the project shall sign a training log indicating that they understand the hazards of the project as indicated on the JSA.

Examples of activities that may require a JSA:

- Potential for collapse, (work-in trenching, tunneling. This may include demolition, etc).
- Potential release of stored energy, (electrical, pressure, explosive, etc).
- Crane supported work plate form use.
- Critical crane lifts (two cranes used to lift one load).
- Unusual crane operation as defined by the CIP Team.
- Potential exposure to uncontrolled hazardous materials or wastes.
- Blasting operations
- Abrasive /Sandblasting, Hydro blasting, etc.
- Potential injury from burns, both chemical and thermal.
- Respirator use.
- Potential oxygen-deficient environments.
- Entry into confined space.
- Potential of entanglement in, on, or between objects.
- Work in public streets and highways.
- Lockout/Tagout.
- Operations involving fall exposure.
- Structural Steel Erection.
- Use of new or Hazardous Materials, procedures, equipment.
- Material Storage & Handling.
- Powder actuated tool use.
- Suspended scaffolds.
- Scaffold erection.
- Scaffold dismantlement
- Rock drilling.
- Work on live electrical systems.

SPECIFIC PROJECT SAFETY REQUIREMENTS

Controls for possible conflicts between construction operations and aircraft

1) Contractor must request that a notice to Airmen (NOTAM) be issued prior to start of any construction that might affect navigable airspace or surface movement.
2) Barricades and temporary lighting must be installed and maintained per specs.
3) Operators of equipment/vehicles must be instructed on routes and haul procedures.
4) All personnel must stay in defined work areas. Fences/barricades are not to be crossed.
5) No access to active taxiways/runways will be allowed without prior authorization and direction/escort by MSCAA personnel.

Scaffolds, Stair Towers and Work Platforms

The Project requires ***100% continuous fall protection*** during the erection and dismantling of scaffolds where employees may be exposed to a fall greater than (6) six feet. A competent person must be present during erection, dismantling or moving of scaffold. The Contractor/Subcontractor shall develop and use a scaffold tagging system similar to the following:

Tagging

The tagging procedure, at minimum, shall consist of three (3) tags. The appropriate tag will be placed on a scaffold approved by the competent person. Each tag must have at least the following information and be visible by all employees:
- Date tag was placed - date of the last inspection.
- Name of person inspecting. All tags must be weather resistant.

A **GREEN** tag means the scaffold complies with federal OSHA regulations and can be used by any person.
A **YELLOW** tag indicates the scaffold is complete but does not meet all federal OSHA specifications. This tag will be used only in special circumstances. Special precautions, such as wearing a safety harnesses may be required because any accessory, such as a handrail, could not be installed due to the location of the scaffold.

A **RED** tag shall be placed on a scaffold that is being erected, dismantled, damaged and/or defective. No employees except members of the erection/dismantling crew shall work from a red tagged scaffold.

Employees will be instructed to read tags before using scaffolds. If a tag is not attached to the scaffold, **DO NOT USE** the scaffold.

Exceptions: Single buck or Baker scaffolds need not be tagged.

Walking and Working Surfaces

Barrier Identification Tape

Barrier identification tape is strictly prohibited from being used for any form of personnel fall protection. Barricade tape around excavations can be used for short term (24-hours), after this period physical barriers are required.

- **YELLOW** barricade tape shall be used for **CAUTION/WARNING**
- **RED** barricade tape shall be used for **DANGER DO NOT ENTER**

Note: Once the area barricaded is free of the hazard(s) for which it was erected the tape will be removed and properly discarded.

Fall Protection

Employees shall not be exposed to fall hazards. When an employee observes a fall hazard, they will notify their supervisor of the hazard. The responsible Contractor will immediately correct the hazard. **100% continuous fall protection, *for fall hazards greater than six (6') feet,* shall be implemented on this Project - including steel erection and scaffold use, erection and dismantling.**

Each Contractor shall be responsible for meeting fall protection requirements in their overall safety and health program.

Each Contractor shall evaluate ALL fall exposure conditions or tasks and must develop a Fall Protection Plan which outlines what methods, procedures and/or devices will be used in their program.

Each Contractor shall be responsible for implementing the requirements to achieve fall protection in accordance with all Federal, State, local rules, regulations, and the OCIP Safety and Health Guideline.

All fall protection systems used on this project shall comply with OSHA regulations and the project safety guidelines. Fall protection shall provide a positive means of protection. **Controlled Access Zones and Safety Monitoring Systems are not considered positive means of fall protection and shall not be permitted**. Any employee exposed to a fall greater than six (6) feet shall use approved fall protection equipment or devices. Fall protection systems shall be designed and installed under the direction of a Registered Professional Engineer or Qualified Person. Fall protection is required, as a minimum, under the following examples:

- Formwork and reinforcing steel. Each employee on the face of formwork or reinforcing steel shall be protected from falling 6 feet or more to lower levels by Personal Fall Arrest Systems, safety net systems, or positioning device systems.
- When working from a telescoping, articulating, or rotating type lifts and scissors lifts, personnel shall wear a safety harness with shock absorbing lanyard, secured to an approved anchorage point.
- When working on a ladder higher than six (6) feet from a solid surface, if the employee's torso extends past the side rails or if a vertical ladder extended a total of 20' or greater.
- When working on a platform or other support not equipped with an adequate guardrail, which is higher than six (6) feet from a solid surface.
- When working from a crane-suspended work platform, a safety harness with shock absorbing lanyard is mandatory.
- When an employee may have to be lowered into or raised from a confined space, a personal fall arrest system will be worn. The employee will be supported by an approved platform or a boatswain's chair, with certified hoisting device and fall arrest device.

- When working adjacent to an unguarded floor opening or sloped roof, a lifeline system is desirable for mobility. A positive means of fall protection must be provided unless it can be proven infeasible.
- When working adjacent to a deep excavation, pit or trench. Employees will be instructed on the proper wearing and use of personal Fall Protection Arresting Device Systems.
- **Barricade tape is not adequate fall protection.**

The Fall Protection Plan shall detail in writing when fall protection is required and exactly how this protection is to be provided. This written plan is required for any Contractor exposing workers to falls six (6) feet or greater.

The Contractor shall prepare a written training program to ensure that each employee who might be exposed to fall hazards is knowledgeable of the Fall Protection Plan requirements. The program shall enable each employee the ability to recognize the hazards of falling and shall train each employee in the procedures to be followed in order to eliminate or minimize these hazards.

The Contractor shall assure that each employee has been trained.

Personnel, who have been trained, then re-trained and continue to violate the established fall protection plan/regulations shall be removed from the project <u>IMMEDIATELY</u>.

Confined Space Entry

All employees required to enter a confined space shall be knowledgeable of the hazards involved with confined space entry. Prior to the start of such an entry the Contractor involved in the work will develop a Confined Space Entry Procedure. The Contractor shall train all personnel who will enter the confined space. No one shall enter a confined space area until properly instructed. <u>Contractors shall identify all confined spaces within their work area with a sign identifying the area as a confined space.</u>

A Confined Space Entry procedure shall be used to:
- Prevent inadvertent operation of equipment and/or work process while people are working in the confined space.
- Eliminate unexpected exposure to hazardous materials, oxygen deficient or inert/toxic gaseous atmosphere while working in confined spaces.
- Plan for a timely and effective response to an emergency during a confined space entry.

Confined Spaces are considered to be areas with limited entry and exit, or poor natural ventilation, and not intended for human occupancy. Examples of a confined space include: tanks, covered basins, vaults, columns, mixers, manholes, pipelines, sumps, ditches or excavations. All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise.

Safety considerations include but are not limited to: atmosphere testing for gaseous conditions/lack of oxygen, appropriate personal protective and emergency equipment, and additional personnel as needed to assure communications and assist the individual conducting the entry.

A Permit Required Confined Space means confined space that has one or more of the following:
- May or may not potentially contain a hazardous atmosphere;
- Contains a material that has potential for engulfing entrant;
- Has internal configuration that could trap the entrant;
- Contains any other recognized serious health or safety hazard;

Contractors shall provide their own permit.

A Non-Permit Required Confined Space is a confined space that does not contain or with respect to atmospheric hazards, the potential of causing death or serious physical harm.

Employee Ground Transportation

The purpose of this section is to establish minimum acceptable guidelines for the safe transportation of all personnel traveling within the Project confines. Eliminate personal accidents and injuries resulting from improper equipment use.

Contractors are responsible for assuring that all personnel follow the requirements of this section and prohibit improper transportation of employees and visitors. Transporting employees in cargo beds of pick-ups, vans, etc. is prohibited, unless approved seats and seat belts are provided and used.

- Operators must be qualified. Vehicle operators must have valid state operator's license
- All equipment/vehicles must be identified (company logo) per specifications.
- Safe speed must be maintained and adjusted to site conditions.
- Use flashers/headlamps as directed.
- Mobile cranes, forklifts, winch trucks, front-end loaders, tractors, and other materials handling equipment are not permitted to transport passengers.
- Trucks
  - A maximum of three passengers are permitted to ride inside of the truck cab unless the cab is specifically designed to accommodate additional passengers.
  - Passengers shall ride with all portions of their bodies inside the truck body or frame.
  - Passengers shall be in the seated position, with the seat belts secured and adjusted properly, before the vehicle is set in motion.
  - Riding on a vehicle's bumper or tailgate is prohibited.
  - Tailgates will be closed and latched before the vehicle is operated.
  - Passengers are not permitted to ride in the body of a dump truck, in the bed of a pickup truck or in trailers.
  - Passengers are not permitted to ride on top of the load or to hold materials from shifting.
  - Vehicles must be designed to accommodate passenger transportation, or the vehicle shall not be used for that purpose.
  - Drivers transporting passengers shall follow the posted speed limit and Project traffic rules.
  - The Contractor shall establish a designated employee parking area. Employee vehicles shall not be allowed on the construction project.

Housekeeping - MUST BE A CONTINUING PROCESS

The purpose of this section is to incorporate into the day-to-day work activity a good housekeeping action plan that will be followed by all Contractors working on the project.

- Contractors, through inspection and example, are responsible for assuring that trash and debris remain out of the work areas. Contractors are responsible for all their work areas and the work areas of their subcontractors and sub-subcontractors. If poor housekeeping practices are observed, corrective action will be discussed with the appropriate Contractor to remind them that cluttered work areas will not be tolerated and that their work area(s) pose a hazard to his employees and other personnel.
- Should the Contractor fail to address and correct their poor housekeeping upon 24 hour written notification, the "owner" may at its option, cause the same to be removed and charge the expense of such removal to the appropriate Contractor.
- Specific attention is needed for operations to the Aircraft Operation Area (AOA).
- Contractors shall monitor their work areas daily or more frequently if needed to assure that all debris is removed to minimize hazards.
- Immediately available vacuum sweeper for cleaning taxiway/runway crossings.
- Personnel immediately available for taxiway and runway cleanup. (Provide brooms to supplement cleanup by sweeper.)
- Access to taxiway/runway crossings for cleanup only at the direction of MSCAA guard.
- Loading of haulage vehicles to minimize spillage.
- Maintenance of vehicles/equipment so that no fluids will leak.
- Provide waste containers at the direction of the Construction Manager.

Project Electrical Requirements

- The Contractor shall implement an electrical safety program. This safety program element shall include safe installation, work practices, maintenance, and special equipment considerations. All electrical installations, either temporary or permanent, shall be in conformance with the National Electrical Safety Code, NFPA-70, ANSI-C1, and low and high voltage electrical safety orders OSHA code requirements. Only qualified employees shall install electrical tools and equipment, defective and/or improperly installed equipment shall be repaired immediately.

- Only qualified electricians familiar with code requirements shall be allowed to perform electrical work.
- Extension cords used with portable electrical tools and appliances shall be heavy duty (minimum 12 AWG) and of the three-wire type. Cords shall be covered, elevated, or otherwise protected from damage that would create a hazard to construction site personnel.
- Electrical cords and equipment shall be visually inspected before each shift for external defects. All damaged and defective cords shall be removed from service immediately (this includes cords with the ground prong missing). Cords shall be repaired with approved heat-shrink methods, electrical tape is not permitted.
- All temporary electrical tools, cords and equipment shall be properly protected by ground fault circuit interrupters (GCFI). All portable generators shall have properly functioning GFCI outlets. GFCI receptacles shall be tested monthly with a multi-range GFCI tester (the tests shall be documented) to insure the GFCI is properly functioning and protecting the worker.
- A "task-specific" lockout/tagout safety plan shall be established to ensure power sources to equipment and/or machinery are isolated and de-energized. This plan shall establish minimum steps necessary to disable equipment and machinery to prevent the unexpected release of potentially hazardous energy. Lockout/Tagout shall be performed in accordance with 29 CFR 1910.147.

Cranes and Hoisting Equipment

- Cranes and hoists shall not be used without a current annual certificate of examination and testing issued by an accredited crane examiner**. Annual inspection certificates shall be available when cranes arrive on-site. Operator's manual shall be in the cab of each crane prior to crane operation.**
- Only qualified and designated personnel shall operate cranes or hoisting equipment. Crane operators must have current (Certified Crane Operator) CCO certification and/or local or state certification.
- Rated load capacities and recommended operating speeds, special hazard warnings, or instructions, shall be conspicuously posted on all equipment; they shall be visible to the operator from his/her control station, and an accessible fire extinguisher of 10:ABC rating, shall be available at all operator stations or cabs of equipment. Crane operations position shall be kept clear of loose tools or material.
- Outrigger cribbing shall be used for all crane operations. The size of the cribbing shall be determined by taking the cranes capacity and dividing by 5 (example: 40 to crane divided by 5 = 8 sq. ft. per outrigger).
- All cranes working over shafts or lifting personnel platforms shall have anti-two block devices installed and operating properly.
- Radio or other positive means of communication shall be used to direct the operator when the point of operation is not in direct view of the operator.
- The operator shall respond to signals from only one person. The operator shall not follow any signal which is not understood but shall always obey a stop signal.
- The operator shall be responsible for the operations and load, under their control, at all times. Whenever there are doubts about the safety of movement, the operator shall stop operations until safety is assured.
- A warning signal, such as a horn, shall be sounded to alert personnel to proximity of moving loads. Loads should not be passed over personnel, and personnel should not be permitted to work in the area directly under a suspended load.
- Concrete buckets - Employees shall be permitted to work under concrete buckets while the buckets are elevated.
- **Employees shall keep out from under suspended loads, at all times**.
- Employees shall not ride on loads, slings, hooks, buckets, or other load handling attachments.
- All repairs, adjustments, modifications, rigging assembly or dismantling shall be conducted only by qualified and authorized personnel.
- The swing radius shall be barricaded, or other positive means shall be taken to prevent personnel from entering the area between the counter-weight/swing radius and any stationary and/or outside obstructions.
- A critical lift checklist will be completed and submitted anytime:
  - 2 cranes are used to make a lift
  - when a lift exceeds 75% of the load chart
  - or any unusual conditions are encountered
    (See Appendix C, "Critical Lift Checklist")
- Crane suspended work platforms shall only be used if there is no other safe means to reach the work area. The Contractor shall complete a JSA prior to the lift.
- Any overhead wire shall be considered to be energized unless and until the person owning such line or operating officials of the electrical utility supplying the line assures that it is NOT ENERGIZED and it has been visibly grounded at the work site.
- Taglines shall be used to control all loads

- Daily inspection of all cranes shall be completed and documented prior to crane usage

Rigging

- Major rigging operations shall be planned and supervised by Competent Personnel to ensure that the best methods and most suitable equipment and tackle are employed. This should be the superintendent or foreman in charge.
- Job site management shall ensure that:
  - Proper rigging equipment is available.
  - All rigging is inspected before use. Documented inspections are required.
  - Correct load ratings are available for the material and equipment used for rigging.
  - Rigging material and equipment are maintained in proper working condition.
- The supervisor of the hoisting operation shall be responsible for:
  - Proper rigging of the load.
  - Supervision of the rigging crew.
  - Ensuring that the rigging material and equipment have the necessary capacity for the job and are in safe condition.
  - Ensuring correct assembly of rigging material or equipment as required during the operation, such as the correct installation of lifting bolts.
  - Safety of the rigging crew and other personnel as they are affected by the rigging operation.

Excavation (Any process which disturbs soil)

A. Contact MSCAA/FAA thru the Construction Manager at least 72 hours prior to proposed work for location of underground hazards (cables, ducts, fuel lines, etc.). A request form will be provided to the contractor.
B. The contractor must contact Tennessee one call at least 72 hours prior to proposed excavation for location of utilities. Contractor must make arrangements to have personnel at the site when utilities are located. Documentation of the control number must be maintained on site.
C. **Utilities must be located/marked prior to any process that disturbs the soil.**

Earthmoving Equipment and Trucks

- All earthmoving equipment shall be maintained in safe working condition and shall be appropriate and adequate for the intended use.
- Only authorized personnel shall operate equipment. Operators of equipment, machinery or vehicles shall be qualified and properly licensed for the operation involved.
- Equipment maintenance shall be performed only by qualified mechanics.
- Equipment operators and truck drivers shall make a documented pre-shift safety inspection of their equipment. Any conditions that effect safe operation will be corrected before use.
- Equipment shall not be operated unless all required safety devices are in place and functioning properly.
- Careless, reckless, or otherwise unsafe operation or use of equipment shall result in discipline and may constitute grounds for dismissal.
- Before performing any service or repair work, all equipment shall be stopped and positively secured against movement or operation, locked, and tagged out of service, unless it is designed to be serviced while running, following the manufacturer's instructions.
- When equipment is serviced or repaired, the operator shall dismount until the service or repair is completed and then make a complete walk-around safety check before remounting.
- All heavy equipment including cranes, forklifts, dozers, end-loaders, skid-steers, etc., shall have a reverse signal/back-up alarm audible above surrounding background noise.
- All off-highway earthmoving equipment and trucks such as loaders, dozers, scrapers, motor graders, rock trucks, tractors, rollers and compactors shall be equipped with rollover protective structures (ROPS) and seat belts.
- Seat belts shall be used and adjusted properly by operators of all heavy equipment.
- Mobile equipment shall not be left unattended unless parked securely to prevent movement, with all ground engaging tools lowered to the ground, brakes set and the engine off.
- Equipment parked at night shall be lighted, barricaded or otherwise clearly marked when exposed to traffic. Keys shall not be left in equipment overnight.
- Personnel shall not be transported or ride on equipment or vehicles that are not equipped with seats for passengers.

- When fueling equipment or vehicles with gasoline or liquefied petroleum gas (LPG) the engine shall be shut down.
- All equipment and vehicles shall be equipped with appropriate fire extinguisher or fire suppression system.
- Haul roads shall be designed, constructed, and maintained for safe operation consistent with the type of haulage equipment in use. Standard traffic control signs shall be used where necessary.
- Elevated roadways shall have axle high beams or guards maintained on their outer banks.
- Equipment, tools, and materials hauled on pickups and flat bead trucks must be secured to prevent them from falling onto the road.

Welding & Cutting

- Welding leads and cutting hoses shall be kept clear of walkways and stairways.
- Flash arrestors shall be installed provided in both oxygen and acetylene hoses at the regulator connection.
- Welders shall wear approved eye and head protection when welding. Personnel assisting the welder shall also wear approved eye protection.
- Prior to welding or cutting a "20-ABC" rated fire extinguisher shall be within easy reach of the worker. A fire watch shall be stationed at all locations where sparks and/or flames may fall to a lower floor/work area or to another side of a wall.
- A suitable cylinder truck, with chain shall be used to keep cylinders from being knocked over while in use.
- Spent welding rods shall be picked up and disposed of daily.
- When practical all welding and cutting operations shall be shielded by non-combustible or flame-proof screens.
- Oxygen and acetylene cylinders shall not be stored inside buildings.
- Rubber boot protectors shall be provided on all welding leads where they make connections at the welding machine.

Personal Protective Equipment

Eye and Face Protection

All employees shall wear safety glasses 100% of the time while on the construction site. Minimum eye protection shall include approved safety glasses **with side shields** which meet the standards specified in ANSI Z-87.1-1989 (this shall also include prescription eye wear).

Additional eye and face protection in combination shall be worn when:
- Welding, burning or cutting with torches
- Using abrasive wheels, portable grinders or files
- Chipping concrete, stone or metal
- Working with any materials subject to scaling, flaking or chipping
- Drilling or working under dusty conditions
- Using explosive actuated fastening or nailing tools
- Working with compressed air or other gases

Only clear safety glasses shall be worn inside any building(s).

Head Protection

All construction workers shall wear hard hats which meet ANSI Z 89.1-1986, 100% of the time while on the construction site. Hard hats shall display the company decal where the employee works.

All delivery personnel, vendors and visitors shall wear approved hard hats while on the project.

Hearing Protection

Work areas shall be monitored to identify areas of high noise exposure (85 dBA and higher). All work areas identified as high noise exposure shall be properly posted to warn employees of the exposure.

Appropriate hearing protection shall be worn in work areas where noise levels are 85 dBA or greater.

Respiratory Protection

Contractors whose work activities warrants employees wear respiratory protection, shall establish and implement a respiratory protection program. The program shall meet the requirements set forth in 29 CFR 1926.134.

Foot Protection

All personnel on the construction site shall wear leather hard-soled work boots. No one is permitted to wear sneakers (including ANSI approved), tennis shoes or athletic shoes of any type, sandals, high heels or thongs on the construction site.

Clothing

Suitable clothing for construction shall be worn on the construction site. Shirts with sleeves (at least t-shirt (4 inches) in length), full length pants and reflective safety vests shall be required. Shorts, sweat-pants or tank-tops are not allowed.

Appendix A - Safety Orientation

Check each box when completed - To be completed by all employees on the jobsite. To be completed by site supervision and employee prior to beginning work.

- ❑ Alcohol and/or drug use, fighting or horseplay are prohibited and will result in immediate termination
- ❑ 100 % eye protection, hard hats and reflective safety vests are required when on the construction project
- ❑ Review potential hazards on the project and the precautions to be taken to prevent injury
- ❑ Disciplinary Policy:

  Non-serious violation
  First violation - Verbal warning
  Second violation - Verbal & written warning
  Third violation - Verbal & written warning and three day suspension without pay
  Fourth violation - Employee discharge from company

  Serious violation - (see disciplinary policy)
  First violation - Verbal & written warning
  Second violation - Employee discharge from company
- ❑ Hazard Communication Program - location of MSDS's and written program on the project
- ❑ All accidents, injuries and unsafe conditions shall be reported to supervisor immediately
- ❑ Medical treatment protocols for injuries requiring off-site medical treatment with a doctor
- ❑ Safety meetings are held on a weekly basis (attendance is mandatory)
- ❑ All employees shall dress properly while working. Minimum attire is long pants, shirt with at least 4-inch sleeves and sturdy above the ankle work-boots
- ❑ Ground fault circuit interrupters (GFCI) are required on all tools. All extension cords and power tools shall be properly grounded. Notify supervision immediately if defective equipment exists.
- ❑ All employees exposed to a fall exposure of six or greater, shall be protected by the means of fall protection. Specific training is required for fall protection.
- ❑ Employees are not allowed to work in excavations 4 feet or more in depth, unless they are properly sloped or protected by shielding or shoring
- ❑ Lockout/tagout is required when working on equipment or tools where unexpected start-up may occur or the release of energy may result in injury
- ❑ Before any employee is allowed to wear a respirator (including paper masks) they must be medically approved by a doctor and fit-tested
- ❑ Scaffolds shall be inspected and tagged prior to use by any personnel. Red tag means DO NOT USE; Yellow Tag means section of scaffold does not meet OSHA standards and Green Tag means SAFE FOR USE.
- ❑ Other hazards discussed related to the construction project:
  _____
  _____
  _____

Equipment Issued

- ❑ Hardhat
- ❑ Safety Glasses
- ❑ Orange vest
- ❑ Fall Protection Harness & Lanyard
- ❑ Respirator
- ❑ Other _____

To be completed by supervisor in the field with the employee

- ❑ Show employee around the project and discuss potential hazards
- ❑ Introduce employee to crew members
- ❑ Assign new employee to experienced work crew
- ❑ Specify work duties
- ❑ Where to eat lunch

This is to acknowledge that I have completed new employee orientation and understand that failure to comply with the Safety Program may be grounds for dismissal.

Employee Print Name: _____ Date: _____

Emergency Contact: _____

Employee Signature: _____

Supervision Signature: _____ Date: _____

Appendix B – Employee Disciplinary Guideline

The discipline policy is intended to encourage compliance with the requirements of the Federal Occupational Safety and Health Act of 1970 (OSHA) and all additions and revisions thereto, as well as other applicable federal, state and local requirements and this Safety and Health Guideline. Workers performing work in an unsafe manner that would endanger the employee, other workers or the public shall be subject to discipline or termination.

The Project Representative in conjunction with the Project Manager and Project Foreman will determine the course of action best suited to the circumstances. The steps to be taken shall be progressive, except in the most egregious circumstances and shall include:

a) **Non-Serious** – Initial, isolated, or rare instances of violation, that do not result in danger to the employee, property, or others, should be corrected through non disciplinary discussion and instruction. Safety violations of a less serious nature will be handled as follows:

First Offense	Verbal Warning
Second Offense	Written Warning
Third Offense	Employee given three-day suspension without pay
Fourth Offense	Employee Discharge

b) **Serious** – One which could result in serious injury or loss of life or serious loss of property, shall be subject to:

First Offense	Employee given three-day suspension without pay
Second Offense	Employee Discharge

c) **Supervisor Accountability** – If two or more employees working for the same supervisor are found in serious violation as described above, that subcontractor supervisor is also subject to disciplinary action up to and including immediate discharge.

Documentation - Notice of safety violation (written) shall be given to the employee, and a copy sent to the Project Safety Representative.

Appendix C - Critical Lift Checklist

Project: _____ Date: _____

Description of Lift:_____

_____

_____

Name of supervisor in charge of lift: _____

Name of crane operator(s):_____

Name of signal person(s):_____

Crane Data:

Make and Model: _____

Boom Length: _____

Counterweight: _____

Capacity:_____

Load Data:

Gross Load Weight: _____

Rigging Weight: _____

Load block & line Weight: _____

Max. Load Radius: _____

Min. Load Angle:_____

Max. Boom Angle: _____

Min. Boom Angle: _____

Net Load Weight: _____

Pre-Lift Requirements:

_____ Load is within chart limits.

_____ Has the Center of Gravity of the Load been established and marked?

_____ Is rigging adequate and in good condition?

_____ Load chart utilized is for exact crane model; boom type, length, tip; counterweight.

_____ Competent person in charge of lift: Name

_____ Competent signal person identified: Name

_____ Pre-pick meeting held with crew

_____ Written crane inspection completed within 1 day of critical pick

_____ Swing path not over personnel

_____ Footing is sound and level (soil conditions/compaction, underground tunnel or utilities).

_____ Pre-planning for radio or hand signal communications.

_____ Minimum clearances from power lines can and will be maintained.

_____ The load radius has been measured with tape measure.

_____ Weather conditions have been checked, including wind speed.

_____ Load will not touch boom at any time.

_____ For dual crane lift – diagrams have been prepared.

_____ Pad blocking is adequate and substantial.

_____ Outriggers are fully extended.

Signed: _____
Supervisor in Charge

Appendix D – Substance Abuse

Policy Statement

The Owner **Memphis-Shelby County Airport Authority** and the OCIP Team are committed to providing project employees with a drug-free and alcohol-free workplace. It is our goal to protect the health and safety of these employees and visitors to our job site, promote a productive workplace, and protect the reputation of our project.

Consistent with those goals, the use, possession, distribution, or sale at project sites of drugs, drug paraphernalia or alcohol is prohibited. A program of drug and alcohol testing will be instituted to monitor compliance with this policy.

Contractors / Subcontractors refusing to comply with this Drug and Alcohol Policy will not be permitted to work on this OCIP project and will be noted as being in violation of their contract with the (Project Name) / or other contractors & subcontractors working on this project.

This Policy does not represent a contract between the Owner **Memphis-Shelby County Airport Authority**, Design and Development, the OCIP Team, Owners of project, Construction Managers, General Contractors, Subcontractors, employees, or perspective employees of the project.

Policy Administration

It is our combined goal to protect the health and safety of personnel, craft workers, and visitors to our job site; to promote a productive workplace and protect the reputation of this OCIP.

Prohibited Substances

1. Drugs or Drug is defined as any substance which may impair mental or motor function including but not limited to illegal drugs, controlled substances, designer drugs, synthetic drugs, look alike drugs, and under circumstances described in this policy -prescription drugs.

2. Alcohol is defined as any beverage or substance containing alcohol, ethyl alcohol or ethanol. “Alcohol Testing or Alcohol test means testing by certified breath-alcohol technician using a DOT approved initial screening device or urine alcohol testing conducted by a certified laboratory and confirmed by gas chromatography/mass spectroscopy (GC/MS)”. Test levels must not meet or exceed.04 grams per 210 liter of breath.

Pre-Project Testing

Prior to the beginning work on this Project, employers will be required to ensure that all employees have met the requirements of this policy with a negative (passing) test result. Employers and employees not meeting the requirements will not be allowed to work on this OCIP job site.

Additional Testing of Employees

1. **Post-Accident**: It is agreed that drug and alcohol testing of employees shall be required after each and every work-related incident. This testing shall take place at the medical facility providing treatment for the injury. A work-related accident is defined as an accident resulting in an injury requiring treatment by a physician to the employee or other employees injured and / or resulting in damage to property or equipment.

2. **Reasonable Suspicion**: Is defined as supervision having a reason to suspect employee drug or alcohol use. The employer will bear the cost of this test.

Points of Understanding Regarding Substance Abuse Testing

1. The employer, the medical facility and the testing laboratory agree that the results of the described tests are to be held in strictest **CONFIDENCE** between the employer, the OCIP Workers Compensation Carrier and the

medical facility (MRO). This is an issue of employee – employer relationship (employment) and falls under the requirements within the employer's program.

2. This statement is noted for the purpose of adjudicating a workers compensation claim. The OCIP Workers Compensation Carrier requires the employer to report all accident-related drug and alcohol test results to them immediately.

Testing Procedures

1. At a minimum pre-project and post-accident testing is required.
2. Testing shall include the following drugs at a minimum:
   Marijuana, Cocaine, Opiates, Amphetamines, Phencyclidine, Barbiturates, Benzodiazepines, Methadone, Propoxyphene
3. For reasons of safety, any employee subject to a reasonable suspicion test shall be suspended until test results are available.

Prescription Drugs

The use of current valid prescription Drugs that may impair an employee's ability to safely perform his or her duties must be reported to the safety director, supervisor and management personnel.

Alcoholic Beverages

Under no circumstances are alcoholic beverages allowed on the project site.

Disciplinary Action

1. A positive pre-project or post-accident test will result in worker dismissal from this project site

2. Employees found using, selling, possessing, or manufacturing drugs shall be removed from this project and may be reported to local law enforcement.

Confidentiality

All actions taken under this policy will be in conformance with the Local Drug Testing Act

Subcontractors and Vendors

Subcontractors, sub-tiered contractors, vendors, and their employees shall cooperate with this policy in achieving a drug-free and alcohol-free workplace.

Amendments to Policy

Amendments to this policy may be issued to comply with project owner requirements, state or local laws, or federal contract requirements.

Company Name _____

DRUG AND ALCOHOL POLICY
ACKNOWLEDGMENT AND ACCEPTANCE STATEMENT

I certify that I have read and understand the statement and policy. I further understand that prior to employment and during employment, I am subject to drug and alcohol screening tests. I agree to provide the specimen appropriate to such drug or alcohol test(s) as may be required. I further understand that my property and I may be subject to search under the terms of this policy while I am on the Owner's premises. Failure to provide the appropriate specimen, or to permit a search, will subject me to removal from this site.

I also understand that I will not be allowed to go to work prior to the reporting of my pre-employment drug test results.

If I am an employee of a subcontractor company, an employee of an affiliate company assigned to the job site, or a contract staff, I understand that I am subject to pre-employment drug testing and all testing conditions of this Policy. Failure to provide the appropriate specimen or to permit a search or a positive test result will result in my immediate removal from this job site.

_____ _____
Signature Date

_____
Print Name and Title

_____
Witness

Guidelines for Reasonable Suspicion

Observation Checklist

1.	**Walking**	___ Stumbling	___ Staggering	___ Falling	___ Unable to Walk
		___ Swaying	___ Unsteady	___ Holding On	___ Normal
2.	**Standing**	___ Swaying	___ Rigid		___ Unable to Stand
		___ Staggering	___ Sagging at Knees		___ Feet Wide Apart
3.	**Speech**	___ Shouting	___ Silent	___ Whispering	___ Slow
		___ Rambling	___ Mute	___ Slurred	___ Slobbering
		___ Incoherent	___ Confused	___ Normal	
4.	**Demeanor**	___ Cooperative	___ Polite	___ Calm	___ Sleepy
		___ Silent	___ Talkative	___ Crying	___ Excited
		___ Sarcastic	___ Fighting		
5.	**Actions**	___ Resisting Communications	___ Fighting	___ Threatening	___ Erratic
		___ Drowsy	___ Profanity	___ Hyperactive	___ Hostile
		___ Calm			
6.	**Eyes**	___ Bloodshot	___ Watery	___ Dilated	___ Glassy
		___ Droopy	___ Closed	___ Normal	
7.	**Face**	___ Flushed	___ Pale	___ Sweaty	___ Normal
8.	**Appearance/ Clothing**	___Unruly	___ Messy	___ Dirty	___ Partially Dressed
		___ Body Excrement	___ Stains	___Neat	___ Normal
9.	**Breath**	___ Alcoholic Odor	___ Faint Alcohol Odor	___ No Odor	
10.	**Movement**	___ Fumbling	___ Jerky	___ Slow	___ Hyperactive
		___ Nervous	___ Normal		
11.	**Eating/ Chewing**	___ Gum	___ Candy	___ Mints	___ Other – identify

12. Other observations: (Visible drug use, possession, sale, etc.: attendance; poor work performance or accident; tampering with drug test; credible reports, etc.)

_____

_____

Observed by: _____ Observed by: _____

Date: _____ Time: _____ Location: _____

Appendix E - Supervisor's Report of Bodily Injury

Date of Accident _____ Date Returned to Work: _____

Location of Accident _____Time of Accident _____ am/pm

Contractor/Subcontractor Involved_____

First Aid: _____ Recordable _____ Lost Time _____ Fatality _____

Damage*_____ Fire _____ Property _____

Equipment _____

Injured Person: _____ SSN: _____

Address: _____ Occupation: _____

_____ Home Phone: _____

Male _____ Female _____ Age _____

Nature of Injury: _____

First Aid Administered By: _____

Hospital_____

Physician _____

Witnesses: _____

_____

Equipment and/or Materials Involved: _____

Cause Of Accident:_____

_____

_____

Superintendent's Corrective Action: _____

_____

Employee's Signature: _____

Supt. Signature_____

Date of report:_____

*Attach a list of damaged property and/or equipment excluding motor vehicles. Indicate owner's names and addresses. Complete "Report of Damage to Equipment or Property" (Appendix F).

Appendix F - Report of Damage to Equipment or Property

Date _____

Contractor/Subcontractor _____

Location of Accident _____

Equipment Involved _____

Personal injuries Yes _____ No _____

Damage Estimate $ _____

Witness to Accident	Statement Obtained		Statement Attached	
	Yes	No	Yes	No
_____	Yes	No	Yes	No
_____	Yes	No	Yes	No
_____	Yes	No	Yes	No

Remarks _____

_____

_____

_____

Time of Accident _____ AM _____ PM _____ Date _____

Weather Conditions _____ Temperature _____

Roadway or surface type _____ Wet _____ Dry _____ Other _____ *

*If other, explain _____

_____

_____

If more space is required, use back of this sheet for additional information and sketches.

Signed _____

Title _____

Employee Name _____

Appendix G - Contractor Monthly Report of Safety Statistics

MONTHLY ACCIDENT EXPERIENCE SUMMARY	CONTRACT NO:		
	CONTRACTOR/SUBCONTRACTOR NAME:		
	MONTH YEAR		
	REPORTING PERIOD: THROUGH:		
	THIS MONTH	YEAR TO DATE	PROJECT TO DATE
HOURS WORKED			
PAYROLL			
A. FIRST-AID CASES B. OSHA RECORDABLE CASES C. LOST TIME CASES (list each under comments) D. TOTAL LOST WORK DAYS E. PROPERTY DAMAGE F. EQUIPMENT G. GENERAL PUBLIC			
OSHA Recordable Incidence Rate* Lost Time Incident Rate*			
COMMENTS:			
Prepared By: Date		PM/Superintendent Date	

Appendix H – Safety Improvement Team Guidelines

The Owner recognizes that a cooperative effort is required to insure a safe construction project. Therefore, the Contractor shall establish a Safety Improvement Team to facilitate the proper cooperative attitude.

The Safety Improvement Team shall be composed of an equal number of employee and management representatives. The management personnel (4) will consist of one Owner representative, one person from the Contractor, one from the workers' compensation/general liability insurance carrier and a representative of subcontractor supervision. The employee members (4) shall be selected from the various subcontractor trades on a voluntary basis or by nomination to serve a minimum of one year each.

The Contractor's Safety Manager shall serve as the Safety Improvement Team advisor and is responsible for providing meeting agendas and minutes, giving assignments to the committee, and publicizing committee accomplishments. Safety Improvement Team meeting minutes and attendance roster shall be maintained.

The Contractor's Safety Manager is responsible for assuring that Committee members are adequately trained to perform their duties and responsibilities.

The Contractor's Safety Manager is responsible for assuring that subcontractors with 25 or more employees establish their own Safety Improvement Team commensurate with the NRS requirements.

The primary purpose of the Safety Improvement Team is to evaluate safety and health program effectiveness, suggestions, hazard reports, hotline reports, etc., and to provide suggestions and recommendations to improve workplace safety.

Additional duties include advising and educating employees in safe working practices, investigating accidents and their causes, recommending preventative measures, inspecting work areas, and other duties as assigned.

Meetings shall be held at least monthly, and discussion items shall include:

- Inspection Reports
- Accident Reports
- The safety of construction methods and practices
- Review and make recommendations on employee hazard reports, hotlines, etc.

The Safety Improvement Team members will receive their regular rates of pay while performing Safety Improvement Team duties. Time spent performing Safety Improvement Team duties shall be documented using normal time reporting procedures.

EXHIBIT E
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
GLYCOL MANAGEMENT PROGRAM – CONTROL FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

FAA REQUIRED CONTRACT PROVISIONS

Federal laws and regulations require that recipients of federal assistance (Sponsors) include contract provisions in certain contracts, requests for proposals, or invitations to bid. The provisions are as follows:

1. Title VI Clauses for Compliance with Nondiscrimination Requirements (FAA Provision A6.4.1). (Reference: 49 USC § 47123)

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:

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

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 subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.

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 subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Nondiscrimination Acts And Authorities on the grounds of race, color, or national origin.

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 Nondiscrimination Acts And Authorities 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.

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.

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 subcontractor, 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.

2. Title VI List of Pertinent Nondiscrimination Acts and Authorities (FAA Provision A6.4.5).

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 non-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).

3. Federal Fair Labor Standards Act (FAA Provision A17). (Reference: 29 U.S.C. § 201, et seq**.)**

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part time workers.

The Contractor has full responsibility to monitor compliance to the referenced statute or regulation. The Contractor must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division.

4. Occupational Safety and Health Act of 1970 (FAA Provision A20). (Reference: 29 CFR part 1910)

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. Contractor must provide a work environment that is free from recognized hazards

that may cause death or serious physical harm to the employee. The Contractor retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 CFR Part 1910). Contractor must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

5. General Civil Rights Provisions (FAA Provision A5). (Reference: 49 U.S.C**.** § 47123)

The Contractor agrees to 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 disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision binds the contractor and subcontractors 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.

EXHIBIT F
TO
LUMP SUM CONSTRUCTION CONTRACT
FOR
GLYCOL MANAGEMENT PROGRAM – CONTROL FACILITY - CONSTRUCTION

BY AND BETWEEN
THE MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY
AND
(CONTRACTOR NAME)

STATE REQUIRED CONTRACT PROVISIONS

F.1. Conflicts of Interest. Contractor warrants that no part of the total contract amount shall be paid directly or indirectly to an employee or official of the State of Tennessee as wages, compensation, or gifts in exchange for acting as an officer, agent, employee, subcontractor, or consultant to MSCAA in connection with any work contemplated or performed relative to this Contract.

F.2. Lobbying. The Contractor certifies, to the best of its knowledge and belief, that:

a. No federally appropriated funds have been paid or will be paid, by or on behalf of the undersigned, 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.

b. If any funds other than federally 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 contract, grant, loan, or cooperative agreement, the Promisor shall complete and submit Standard Form-LLL, “Disclosure of Lobbying Activities,'' in accordance with its instructions.

c. The Contractor shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into and is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. § 1352.

F.3. Nondiscrimination. Contractor hereby agrees, warrants, and assures that no person shall be excluded from participation in, be denied benefits of, or be otherwise subjected to discrimination in the performance of this Grant Contract or in the employment practices of the Contractor on the grounds of handicap or disability, age, race, color, religion, sex, national origin, or any other classification protected by federal, Tennessee state constitutional, or statutory law. The Contractor shall, upon request, show proof of nondiscrimination and shall post in conspicuous places, available to all employees and applicants, notices of nondiscrimination.

F.4. Public Accountability. If the Contractor is subject to Tenn. Code Ann. § 8-4-401 *et seq*., or if this Contract involves the provision of services to citizens by Contractor on behalf of the State, Contractor agrees to establish a system through which recipients of services may present grievances about the operation of the service program. The Contractor shall also display in a prominent place, located near the passageway through which the public enters in order to receive Grant supported services, a sign at least eleven inches (11") in height and seventeen inches (17") in width stating:

NOTICE: THIS AGENCY IS A RECIPIENT OF TAXPAYER FUNDING. IF YOU OBSERVE AN AGENCY

DIRECTOR OR EMPLOYEE ENGAGING IN ANY ACTIVITY WHICH YOU CONSIDER TO BE ILLEGAL, IMPROPER, OR WASTEFUL, PLEASE CALL THE STATE COMPTROLLER'S TOLL-FREE HOTLINE: 1-800-232-5454.

The sign shall be on the form prescribed by the Comptroller of the Treasury. MSCAA shall obtain copies of the sign from the Tennessee Department of Transportation, Aeronautics Division, and upon request from the Contractor, provide Contractor with any necessary signs.

F.5. Public Notice. All notices, informational pamphlets, press releases, research reports, signs, and similar public notices prepared and released by the Contractor in relation to this Contract shall include the statement, "This project is funded under a grant contract with the State of Tennessee." All notices by the Contractor in relation to this Contract shall be approved by the State.

F.6. Records. The Contractor and any approved subcontractor shall maintain documentation for all charges under this Contract. The books, records, and documents of the Contractor and any approved subcontractor, insofar as they relate to work performed or money received under this Grant Contract, shall be maintained in accordance with applicable Tennessee law. In no case shall the records be maintained for a period of less than five (5) full years from the date of the final payment. The Contractor's records shall be subject to audit at any reasonable time and upon reasonable notice by the Tennessee Department of Transportation, the Comptroller of the Treasury, or their duly appointed representatives.

The records shall be maintained in accordance with Governmental Accounting Standards Board (GASB) Accounting Standards or the Financial Accounting Standards Board (FASB) Accounting Standards Codification, as applicable, and any related AICPA Industry Audit and Accounting guides.

In addition, documentation of grant applications, budgets, reports, awards, and expenditures will be maintained in accordance with U.S. Office of Management and Budget's *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards*.

Contract expenditures shall be made in accordance with local government purchasing policies and procedures and purchasing procedures for local governments authorized under state law.

The Contractor shall also comply with any recordkeeping and reporting requirements prescribed by the Tennessee Comptroller of the Treasury.

The Contractor shall establish a system of internal controls that utilize the COSO Internal Control - Integrated Framework model as the basic foundation for the internal control system. The Contractor shall incorporate any additional Comptroller of the Treasury directives into its internal control system.

Any other required records or reports which are not contemplated in the above standards shall follow the format designated by the head of the Tennessee Department of Transportation, the Central Procurement Office, or the Commissioner of Finance and Administration of the State of Tennessee.

DIVISION 0 – SECTION 00605

CERTIFICATE OF SECRETARY

AS TO RESOLUTION ADOPTED BY BOARD OF DIRECTORS

On _____

I,_____, hereby certify that I am the duly authorized Secretary of _____, charged with keeping the records and the seal of said Corporation, and that the following is a true and correct copy of a resolution adopted at a meeting of the Board of Directors of the Corporation duly held on _____, which resolution is now in full force and effect.

RESOLVED, that _____, (President, Vice President) of _____ is hereby authorized to execute contracts, performance bonds and labor materials bonds on behalf of the Corporation.

WITNESS my hand as Secretary, and the seal of the Corporation this _____ day of _____, 20____.

_____
Secretary

BEFORE ME, a notary public of the state and county mentioned, personally appeared _____, with whom I am personally acquainted, and who, upon oath, acknowledged such person to be _____, and officer authorized to execute the instrument, of _____, the within named bargainor, a corporation, and that such officer, as such _____, executed the foregoing instrument for the purposes therein contained, by personally signing their name of the corporation as _____.

WITNESS my hand and seal, at office, this _____ day of _____ , 20 .

_____
Notary Public
(SEAL)

My Commission Expires:_____

END OF SECTION 00605

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PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

as Principal, hereinafter called Contractor or Principal, and

as Surety, hereinafter called Surety, are held and firmly bound unto

MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY

hereinafter called Owner, or Obligee, in the amount of _____ Dollars, for the performance whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly, severally, and solidarily, firmly by these presents.

The penal sum of this Performance Bond shall be increased by the amount that the Contract, as herein below defined, is increased during the term of the Performance Bond.

WHEREAS, Principal has entered into a written agreement with the Owner (hereinafter referred to as "Contract") for:

in accordance with Drawings and Specifications prepared and to be prepared by

Ross Witt PLLC

which Contract is by reference incorporated herein and made a part hereof.

WHEREAS, the Surety represents that it possesses an A-VIII rating or higher in the most recent edition of Best Insurance Reports and that Surety is authorized to execute and deliver bonds in the State of Tennessee.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly and faithfully perform each and every term, condition, obligation and provision of said Contract, including but not limited to, completion and delivery of the work described in the Contract within the scheduled time as such time may be extended from time to time as permitted in the Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

The Surety shall within sixty (60) days from notice by Owner to the Surety, either

1. Proceed to complete the performance of the Contract timely in accordance with the terms and conditions of the Contract, including but not limited to:

   (a) The responsibilities of the Principal for completion of the Work, correction of defective Work, warranty Work and payment for the Work; and

   (b) Payment of liquidated damages specified in the Contract, or

2. Pay to the Owner the amount of its costs and damages, up to the penal sum of this bond, that would be owed by the Principal to the Obligee under the Contract to complete the obligations of the Principal, including any liquidated damages that may be due and any additional legal, design professional or delay costs resulting from the Contractor's default less any remaining contract funds.

The Surety hereby waives notice of any alteration or extension of time made by the Owner. The Surety hereby waives notice of any change in the scope of the Contract.

Any suit under this Performance Bond must be instituted in a court of competent jurisdiction, in Shelby County, Tennessee, and not elsewhere within four (4) years from Substantial Completion as defined in the Contract.

No right of action shall accrue on this bond to or for the use of any person, partnership or corporation other than the Owner or the heirs, executors, administrators, successors or assigns of the Owner.

Notice of claim to the Surety under the bond shall be sent to the following address:

SIGNED AND SEALED this ____ day of _____, 20____.

_____
PRINCIPAL

TITLE: _____

_____
SURETY

TITLE:_____

_____
ADDRESS

_____
CITY STATE ZIP CODE

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

as Principal, hereinafter called Contractor or Principal, and

as Surety, hereinafter called Surety, are held and firmly bound unto

MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY

hereinafter called Owner or Obligee, in the amount of _____ Dollars, for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly, severally, and solidarily, firmly by these presents.

The penal sum of this Labor and Material Payment Bond shall increase by the amount that the Contract, as herein below defined, is increased during the term of the Labor and Material Payment Bond.

WHEREAS, Principal has entered into a written agreement with the Owner (hereinafter referred to as the "Contract") for:

in accordance with Drawings and Specifications prepared and to be prepared by

Ross Witt PLLC

which Contract is by reference incorporated herein and made a part hereof.

WHEREAS, the Surety represents that it possesses an A--.VIII rating or higher in the most recent edition of Best Insurance Reports and that Surety is authorized to execute and deliver bonds in the State of Tennessee.

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly and faithfully complete the work as defined in the Contract free and clear of all claims, liens and any other contractual, statutory, or legal rights the Claimants, as hereinbelow defined, may have for the payment of amounts owed in connection with or arising out of the Contract ("Claims"); and the Principal shall make prompt payment to all persons having a Claim or lien pursuant to any statute or law of the State of Tennessee, then this obligation shall be void; otherwise, it shall remain in full force and effect.

1. A Claimant is defined as one having a contract with the Principal or a subcontractor or supplier of any tier for labor, materials, equipment used or reasonably required for use in the performance of the Contract, labor and materials being construed to include water, power, gas, light, heat, oil, gasoline, or telephone services applicable to the Contract.

2. No suit or action shall be commenced by any Claimant:

   a) After the expiration of two (2) years following the date which Substantial Completion as defined in the Contract is achieved. However, if any limitation embodied in this bond is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

b) Other than in a court of competent jurisdiction in Shelby County, Tennessee, and not elsewhere.

3. Upon written notice to Surety from the Owner, Surety shall, within forty-five (45) days after receipt of said notice, pay or cause to be paid all Claims made or if the Surety contests in good faith the validity of any Claim, the Surety shall, within forty-five (45) days after receipt of said notice, cause bonds to be posted in an amount and form acceptable to Obligee to bond off such Claims. Surety shall indemnify, defend and hold Obligee harmless from any such Claims together with any and all attorney's fees, costs and expenses or liability in any manner arising out of or in connection therewith.

4. The Surety hereby waives notice of any alteration or extension of time made by the Owner. The Surety hereby also waives notice of any changes in the scope of the Contract, including changes to the contract amount.

Notice of claim to the Surety under the bond shall be sent to the following address.

SIGNED AND SEALED this the _____ day of _____, 20____.

_____
PRINCIPAL

TITLE: _____

_____
SURETY

TITLE: _____

_____
ADDRESS

_____
CITY STATE ZIP CODE

MEMPHIS INTERNATIONAL AIRPORT

APPLICATION FOR PAYMENT NO. ____

TO: MEMPHIS-SHELBY COUNTY AIRPORT AUTHORITY

REGARDING CONTRACT FOR: **MSCAA PROJECT NO. 08-1260-05**
Glycol Management Program - Control Facility - Construction

CONTRACTOR: **CONTRACTOR**

FOR WORK ACCOMPLISHED FROM __ TO __

STATUS OF CONTRACT:

ORIGINAL CONTRACT PRICE:			**$0.00**
APPROVED CONTRACT AMENDMENTS:			
No. 1 Approved	MM/DD/YYYY	Adds 0 days	**$0.00**
No. 2 Approved	MM/DD/YYYY	Adds 0 days	**$0.00**
No. 3 Approved	MM/DD/YYYY	Adds 0 days	**$0.00**
No. 4 Approved	MM/DD/YYYY	Adds 0 days	**$0.00**
No. 5 Approved	MM/DD/YYYY	Adds 0 days	**$0.00**
No. 6 Approved	MM/DD/YYYY	Adds 0 days	**$0.00**
	Total time extension:	**Adds 0 days**	
TOTAL AMENDED CONTRACT PRICE			**$0.00**

NOTICE TO PROCEED DATE:

ORIGINAL COMPLETION DATE:

AMENDED COMPLETION DATE:

REMARKS:

TOTAL INSTALLED TO DATE		
previously installed to date	**$0.00**	
this application installed	**$0.00**	
		$0.00
plus STORED MATERIALS		
previously stored materials	**$0.00**	
this application stored materials	**$0.00**	
		$0.00
less PREVIOUSLY CERTIFIED FOR PAYMENT		**$0.00**
equals AMOUNT DUE THIS APPLICATION		**$0.00**

CONTRACTOR'S CERTIFICATION:

The undersigned Contractor certifies that (1) all previous progress payments received from Owner on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of Contractor incurred in connection with Work covered by prior Application for Payment number 0 through ___ inclusive; and (2) title to all materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all liens, claims, security interests and encumbrances (except such as covered by Bond acceptable to Owner). Progress status is as described in schedule under monthly construction payment request.

Dated: MM/DD/YYYY

CONTRACTOR:
Contractor

State of: Tennessee

BY: _____
Signatory
Title

County of: Shelby

Subscribed and sworn to before me this _____ day of _____, YYYY .

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DIVISION 0 - SECTION 00640

Business Diversity
Monthly Compliance Report

MSCAA Project. Name and Number: Glycol Management Program - Control Facility - Construction

(08-1260-05) Date: _____

To: Memphis Shelby County Airport Authority
Attn: ReGina Armstrong
2491 Winchester Rd., Ste. 113
Memphis, TN 38116-3856

From: Name: _____
Company: _____
Address: _____
Ph: _____
Owner Gender & Ethnicity: _____

For the month ending _____, I certify that the current payment for this contract was satisfied by the means shown below:

Name, Address, & Phone No. of All Subcontractors	Company Code	Current Payment Amt.	Check No.	Total for Calendar Year	Cumulative Total to Date	Gender	Ethnicity

PLEASE PROVIDE PROOF OF YOUR PAYMENT AMOUNT TO YOUR SUB CONTRACTORS.

Signed: _____ Title: _____

Gender Code: M=Male, **F**=Female **Proof of Payments**: Copy of Check, or Copy of E-Payment Confirmation

Company Code: DBE =Disadvantaged Business Enterprise, **MOC**=Majority Owner Company, **INC**=Incorporated/Partnership, **CM/WBE** = M/WBEs the owners of which have been certified as having a personal net worth less than $1.32mil

Ethnicity Code: **B**=Black, **H**=Hispanic, **N**=Native American, **AA**=Asian American, **APA**=Asian Pacific American, **SCA**=Sub Continent Asian, **NM**=Non-Minority, **C**=Caucasian & **O**=Other

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DIVISION 0 – SECTION 00765

SUPPLEMENTAL PROVISIONS

00765-01 CONTRACTOR'S FIELD OFFICE

A Contractor's field office is required for this project. Contractor shall keep on file at the project site copies of contract drawings, shop drawings, specifications, and other records pertaining to the project, in good condition, and readily accessible to the Contractor, Owner, Engineer, and all parties concerned.

00765-02 PROTECTION OF PERSONS AND PROPERTY

00765-02.1 The Contractor shall be responsible for initiating, maintaining and supervising safety and anti-substance abuse precautions and programs in connection with the Work, and shall provide all protection to prevent injury to all persons involved in any way in the Work and all other persons, including, without limitation, the employees, agents, guests, visitors, invitees and licensees of the Owner who may visit or be affected thereby. These precautions shall include, but in no event be limited to: the posting of danger signs and personal notification to all affected persons of the existence of a hazard of whatever nature; the furnishing and maintaining of necessary traffic control barricades and flagman services; the use, or storage, removal and disposal of required explosives or other hazardous materials only under the supervision of qualified personnel and after first obtaining permission of all applicable governmental authorities; and the maintenance of adequate quantities of both hose and operable fire extinguishers at the job site. The Contractor shall set forth in writing its safety and anti-substance abuse precautions and programs in connection with the Work and, if requested by the Owner, submit the same to the Owner for review. The Owner may, but shall not be obligated to, make suggestions and recommendations to the Contractor with respect thereto.

00765-02.2 All Work, whether performed by the Contractor, its Subcontractors or Sub-Subcontractors, or anyone directly or indirectly employed by any of them, and all equipment, appliances, machinery, materials, tools and like items incorporated or used in the Work, shall be in compliance with, and conform to: (a) all applicable laws, ordinances, rules, regulations and orders of any public, quasi-public or other governmental authority relating to the safety of persons and their protection against injury, specifically including, but in no event limited to, the Federal Occupational Safety and Health Act of 1970, as amended, and all rules and regulations now or hereafter in effect pursuant to said Act; and (b) all codes, rules, regulations and requirements of the Owner and its insurance carriers relating thereto. In the event of conflicting requirements, the more stringent shall govern.

00765-02.3 The Contractor shall designate a responsible member of its organization at the Job site as the Project Safety Officer, whose duties it shall be to enforce the Contractor's safety and anti-substance abuse programs, to assure compliance with the Contract Documents and to prevent accidents. This person shall have enforcement authority and be responsible for carrying out the relevant duties and be designated in writing by the Contractor and approved by the Owner. The Contractor shall further cause each of its Subcontractors and Sub-Subcontractors to designate a responsible supervisory representative to assist the Contractor's Project Safety Officer representative in the performance of their duties as aforesaid.

00765-02.4 Should the Contractor fail to provide a safe area for the performance of the Work or any portion thereof, the Owner shall have the right, but not the obligation, to suspend Work in the unsafe area. All costs of any nature (including, without limitation, overtime pay) resulting from the suspension, by whomsoever incurred, shall be borne by the Contractor.

00765-02.5 The Contractor shall provide to each worker on the job site the proper safety equipment for the duties being performed by that worker and will not permit any worker on the job site who fails or refuses to use the same. The Owner shall have the right, but not the obligation, to order the Contractor to send a worker home for the day or to discharge a worker for their failure to comply with safe practices or anti-substance abuse policies, with which order the Contractor shall promptly comply.

00765-02.6 The Contractor shall indemnify the Owner, from and against any and all liability, public or private, penalties, contractual or otherwise, losses, damages, costs, attorney's fees, expenses, causes of action, claims or judgments resulting either in whole or in part from any failure of the Contractor, its Subcontractors or Sub-Subcontractors or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, to comply with the provisions of the Contract. The Contractor shall not be relieved of its responsibilities under the Contract, should the Owner act or fail to act pursuant to its rights hereunder, nor shall the Owner thereby assume, nor be deemed to have assumed, any responsibilities otherwise imposed upon the Contractor by this Construction Contract, in any manner whatsoever.

00765-02.7 The Contractor shall, throughout the performance of the Work, maintain adequate and continuous protection of all Work and temporary facilities against loss or damage from whatever cause, shall protect the property of the Owner and third parties from loss or damage from whatever cause arising out of the performance of the Work and shall comply with the requirements of the Owner, its designated agents, and its insurance carriers and with all applicable laws, codes, rules and regulations with respect to the prevention of loss or damage to property as a result of fire or other hazards. The Owner may, but shall not be required to, make periodic patrols of the job site as a part of its normal security program. In such event, however, the Contractor shall not be relieved of its aforesaid responsibilities.

END OF SECTION 00765

DIVISION 0 – SECTION 00801

AIRPORT CONSTRUCTION SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section contains the minimum level of safety requirements for construction projects at Memphis International Airport, General DeWitt Spain Airport, and/or Charles W. Baker Airport.

B. Related work:

1. Other contract documents affecting construction safety include, but are not limited to, the DIVISION 0 AND DIVISION 1 specifications.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 CONTRACTOR PERSONNEL SAFETY ORIENTATION

A. The Contractor shall be responsible for briefing all construction personnel on the requirements contained in this section prior to their working in the construction area and at periodic intervals throughout the course of the contract. These briefings will be documented in writing.

3.02 SCHEDULING WORK

A. See Specification section 01100, SEQUENCE OF CONSTRUCTION & LIQUIDATED DAMAGES.

B. See General Provision Section 80, Paragraph 80-04, Limitation of Operations.

3.03 CONSTRUCTION SECURITY

A. See Specification section 00802, AIRPORT SECURITY REQUIREMENTS.

3.04 LIMITATION ON CONSTRUCTION

A. The limits of construction, material storage areas, equipment parking and other areas defined as available for the contractor's exclusive use during construction shall be identified and defined by the contractor prior to starting work on the project. Temporary barricades, flagging and flashing caution lights may be required at access points, taxiway crossings and pavement tie-ins. The type markings, barricades and flashing caution lights are designated on the construction plans and must be inspected and approved by the Airport Authority.

B. The Contractor shall store all materials and park construction equipment, when not in use only in the areas designated on the plans or during the pre-construction conference.

C. Stockpiling of dirt and construction materials shall be constrained in a manner preventing movement resulting from jet blast or wind in excess of 10 knots.

D. Construction debris, waste, wrappings or loose material capable of causing damage to aircraft engines, propellers, or landing gear shall not be allowed on active aircraft movement areas. Material meeting this criteria shall be contained and removed immediately from the AOA.

E. Open flame, welding, or torch cutting operations are prohibited in the construction area unless written permission has been given by the Airport Authority and adequate fire and safety precautions have been taken.

F. The use or possession of explosives is prohibited on Airport property.

G. Extensive stockpiles of construction materials will not be permitted near runway ends, runway edges, taxiways or aircraft parking aprons.

H. Excavation and open trenches may be permitted within runway safety areas and up to the edge of structural pavement on taxiways and aprons, on a case-by-case basis, i.e. cable trenches, pavement tie-ins, etc.; but only with prior approval of the Owner and, where required, the FAA.

I. Hazardous areas, into which no part of an aircraft may enter, (i.e., excavations, open trenches, material stockpiles, etc.) must be permanently delineated by use of barricades with alternate orange and white markings. The barricades are to be supplemented with orange flags (20x20 inch minimum) made and installed so that they are always in the extended position and properly oriented. For nighttime use, the barricades are supplemented with flashing red lights. Light intensity and barricade spacing must adequately delineate the hazardous area. Flare pots are prohibited.

Note: The Contractor shall designate an individual by name who is on call 24 hours per day for emergency maintenance of airport hazard lighting and barricades.

J. FAA approval is required in advance of scheduled operation of any crane or other construction equipment with top elevation exceeding 300 feet mean sea level or that will penetrate any navigable surface as defined under FAR PART 77. Advance notification of intended use will be provided by the Owner well in advance of intended use.

3.06 CONSTRUCTION VEHICLE TRAFFIC

A. Access to the construction site is as shown on the plans or as directed by the Owner. No other access point is authorized unless designated in writing by the Airport Authority. Construction traffic will operate only on designated haul routes within the construction area limits.

B. Drivers of construction vehicles will be knowledgeable of construction routes or will be escorted by other Contractor or Owner designated personnel who are knowledgeable.

C. The Contractor will be responsible for traffic control in the various construction areas of the work site. The Contractor will not permit unauthorized personnel or vehicles on the construction site.

D. The Contractor shall be responsible for immediate cleanup of any debris deposited along construction routes, as result of his construction traffic.

E. Directional signing at the construction access gate and along the delivery route to work site temporary storage areas shall be as designated and approved by the Owner.

F. Construction vehicle identification shall be as prescribed in Specification Section 00802, AIRPORT SECURITY REQUIREMENTS.

G. No construction vehicle is authorized on any active AOA pavement surface or to enter runway safety areas without specific authorization from the Owner.

3.07 REPORTING PROPERTY DAMAGE OR PERSONNEL INJURY

A. All persons involved in any accident whether personal injury, aircraft or automotive, occurring on Airport property, shall make a full report to the Airport Police (922-8298) as soon after the accident as possible. The report shall include, but not be limited to, the names, addresses of all principals and witnesses, if known, and a statement of the facts. Construction accidents fall under this category.

B. In the event of personnel injury requiring ambulance response, the Airport Police Dispatcher, upon notification, telephone 922-8333, will call the ambulance and arrange Airport Police escort to the injury site. A written report will be prepared by the Airport Police after the injury is treated.

END OF SECTION 00801

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DIVISION 0 – SECTION 00802

AIRPORT SECURITY REQUIREMENTS

PART 1 GENERAL

1.01 CONTRACTORS SECURITY AND VEHICLE PROCEDURES OVERVIEW

A. This overview outlines procedures concerning Airport security requirements, vehicle operation, and maintenance requirements for contractors at Memphis International Airport or any airport owned and operated by the Memphis-Shelby County Airport Authority. The sponsor Memphis-Shelby County Airport Authority (Airport Authority), airline, tenant, or concessionaire at the Airport who has hired the contractor is responsible for ensuring the contractor understands and complies with all the rules and regulations. This is a consolidated synopsis of the contractor requirements from the Airport Security Program and the Airport Rules and Regulations.

1.02 DEFINITIONS

A. **Aircraft** - shall mean any contrivance known or hereinafter invented, used or designed for navigation of or flight in the air.

B. **Air Operations Area (AOA)** - that part of the Airport used or intended to be used for landing, taking off, surface maneuvering, loading, unloading, or servicing the aircraft.

C. **Airport** - shall mean the Memphis International Airport and/or the General DeWitt Spain Airport and/or the Charles W. Baker Airport – where applicable.

D. **Airport Restricted Area** - area of Memphis International Airport that is not intended for public uses or access. These are areas designated by the Airport Authority as restricted areas and clearly identified with signs designating those areas as "RESTRICTED AREA." The restricted area also includes the AOA.

E. **AOA Driver's Permit** - permit issued by the Airport Authority for operating unescorted motor vehicles on the AOA.

F. **Construction Restricted Area** - any area, inside or outside of the Airport Restricted Area, which is fenced, or in some like manner defined by the Contractor. The Contractor is responsible for the security of the Construction Restricted Area.

G. **Director** - shall mean the Director of Operations and Public Safety or his duly authorized representatives.

H. **Job Site** - a predetermined geographic area with specific boundaries established by the Airport Authority.

I. **Movement Area** - runways, taxiways, and other areas of the Airport used for taxiing, takeoff, and landing of aircraft, except loading ramps and parking areas.

J. **Personal Escort** - remaining within sight of the individual under escort at all times while in the Airport restricted areas at a distance not to exceed 20 feet.

K. **Public Area** - any area within Airport facilities open to the general public.

L. **SIDA** - Security Identification Display Area.

M. **Unescorted Identification Badge** - pictured identification badge issued by the Airport Authority, which allows bearer to enter Airport Restricted Areas where there is a job related need.

N. **Vehicle Escort** - means the following of an authorized escort vehicle into the Airport Restricted Areas.

PART 2 PRODUCTS

(No products are required in this Section.)

PART 3 EXECUTION

3.01 AMENDMENTS AND SPECIAL NOTICES

A. The Contractor will be bound by any future amendments, additions, deletions, or corrections of the Airport Rules and Regulations promulgated by the Airport Authority, as dictated by changes in Federal Transportation Security Administration (TSA) regulations, as dictated by changes in Federal Aviation Administration (FAA) regulations, or safety requirements at Memphis International Airport or any airport owned and operated by Memphis-Shelby County Airport Authority.

B. Special regulations, notices, memoranda, or directions of an operations nature of interest to persons engaged in business with the Airport Authority, as generated by the Director, shall be issued under the authority of the Airport Regulations and shall have the same effect as the Airport Rules and Regulations.

C. The Director is authorized to interpret and construe these regulations wherever necessary, either by directions of general or specific application, and his interpretation and construction should be deemed a part of the regulations and binding upon all persons.

3.02 ENFORCEMENT AND COMPLIANCE WITH AIRPORT REGULATIONS

A. The uniformed Airport Police Officers of the Airport Authority and other representatives as designated by the Director are empowered to require compliance with Airport Rules and Regulations, ordinances of the City of Memphis, laws of the State of Tennessee, and federal rules and regulations. No authority is either hereby expressed or implied, however, that would permit any individual other than the Director to change, alter, or amend Airport Rules and Regulations.

B. It shall be unlawful for any person to do or commit any act forbidden herein or fail to perform any act required by Airport Rules and Regulations.

3.03 SCOPE

A. All users of and persons on Airport property shall be governed by the Airport Rules and Regulations and directions of the Director. Airport Rules and Regulations are subject to change by the Airport Authority Board of Directors at any time.

B. Airport Rules and Regulations are not intended to amend, modify or supersede federal, state, or local laws or regulations.

C. If any portion of the Airport Rules and Regulations shall be invalid or unenforceable, all other portions shall remain in effect and be construed to achieve the purposes hereof.

3.04 IDENTIFICATION REQUIREMENTS

A. Entry into the SIDA is controlled by an automated access control system as mandated under CFR 49 Part 1540 and 1542. All persons in the SIDA must display, on the outermost garment, below the head and above the waist, an Airport-approved identification media unless under Airport approved escort.

B. The Airport Authority will issue Airport Identification badges to the Contractor's employees who require access to the Airport Secured/Restricted Areas. The extent of the background check necessary for access into any worksite will be determined on a project by project basis. AIRPORT ID BADGES REMAIN AIRPORT AUTHORITY PROPERTY. Other identification procedures must be authorized by the Director in accordance with TSA regulations.

C. Recent changes to Federal TSA Regulations provide for individual sanctions against employees who violate regulatory requirements. Individual employees may be subject to federal enforcement action by the TSA to include civil penalties. Some examples of punishable actions would include:

1. Loaning a badge to someone else for use in the system.
2. "Tailgating" through restricted area doors (or not using their own badge when entering or exiting).
3. Failing to challenge unauthorized individuals in Airport restricted areas.
4. Failing to notify proper authorities for individuals violating prescribed security regulations.

D. The Memphis International Airport Identification Badge is the property of the Memphis-Shelby County Airport and must be surrendered upon termination of employment or completion of the project. The bearer will be held personally responsible for its return and is subject to any fines or penalties imposed. The badge is mandated through federal government guidelines and any misuse or tampering of badges is punishable under federal guidelines.

E. Any employee attempting to bypass security measures will be subject to having their badge confiscated and access privileges terminated. Further, any efforts by an employee to circumvent prescribed security measures could result in arrest and the imposition of penalties from the TSA to the employee and to the related employer.

F. Identification badges will be issued following the procedures listed below.

1. Identification Badge Application – To be issued at Pre-Construction Meeting.

a. Prior to the issuance of an Airport identification badge to a contract employee of the Airport or Airport tenant, a badge application form must be prepared and submitted to the Airport Authority Identification Office.

b. Badge applications must be completed before badges will be issued. Employees should be instructed to print all information clearly and legibly. After an employee completes the employee and applicant portions of the application, certification by a designated MSCAA Approved Certifying Official is required.

c. Access is limited to only those restricted areas predicated on the Contractor's duties determined by the Development and Operations Divisions.

d. The Aviation Transportation Security Act (ATSA), which was passed by Congress on November 19, 2001, changed the requirements for SIDA access by requiring immediate fingerprint based background checks of all persons applying for and currently with unescorted SIDA access.

In addition, the number of disqualifying criminal offenses has increased. (See Attachment) The fingerprint based check must be complete and not reveal any

disqualifying crimes in the last 10 years prior to any applicant receiving unescorted access to the SIDA.

e. For employees unable to produce a legible set of fingerprints, they will submit to a manual criminal history check by the TSA. The process will take 30 days or more.

2. Airport Security Briefing

a. Each employee requesting an Airport identification badge must attend a security training class. This briefing is conducted Monday through Friday. Contact the Airport Authority Identification Office at 922-8005 for the correct time.

3. Accountability

a. In accordance with TSA guidelines, no more than 5% of identification badges issued by the Airport Authority can be unaccounted for at any time. A badge is considered unaccounted for if it is lost, stolen or not returned. If 5% of issued identification badges are unaccounted for, all badges must be reissued. Contractors will be assessed a fee for each badge leading to this reissuance. See Section 3.04, Identification Requirements, paragraph H.1.h below for the applicable fee.

b. Federal regulations require immediate notification of employee terminations and lost badges to the operator in charge of deleting access privileges, which, in our case, would be the Control Center, 922-8298.

c. When the Contractor has reason to believe that the terminated employee may pose a threat to the Airport or air carrier operations, the Contractor is responsible to immediately notify the Airport Authority Identification Office in person, via telephone, or in writing whichever is most expeditious.

d. Routine termination of employee access authority will be accomplished by the Airport Authority Identification Office **within 8 hours** of notification. The identification badge must be returned to the Airport Authority Identification Office or the Airport Authority Security Coordinator **within 24 hours** of employee dismissal or resignation. Identification cards recovered from the employee at the time of routine termination are considered to be denied access.

e. It is the Contractor's responsibility to retrieve the Airport identification badge IMMEDIATELY upon an employee's termination (voluntary or involuntary), transfer, retirement, death, reassignment, or completion of work assignment.

f. Reportedly lost or stolen identification badges must be thoroughly investigated and closely scrutinized. Replacement Identification badges will be issued only upon written request from the employer. Such request must be on company letterhead stationary, must state the circumstances surrounding the loss, and must be signed by an authorized company representative on file with the Airport Authority. A fee will be charged for a lost badge.

g. Identification badges shall be valid only during the term of the contract for which it is issued.

h. If the Airport Authority Identification Office receives notification from an outside source (e.g. Airport Police Department, etc.) that immediate denial

should be enacted, then our office will contact the proper company officials to notify them of the change that is being requested.

H. Identification Badge Fees.

1. After the Contractor meets all requirements, the Airport Authority shall issue the Contractor's employees automated photo identification badges for the following fees. Payment must be made according to the arrangement made with the Finance Division as indicated on the badge application. The following fees will be implemented as of September 1, 2018.

a.	Fingerprint Fee (required initially and every two years)	$27.00
b.	Fingerprint Admin Fee	$10.00
c.	Initial ID Badge (Includes $11 lifetime STA fee)	$25.00
d.	Deposit Per Badge	$100.00
e.	Badge Renewal Fee	$10.00
f.	1st Lost Badge Fee (Refund of $50 upon return)	$100.00
g.	2nd Lost Badge Fee (Refund of $75 upon return)	$150.00
h.	3rd Lost Badge Fee (Refund of $100 upon return)	$200.00*
i.	Non-Returned Badge	$100.00
j.	Badge Replacement	$10.00
k.	Damaged Badge	No Charge

*Requires meeting with Project Manager and Security Coordinator before identification badge can be replaced.

2. Deposits.

a. Badge deposits are due prior to the release of any badges.
b. Payments may be made by check, money order or cashier's check. Absolutely no cash will be accepted.
c. The fee for expired badges will be deducted from the deposit until the badge is returned. If an update for the expired badge is requested, the Contractor must bring the amount on deposit to $100 before the badge can be released.
d. Deposits will be reimbursed to the Contractor upon receipt of the identification badges once a project has been completed or badging is no longer required.

3. Employees challenged in the Airport Restricted Areas without an Airport Identification Badge PROPERLY DISPLAYED will be transported to the Airport Police Office where a fine of $25.00 will be assessed and access authority removed for a minimum of 5 days. FINES NOT PAID WITHIN 14 DAYS OF THE VIOLATION WILL RESULT IN THE SUSPENSION OF THE EMPLOYEE'S ACCESS TO AIRPORT RESTRICTED AREAS.

I. Airport Access Gate Control.

1. At the Contract preconstruction conference a specific airfield security gate will be designated in writing for Contractor ingress and egress to and from the construction site. The Contractor's, suppliers, and subcontractors are required to use **only** this gate unless designation is made in writing by the Director of Operations and Public Safety, authorizing use of a different gate.

2. Under normal circumstances the designated access gate will be manned by security personnel under contract with the Airport Authority. These gates are manned only during specific hours. Contractors scheduling work are required to coordinate with the Program Manager, a minimum of 7 days in advance of required gate use.

3. If a gate other than the regular construction gate is necessary, the Contractor must provide a guardhouse for the Airport security guard. If the Airport Authority does not have a portable guard house available for the Contractor's use, the Contractor will be required to furnish a guard house which meets the requirements as set forth in Exhibit B.

4. The Contractor will submit a projected estimate of the guard services required for the following week. This projection must be submitted by noon each Thursday to the Security Coordinator. (Exhibit C)

J. Clearance Procedures.

1. Gate guards will perform the following procedures for all persons requesting entrance into restricted areas:

a. The guard will take possession of the badge of each person entering an access gate.
b. The photo is checked against the holder.
c. The badge information is checked against the stop list**.**
(1) If a badge is on the stop list the guard will retain the badge and notify the Airport Police.
d. Expiration date is checked to ensure that the badge has not expired.
e. The vehicle will be checked for an authorizing decal, debris and unauthorized items. A request to enter a restricted area IMPLIES CONSENT TO SEARCH.
f. The person or vehicle (if applicable) will be logged in by entering name, employer, destination, license number, time in and badge expiration date.
g. Clear persons to be escorted (if required) to destination.

2. Under special circumstances, Contractors may have airfield security gates designated for their contract use, which are not manned by security personnel. In this event the Airport Authority, with the concurrence of the TSA, will furnish the Contractor with written requirements for the control of authorized access gates proper to the beginning of any construction.

K. Escorts Into An Airport Restricted Area.

1. Contractors who do not have a valid Airport identification badge wishing to enter a restricted area must be escorted by a person holding a valid Airport identification badge.

2. All vehicles operated in a restricted area must either be driven by or escorted by a person holding an Airport identification badge and an Airport Driver's Permit.

L. Operating Without Escort.

1. The Airport Authority will take under consideration, on a case-by-case basis, the issuance of an Airport Driver's Permit to one project supervisor on each shift. The Contractor will be required to justify, in writing to the Director of Public Safety, the need for unescorted vehicle movement. This Airport Driver's Permit does not permit the holder to escort other vehicles.

2. If a Contractor is authorized by the Airport Authority to provide their own vehicle escorts, the Airport Police will conduct the necessary training. This training will consist of approximately 16 hours of classroom and practical exercises.

M. Exiting Restricted Areas.

1. Construction workers must exit the same gate they entered.
2. Upon exiting the restricted area, vehicles may be required to stop and all persons in the vehicle may be required to present an Airport photo identification badge to the gate guard.

3.05 VEHICLE PARKING AND OPERATION

A. General.

1. All streets on the Airport shall have the status of dedicated city streets for the purpose of traffic enforcement.

2. Motor vehicles operated on the public roadways and parking lots of the Airport shall be governed by the traffic ordinance of the city and state laws applicable and, in addition thereto, the following regulations shall be applicable.

B. Traffic Rules and Regulations in the Air Operations Area.

1. The driver of any motor vehicle operating within the Airport boundary shall comply with the lawful orders, signals or directives of Airport Police Officers.

2. All drivers operating motor vehicles within the Airport boundary must possess a valid state driver's license.

3. Only drivers possessing a valid Airport Driver's Permit issued by the Airport Authority are authorized to operate any motorized vehicle unescorted on the AOA of Memphis International Airport. (The Security Coordinator may designate certain construction areas as void of this requirement)

4. Riding on trailer hitches, fenders, or on any portion of a vehicle not equipped with proper seats, running boards, or handholds is prohibited. Standing up in a moving motor vehicle, riding outside of a moving motor vehicle, or riding with arms or legs protruding from the body of the vehicle is prohibited.

5. All vehicle lights shall be lighted during the hours of darkness or during the time of reduced visibility when said vehicle is being operated in the restricted area.

6. No person shall operate any motorized vehicle when vision is restricted due to the load being carried, or for any other reason.

7. No person under the influence of alcoholic beverages or narcotic drugs shall operate any motor vehicle or motorized equipment on the Airport.

8. It shall be the responsibility of the operator to ascertain that the vehicle is in good operating condition. Operators are required to check proper operation of the vehicle's brakes before commencing any operation on airport.

9. Vehicles dripping oil, gasoline, water, or debris of any kind, shall be restricted.

10. Pedestrians and aircraft shall at all times have right-of-way over vehicular traffic. All vehicles must pass to the rear of taxiing aircraft.

C. Radio Equipment.

1. All vehicles operating in the aircraft movement area must be equipped with a two-way radio and, when the movement area is being controlled, be in continuous communication with the Control Tower, unless being escorted by authorized escort vehicle.

2. The installation of two-way radios does not permit the operation of vehicles on the Airport without proper authorization of the Director.

D. Contractor Employee Parking.

1. Employee parking is not available on the job site. The Contractor must provide for remote parking for employees and transport them to the job site.

E. Authorized Contractor Vehicles.

1. Unless otherwise authorized, the Contractor and each subcontractor shall be permitted to have no more than one (1) vehicle per trade on the job site. All Contractor vehicles authorized access to Airport restricted areas shall be:

a. Owned or hired by the Contractor or subcontractor;
b. Insured under company policy;
c. On a pre-approved list; and
d. Marked in accordance with Airport regulations.

2. Passenger type vehicles, including pickup trucks, must have the company name displayed on each front door of the vehicle. The company name must be readable, but at a minimum (the letter size shall be 4.5”). The vehicle must display the appropriate Airport registration decal. Specialized equipment such as bulldozers, cranes, etc., will be exempted from this requirement.

3. Cranes used during daylight hours shall have a red flag affixed to the top of boom. Cranes shall have a red obstruction light on the top of boom when used at night. Crane booms shall not be left erect when not in use or following end of workday.

F. Emergency Vehicles and Conditions.

1. Any person operating a motor vehicle on the air operations area shall immediately yield the right-of-way to the police, ambulance, fire department, or other emergency vehicle giving an audible or visual signal or as otherwise directed by an Airport law enforcement officer or fire/rescue department personnel.

2. Emergency conditions existing on the air operations area will not mitigate or cancel existing regulations for non-emergency vehicles in areas not affected by the emergency.

3. Under emergency conditions such as an aircraft accident or fire, access to the scene is denied to all vehicles or persons except those whose duties require their presence. Permits and licensing shall be rendered invalid in the area of emergency conditions and the Airport Authority shall determine when normal operations may be resumed.

G. Passing Aircraft.

1. All vehicles shall pass to the rear of taxiing aircraft and shall pass no nearer than 20 feet horizontal distance.

H. Passenger Concourse.

1. No motorized vehicles or carts of any type shall be used in any concourse or terminal lobby unless approved by the Director.

2. No vehicle or motorized equipment shall be driven under concourses except at authorized vehicle pass-throughs designated by the Director.

I. AOA Driving Lanes.

1. Vehicles on the aircraft parking apron at the terminal and air cargo buildings shall be operated within the marked driving lanes and in compliance with marked traffic control signs except for the following:

   a. Authorized vehicles engaged in parking apron repair and inspection; and
   b. Vehicles exceeding a width of 12 feet which shall follow marked lanes as closely as possible.

2. Vehicles shall enter and exit designated driving lanes at a point nearest to the origin and destination.
3. No vehicles or equipment shall be parked in a manner as to obstruct any portion of the driving lanes.

J. Taxiing Aircraft.

1. Vehicles shall yield to taxiing aircraft or aircraft under tow.

K. Speed Limits.

1. No person shall operate a motor vehicle or other motorized equipment at a speed greater than the following:

   a. Five miles per hour in designated drives under the terminal;
   b. Fifteen miles per hour on paved service roads in the vicinity of the terminal and air cargo buildings; or
   c. Twenty-five miles per hour on all aprons or ramps unless the area has an otherwise posted speed limit.
   d. Fifteen miles per hour on all aprons or ramps at General DeWitt Spain Airport and Charles W. Baker Airport unless the area has an otherwise posted speed limit.

L. Inspection of Vehicles.

1. Contractors authorized to operate vehicles on the air operations area shall be responsible for ensuring that each motor vehicle is inspected at least each 12 months by a qualified mechanic, is in good mechanical condition and has all the required safety equipment.

2. The Contractor shall remove from service any vehicle, which, in the opinion of the Director, is defective and in need of repair and said vehicle will not be returned to service until properly repaired.

M. Violations of Restricted Area Traffic Regulations.

1. The penalties for a violation of restricted area traffic regulations shall be as follows:

    a. First offense within any 12-month period: retraining;
    b. Second offense within any 12 month period: retraining and fine not to exceed $50.00;
    c. Third offense within any 12 month period: retraining and fine not to exceed $100.00; and
    d. Fourth offense within any 12 month period: revocation of privilege to drive in restricted area (unescorted or escorted).

2. The above set penalties do not negate the right of the Airport Authority to immediately revoke driving privileges, dependent upon the seriousness of the violation.

N. Vehicle Registration.

1. The Contractor shall list all construction vehicles requiring passage through the access gate on the "AOA Access Decal Request Form," which will be provided upon request.

2. Each vehicle approved will be issued a windshield decal, which must be affixed to the driver's side of the windshield. This decal is not transferable. Only those vehicles so marked will be allowed through the access gate with the following exceptions:

    a. dump trucks;
    b. concrete trucks;
    c. vehicles making deliveries; and
    d. cranes, tracter, etc.

O. Delivery Vehicles.

1. Each day the Contractor shall give the access gate guard a written list of deliveries expected. No delivery will be cleared into the restricted area unless it is on the list or the construction supervisor is contacted for clearance.

3.06 GENERAL INFORMATION

A. Access to Public Facilities.

1. Contractor employees are not authorized to use public facilities, (i.e., rest rooms, eating facilities, boarding gate hold rooms or other public areas of the terminal), except as specifically authorized by the Airport Authority and as necessary for access to job site.

2. Contractors shall provide adequate rest room and break facilities within the job site and staging areas as appropriate.

3. All public areas authorized for use by the Contractor's employees are to be kept in a clean and sanitary manner, free of all construction debris.

B. Accident Reports.

1. All persons involved in any accident whether personal injury, aircraft or automotive, occurring on Airport property, shall make a full report to the Airport Police (922-8298) as soon after the accident as possible. The report shall include, but not be limited to, the names, addresses of all principals and witnesses, if known, and a statement of the facts. Construction accidents fall under this category

2. To request paramedics call 922-8333.

C. Airport Rules and Regulations.

1. The Contractor shall conform to the "Memphis-Shelby County Airport Authority Rules and Regulations."

2. The Contractor shall conform to "Memphis-Shelby County Airport Authority's Air Operations Area Rules and Regulations and its Airport Security Program."

D. Alcoholic Beverages and Narcotic Drugs.

1. No person shall have any alcoholic beverages or narcotic drugs on Airport property.

E. Damages.

1. Contractors shall be fully responsible for all damages to buildings, equipment, real property and appurtenances in the ownerships or custody of the Airport Authority caused by negligence, abuse or carelessness on the part of their employees, agents, customers, visitors, suppliers or persons with whom they do business.

F. Disorderly Conduct.

1. No person shall commit any disorderly, obscene or indecent act nor commit any nuisance.

2. Abusive behavior by Contractor supervisors or their employees will not be tolerated.

G. Debris and Cleanup.

1. No person shall dispose of any garbage, trash, refuse or any other material on the Airport except in the receptacles provided for that purpose.

2. No person shall dispose of any fill or building materials or any other materials on Airport property except in such areas as are specifically designated by the Director.

3. Contractors are responsible for the cleanliness of the job site and access to the job site as appropriate. All Contractors must establish an active ongoing program to eliminate any foreign objects which may cause damage to aircraft or cause personal injury to other persons. Contractors must pay particular attention to haul routes used to and from the job site to clean up any debris which may be tracked onto or dropped on the air operations area. Contractor will immediately remove such debris to eliminate the hazard. **END OF THE WORKDAY CLEANUP WILL NOT SUFFICE**. Cleanup shall be done to the satisfaction of the Airport Authority. All Active taxiway crossings and work areas adjacent to the taxiways shall be kept clean.

4. If it should become necessary for the Airport Authority to remove debris left by a Contractor, the Contractor shall be billed at 2 1/2 times the actual cost of the cleanup or a minimum of $250 per trip whichever is greater.

H. Firearms and Explosives.

1. No person shall have any firearm, explosive or incendiary device on or about their person or accessible property while on Airport property.

I. Fire Equipment.

1. All Contractors shall supply and maintain adequate and readily accessible fire extinguishers for the particular hazard involved as directed by the Airport Authority or the Fire Marshal. All fire apparatus shall be maintained in first class operable condition.

2. The Contractor shall maintain the following items on site:
   a. Two-pound dry chemical extinguisher, or
   b. Four-pound carbon dioxide extinguisher.

3. Carbon tetrachloride chlorobromethene or other vaporizing liquid extinguishers are not permitted inside buildings due to their high toxicity unless approved in writing by the Fire Marshal.

J. Gambling.

1. No person shall conduct gambling in any form or operate gambling devices anywhere on Airport property.

K. Hazards.

1. No person shall use flammable volatile liquids having a flash point of less than 100°F in cleaning of parts, appliances, or for any other purpose unless such operations are conducted in the open air not within 50 feet of an aircraft, away from structures and equipment or in properly ventilated, approved paint booths.

2. No person shall keep or store any flammable liquids, gases, oil, oil wastes, flares, paints, or other similar material in any building within the Airport boundary except that such materials may be kept in specially provided rooms or receptacles approved by the Fire Marshal.

3. Contractors shall provide suitable metal receptacles with covers for the storage of wastes, rags, or other rubbish.

4. No person shall start any open fires of any type, including flare posts, torches or fires in containers formerly used for oil, paint, or similar materials on any part of an Airport without permission of the Director.

L. Picketing and Public Demonstrations.

1. Subject to applicable federal, state and local regulations and laws, no persons shall walk in a picket line as a picketer or take part in any labor or other public demonstration on any Airport property or facilities therein except in those places which may be specifically assigned for use of such picket lines or other public demonstration by the Director.

M. Restricted Areas.

1. No persons shall enter any area posted as being restricted or closed to the public except for the following:

   a. Persons assigned to duty therein;
   b. Persons authorized by the Director; or
   c. Persons under contractual agreement with the Airport Authority or tenants of the Airport Authority.

2. All persons in restricted areas of Memphis International Airport must be duly authorized and must have displayed on their person an official identification badge which will clearly establish the individual by name, contractor affiliation, and construction project completion date.

3. The identification badge must be worn on the outermost garment above the waist except in those cases where there exists an overriding safety consideration approved by the FAA.

N. Signs on the Airport.

1. Signs may not be installed in public view on the Airport without prior approval of the Airport Authority. Proposals should be documented and submitted to the Airport Authority with an accompanying sketch depicting the general appearance and location of the desired sign, and the name and telephone number of an individual to contact.

O. Smoking.

1. No person shall smoke or carry lighted cigars, cigarettes, pipes, matches or any naked flame in or on any fuel storage areas, Air Operations Area, public aircraft parking and storage area, in any other place where smoking is specifically prohibited by signs or upon any open space within 50 feet of any fuel carrier which is not in motion. Smoking by tank vehicle drivers, helpers, repairmen, or other personnel is prohibited while they are driving, making deliveries, filling or making repairs to tank vehicles. No person shall smoke or permit any open flame within 100 feet of any aircraft undergoing fuel service or within at least 50 feet of any hangar or building.

P. Storage of Equipment.

1. Contractors shall store or stock material or equipment in a neat and orderly manner and in a manner not to constitute a hazard to personnel or property.

Q. Trash Containers.

1. Areas to be used for trash and garbage containers shall be designated by the Director and no other areas shall be used. Only trash containers approved by the Director shall be used by contractors for the collection of trash and garbage. The placement of trash or garbage outside approved containers is strictly prohibited.

R. Utilities.

1. The following instructions must be adhered to without exception:

   a. No contractor or employee for any craft shall turn off any utilities without contacting the Airport Authority. This includes water, electrical and HVAC;
   b. No one shall open any electrical substations, distribution or motor control centers without first notifying the Airport Authority. No branch circuits shall be turned off or on, without obtaining permission from the Airport Authority; and
   c. No one shall turn off the water or the HVAC or open any drain lines without notifying the Airport Authority.

2. All notifications for utility disruption must be made through the Airport Authority and must be made a minimum of 7 days prior to scheduled shutoff.

3. The Airport Authority has a responsibility to keep the Airport in operation; it is your responsibility to conform to the above instructions. You may contact the Airport Authority.

FOR ANY QUESTIONS CONCERNING SECURITY REGULATIONS CONTACT THE SECURITY COORDINATOR AT 901/922-8021.

END OF SECTION 00802

EXHIBIT B

GUARD HOUSE SPECIFICATIONS

1. No less than 5' x 8'
2. Heated, air conditioned and lighted
3. Counter or table (minimum size 16" x 36")
4. House must have two doors to allow guards to check entering and exiting vehicles.
5. Windows on all sides, large enough for guard to observe restricted areas from a seated position.
6. Chair with turning radius of 360 degrees, at a height which allows guards to observe restricted areas through windows.
7. Trash can (dumping daily responsibility of Contractor)

PORTABLE TOILETS

1. Daily cleanliness responsibility of Contractor
2. Restricted to guards only. NO CONSTRUCTION PERSONNEL PERMITTED.

PLACEMENT OF GUARD HOUSES AND PORTABLE TOILETS

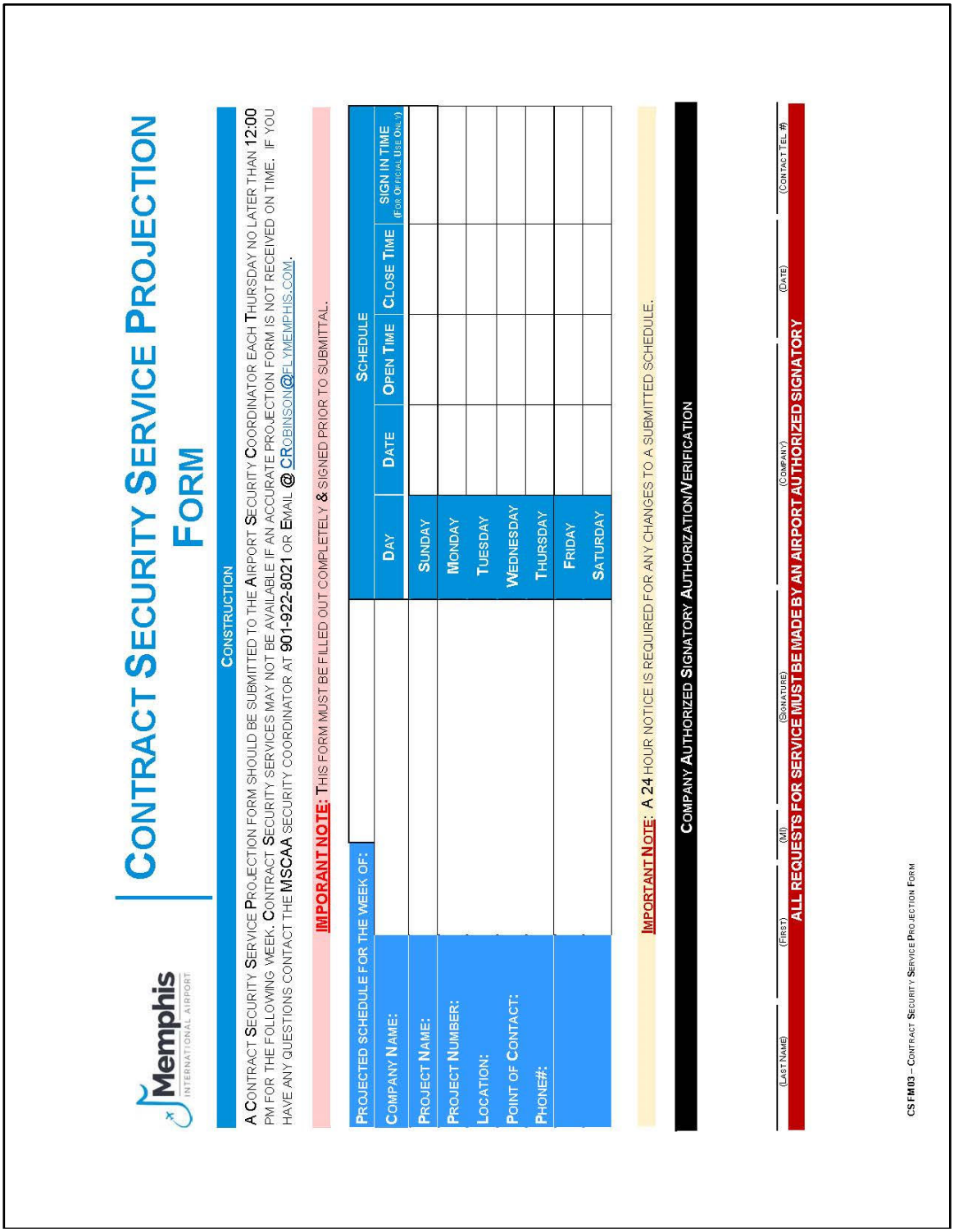
1. Area to be designated by Airport Authority
2. Clear Accessibility (paved or gravel)

The Contractor is responsible for supplying and maintaining power source for the guard houses. The contractor is also responsible for maintaining the heating and cooling of same.

END OF EXHIBIT B

EXHIBIT C

CONTRACT SECURITY SERVICE PROJECTION FORM (.PDF VERSION IS AVAILABLE)



Memphis INTERNATIONAL AIRPORT

CONTRACT SECURITY SERVICE PROJECTION FORM

CONSTRUCTION

A CONTRACT SECURITY SERVICE PROJECTION FORM SHOULD BE SUBMITTED TO THE AIRPORT SECURITY COORDINATOR EACH THURSDAY NO LATER THAN 12:00 PM FOR THE FOLLOWING WEEK. CONTRACT SECURITY SERVICES MAY NOT BE AVAILABLE IF AN ACCURATE PROJECTION FORM IS NOT RECEIVED ON TIME. IF YOU HAVE ANY QUESTIONS CONTACT THE MSCAA SECURITY COORDINATOR AT 901-922-8021 OR EMAIL @ CROBINSON@FLYMEMPHIS.COM.

IMPORANT NOTE: THIS FORM MUST BE FILLED OUT COMPLETELY & SIGNED PRIOR TO SUBMITTAL.

PROJECTED SCHEDULE FOR THE WEEK OF:

COMPANY NAME:

PROJECT NAME:

PROJECT NUMBER:

LOCATION:

POINT OF CONTACT:

PHONE#:

SCHEDULE				
DAY	DATE	OPEN TIME	CLOSE TIME	SIGN IN TIME (FOR OFFICIAL USE ONLY)
SUNDAY				
MONDAY				
TUESDAY				
WEDNESDAY				
THURSDAY				
FRIDAY				
SATURDAY				

IMPORTANT NOTE: A 24 HOUR NOTICE IS REQUIRED FOR ANY CHANGES TO A SUBMITTED SCHEDULE.

COMPANY AUTHORIZED SIGNATORY AUTHORIZATION/VERIFICATION

(LAST NAME) (FIRST) (MI) (SIGNATURE) (COMPANY) (DATE) (CONTACT TEL #)

ALL REQUESTS FOR SERVICE MUST BE MADE BY AN AIRPORT AUTHORIZED SIGNATORY

CS FM 03 – CONTRACT SECURITY SERVICE PROJECTION FORM

END OF EXHIBIT C

Part 1 – General Contract Provisions

Section 10 Definition of Terms

When the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be defined as follows:

Paragraph Number	Term	Definition
10-01	**AASHTO**	The American Association of State Highway and Transportation Officials.
10-02	**Access Road**	The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public roadway.
10-03	**Advertisement**	A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.
10-04	**Airport**	Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; airport buildings and facilities located in any of these areas, and a heliport.
10-05	**Airport Improvement Program (AIP)**	A grant-in-aid program, administered by the Federal Aviation Administration (FAA).
10-06	**Air Operations Area (AOA)**	The term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.
10-07	**Apron**	Area where aircraft are parked, unloaded or loaded, fueled and/or serviced.

Paragraph Number	Term	Definition
10-08	**ASTM International (ASTM)**	Formerly known as the American Society for Testing and Materials (ASTM).
10-09	**Award**	The Owner's notice to the successful bidder of the acceptance of the submitted bid.
10-10	**Bidder**	Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.
10-11	**Building Area**	An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.
10-12	**Calendar Day**	Every day shown on the calendar.
10-13	**Certificate of Analysis (COA)**	The COA is the manufacturer's Certificate of Compliance (COC) including all applicable test results required by the specifications.
10-14	**Certificate of Compliance (COC)**	The manufacturer's certification stating that materials or assemblies furnished fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer's authorized representative.
10-15	**Change Order**	A written order 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 work within the scope of the contract and necessary to complete the project.
10-16	**Contract**	A written agreement between the Owner and the Contractor that establishes the obligations of the parties including but not limited to performance of work, furnishing of labor, equipment and materials and the basis of payment. The awarded contract includes but may not be limited to: Advertisement, Contract form, Proposal, Performance bond, payment bond, General provisions, certifications and representations, Technical Specifications, Plans, Supplemental Provisions, standards incorporated by reference and issued addenda.
10-17	**Contract Item (Pay Item)**	A specific unit of work for which a price is provided in the contract.

Paragraph Number	Term	Definition
10-18	**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 or working days, the contract shall be completed by that date.
10-19	**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.
10-20	**Contractors Quality Control (QC) Facilities**	The Contractor's QC facilities in accordance with the Contractor Quality Control Program (CQCP).
10-21	**Contractor Quality Control Program (CQCP)**	Details the methods and procedures that will be taken to assure that all materials and completed construction required by the contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors.
10-22	**Control Strip**	A demonstration by the Contractor that the materials, equipment, and construction processes results in a product meeting the requirements of the specification.
10-23	**Construction Safety and Phasing Plan (CSPP)**	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.
10-24	**Drainage System**	The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.
10-25	**Engineer**	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for engineering, inspection, and/or observation of the contract work and acting directly or through an authorized representative.
10-26	**Equipment**	All machinery, together with the necessary supplies for upkeep and maintenance; and all tools and apparatus necessary for the proper construction and acceptable completion of the work.

Paragraph Number	Term	Definition
10-27	**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 Owner's Engineer or Resident Project Representative (RPR) to be necessary to complete the work within the intended scope of the contract as previously modified.
10-28	**FAA**	The Federal Aviation Administration. When used to designate a person, FAA shall mean the Administrator or their duly authorized representative.
10-29	**Federal Specifications**	The federal specifications and standards, commercial item descriptions, and supplements, amendments, and indices prepared and issued by the General Services Administration.
10-30	**Force Account**	**a.** Contract Force Account - A method of payment that addresses extra work performed by the Contractor on a time and material basis. **b.** Owner Force Account - Work performed for the project by the Owner's employees.
10-31	**Intention of Terms**	Whenever, in these specifications or on the plans, the words "directed," "required," "permitted," "ordered," "designated," "prescribed," or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer and/or Resident Project Representative (RPR) is intended; and similarly, the words "approved," "acceptable," "satisfactory," or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer and/or RPR, subject in each case to the final determination of the Owner. Any reference to a specific requirement of a numbered paragraph 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 specific reference.
10-32	**Lighting**	A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.

Paragraph Number	Term	Definition
10-33	**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 20% of the total amount of the award contract. All other items shall be considered minor contract items.
10-34	**Materials**	Any substance specified for use in the construction of the contract work.
10-35	**Modification of Standards (MOS)**	Any deviation from standard specifications applicable to material and construction methods in accordance with FAA Order 5300.1.
10-36	**Notice to Proceed (NTP)**	A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.
10-37	**Owner**	The term "Owner" shall mean the party of the first part or the contracting agency signatory to the contract. Where the term "Owner" is capitalized in this document, it shall mean airport Sponsor only. The Owner for this project is **Memphis Shelby County Airport Authority**.
10-38	Passenger Facility Charge (PFC)	Per 14 Code of Federal Regulations (CFR) Part 158 and 49 United States Code (USC) § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls.
10-39	**Pavement Structure**	The combined surface course, base course(s), and subbase course(s), if any, considered as a single unit.
10-40	**Payment bond**	The approved form of security furnished by the Contractor and their own 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.
10-41	**Performance bond**	The approved form of security furnished by the Contractor and their own surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.
10-42	**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. Plans may also be referred to as 'contract drawings.'

Paragraph Number	Term	Definition
10-43	**Project**	The agreed scope of work for accomplishing specific airport development with respect to a particular airport.
10-44	**Proposal**	The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.
10-45	**Proposal guaranty**	The security furnished with a proposal to guarantee that the bidder will enter into a contract if their own proposal is accepted by the Owner.
10-46	**Quality Assurance (QA)**	Owner's responsibility to assure that construction work completed complies with specifications for payment.
10-47	**Quality Control (QC)**	Contractor's responsibility to control material(s) and construction processes to complete construction in accordance with project specifications.
10-48	**Quality Assurance (QA) Inspector**	An authorized representative of the Engineer and/or Resident Project Representative (RPR) assigned to make all necessary inspections, observations, tests, and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.
10-49	**Quality Assurance (QA) Laboratory**	The official quality assurance testing laboratories of the Owner or such other laboratories as may be designated by the Engineer or RPR. May also be referred to as Engineer's, Owner's, or QA Laboratory.
10-50	**Resident Project Representative (RPR)**	The individual, partnership, firm, or corporation duly authorized by the Owner to be responsible for all necessary inspections, observations, tests, and/or observations of tests of the contract work performed or being performed, or of the materials furnished or being furnished by the Contractor, and acting directly or through an authorized representative.
10-51	**Runway**	The area on the airport prepared for the landing and takeoff of aircraft.
10-52	**Runway Safety Area (RSA)**	A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft. See the construction safety and phasing plan (CSPP) for limits of the RSA.

Paragraph Number	Term	Definition
10-53	**Safety Plan Compliance Document (SPCD)**	Details how the Contractor will comply with the CSPP.
10-54	**Specifications**	A part of the contract containing the written directions and requirements for completing the contract work. 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.
10-55	**Sponsor**	A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.
10-56	**Structures**	Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.
10-57	**Subgrade**	The soil that forms the pavement foundation.
10-58	**Superintendent**	The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the RPR, and who shall supervise and direct the construction.
10-59	**Supplemental Agreement**	A written agreement between the Contractor and the Owner that establishes the basis of payment and contract time adjustment, if any, for the work affected by the supplemental agreement. A supplemental agreement is required if: (1) in scope work would increase or decrease the total amount of the awarded contract by more than 25%: (2) in scope work would increase or decrease the total of any major contract item by more than 25%; (3) work that is not within the scope of the originally awarded contract; or (4) adding or deleting of a major contract item.
10-60	**Surety**	The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the Owner by the Contractor.
10-61	**Taxilane**	A taxiway designed for low speed movement of aircraft between aircraft parking areas and terminal areas.

Paragraph Number	Term	Definition
10-62	**Taxiway**	The portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.
10-63	**Taxiway/Taxilane Safety Area (TSA)**	A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an aircraft. See the construction safety and phasing plan (CSPP) for limits of the TSA.
10-64	**Work**	The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.
10-65	**Working day**	A 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 six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.
10-66	**Owner Defined terms**	**See Section 150 General Provisions for additional terms.**

END OF SECTION 10

Section 20 Proposal Requirements and Conditions

20-01 Advertisement (Notice to Bidders). See specification section 00100, Legal Notice to Bidders.

20-02 Qualification of bidders. Each bidder shall submit evidence of competency and evidence of financial responsibility to perform the work to the Owner at the time of bid opening.

Evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, and a list of equipment and a list of key personnel that would be available for the work.

Each bidder shall furnish the Owner satisfactory evidence of their financial responsibility. Evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder's financial resources and liabilities as of the last calendar year or the bidder's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether their financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder's financial responsibility has changed, the bidder shall qualify the public accountant's statement or report to reflect the bidder's true financial condition at the time such qualified statement or report is submitted to the Owner.

Unless otherwise specified, a bidder may submit evidence that they are prequalified with the State Highway Division and are on the current "bidder's list" of the state in which the proposed work is located. Evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.

20-03 Contents of proposal forms. The Owner's proposal forms state the location and description of the proposed construction; the place, date, and time of opening of the proposals; and the estimated quantities of the various items of work to be performed and materials to be furnished for which unit bid prices are asked. The proposal form states the time in which the work must be completed, and the amount of the proposal guaranty that must accompany the proposal. The Owner will accept only those Proposals properly executed on physical forms or electronic forms provided by the Owner. Bidder actions that may cause the Owner to deem a proposal irregular are given in paragraph 20-09 *Irregular proposals*.

See sections C-105, 00405, and 01100 for information on Mobilization.

A Pre-Bid Meeting will be held Thursday, July 8th, at 1:30 PM local time via phone/video conferencing (link: https://zoom.us/j/94094548206?pwd=bkZkU2hmV0M1WE9vcVo3a3d3NGs1dz09; phone: (312) 626 6799; Meeting ID: 940 9454 8206; Passcode: 389856). The project site will be available for inspection immediately following the meeting. Attendance at the Pre-Bid is strongly recommended.

20-04 Issuance of proposal forms. The Owner reserves the right to refuse to issue a proposal form to a prospective bidder if the bidder is in default for any of the following reasons:

a. Failure to comply with any prequalification regulations of the Owner, if such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the Owner at the time the Owner issues the proposal to a prospective bidder.

c. Documented record of Contractor default under previous contracts with the Owner.

d. Documented record of unsatisfactory work on previous contracts with the Owner.

20-05 Interpretation of estimated proposal quantities. An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The Owner does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as provided in the Section 40, paragraph 40-02, Alteration of Work and Quantities, without in any way invalidating the unit bid prices.

20-06 Examination of plans, specifications, and site. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves to the character, quality, and quantities of work to be performed, materials to be furnished, and to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and is satisfied to the conditions to be encountered in performing the work and the requirements of the proposed contract, plans, and specifications.

20-07 Preparation of proposal. The bidder shall submit their proposal on the forms furnished by the Owner. All blank spaces in the proposal forms, unless explicitly stated otherwise, must be correctly filled in where indicated for each and every item for which a quantity is given. The bidder shall state the price (written in ink or typed) both in words and numerals which they propose for each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall correctly sign the proposal in ink. If the proposal is made by an individual, their name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state where the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of their authority to do so and that the signature is binding upon the firm or corporation.

20-08 Responsive and responsible bidder. A responsive bid conforms to all significant terms and conditions contained in the Owner's invitation for bid. It is the Owner's responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 2 CFR § 200.318(h). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

20-09 Irregular proposals. Proposals shall be considered irregular for the following reasons:

a. If the proposal is on a form other than that furnished by the Owner, or if the Owner's form is altered, or if any part of the proposal form is detached.

b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.

c. If the proposal does not contain a unit price for each pay item listed in the proposal, except in the case of authorized alternate pay items, for which the bidder is not required to furnish a unit price.

d. If the proposal contains unit prices that are obviously unbalanced.

e. If the proposal is not accompanied by the proposal guaranty specified by the Owner.

f. If the applicable Disadvantaged Business Enterprise information is incomplete.

The Owner reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the Owner and conforms to local laws and ordinances pertaining to the letting of construction contracts.

20-10 Bid guarantee. Each separate proposal shall be accompanied by a bid bond, certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such bond, check, or collateral, shall be made payable to the Owner.

20-11 Delivery of proposal. Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the bidder on the outside. When sent by mail, preferably registered, the sealed proposal, marked as indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the advertisement or as modified by Addendum before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

20-12 Withdrawal or revision of proposals. A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder's request for withdrawal is received by the Owner in writing, by fax, or by email before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

20-13 Public opening of proposals. Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

20-14 Disqualification of bidders. A bidder shall be considered disqualified for any of the following reasons:

a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

b. Evidence of collusion among bidders. Bidders participating in such collusion shall be disqualified as bidders for any future work of the Owner until any such participating bidder has been reinstated by the Owner as a qualified bidder.

c. If the bidder is considered to be in "default" for any reason specified in paragraph 20-04, *Issuance of Proposal Forms,* of this section.

20-15 Discrepancies and Omissions. A Bidder who discovers discrepancies or omissions with the project bid documents shall immediately notify the Owner's Engineer of the matter. A bidder that has doubt as to the true meaning of a project requirement may submit to the Owner's Engineer a written request for interpretation no later than **[___]** days prior to bid opening.

Any interpretation of the project bid documents by the Owner's Engineer will be by written addendum issued by the Owner. The Owner will not consider any instructions, clarifications or interpretations of the bidding documents in any manner other than written addendum.

END OF SECTION 20

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Section 30 Award and Execution of Contract

30-01 Consideration of proposals. After the proposals 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 bid prices written in words and unit bid prices written in numbers, the unit bid 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:

a. If the proposal is irregular as specified in Section 20, paragraph 20-09, *Irregular Proposals*.

b. If the bidder is disqualified for any of the reasons specified Section 20, paragraph 20-14, *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 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 Owner's best interests.

30-02 Award of contract. The award of a contract, if it is to be awarded, shall be made within seventy-five (75) calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

If the Owner elects to proceed with an award of contract, the Owner will make award to the responsible bidder whose bid, conforming with all the material terms and conditions of the bid documents, is the lowest in price.

30-03 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 paragraph 30-07 *Approval of Contract*.

30-04 Return of proposal guaranty. All proposal guaranties, except those of the two lowest bidders, will be returned immediately after the Owner has made a comparison of bids as specified in the paragraph 30-01, *Consideration of Proposals.* Proposal guaranties of the two lowest bidders will be retained by the Owner until such time as an award is made, at which time, the unsuccessful bidder's proposal guaranty will be returned. The successful bidder's proposal guaranty will be returned as soon as the Owner receives the contract bonds as specified in paragraph 30-05, *Requirements of Contract Bonds.*

30-05 Requirements of contract bonds. At the time of the execution of the contract, the successful bidder shall furnish the Owner a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor's performance of the work. The surety and the form of the bond or bonds shall be acceptable to the Owner. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

30-06 Execution of contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the Owner, along with the fully executed surety bond or bonds specified in paragraph 30-05, *Requirements of Contract Bonds,* of this section, within fifteen (15) calendar days from the date mailed or otherwise delivered to the successful bidder.

30-07 Approval of contract. Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the Owner shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the Owner's approval to be bound by the successful bidder's proposal and the terms of the contract.

30-08 Failure to execute contract. Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the period specified in paragraph 30-06, *Execution of Contract,* of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidated damages to the Owner.

END OF SECTION 30

Section 40 Scope of Work

40-01 Intent of contract. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 Alteration of work and quantities. The Owner reserves the right to make such changes in quantities and work as may be necessary or desirable to complete, in a satisfactory manner, the original intended work. Unless otherwise specified in the Contract, the Owner's Engineer or RPR shall be and is hereby authorized to make, in writing, such in-scope alterations in the work and variation of quantities as may be necessary to complete the work, provided such action does not represent a significant change in the character of the work.

For purpose of this section, a significant change in character of work means: any change that is outside the current contract scope of work; any change (increase or decrease) in the total contract cost by more than 25%; or any change in the total cost of a major contract item by more than 25%.

Work alterations and quantity variances that do not meet the definition of significant change in character of work shall not invalidate the contract nor release the surety. Contractor agrees to accept payment for such work alterations and quantity variances in accordance with Section 90, paragraph 90-03, *Compensation for Altered Quantities*.

Should the value of altered work or quantity variance meet the criteria for significant change in character of work, such altered work and quantity variance shall be covered by a supplemental agreement. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

40-03 Omitted items. The Owner, the Owner's Engineer or the RPR may provide written notice to the Contractor to omit from the work any contract item that does not meet the definition of major contract item. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with Section 90, paragraph 90-04, *Payment for Omitted Items*.

40-04 Extra work. Should acceptable completion of the contract require the Contractor to perform an item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, Owner may issue a Change Order to cover the necessary extra work. Change orders for extra work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the RPR's opinion, is necessary for completion of the extra work.

When determined by the RPR to be in the Owner's best interest, the RPR may order the Contractor to proceed with extra work as provided in Section 90, paragraph 90-05, *Payment for Extra Work*. Extra work that is necessary for acceptable completion of the project, but is not within the general scope of the work

covered by the original contract shall be covered by a supplemental agreement as defined in Section 10, paragraph 10-59, *Supplemental Agreement*.

If extra work is essential to maintaining the project critical path, RPR may order the Contractor to commence the extra work under a Time and Material contract method. Once sufficient detail is available to establish the level of effort necessary for the extra work, the Owner shall initiate a change order or supplemental agreement to cover the extra work.

Any claim for payment of extra work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 Maintenance of traffic. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. The Contractor shall maintain traffic in the manner detailed in the Construction Safety and Phasing Plan (CSPP).

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to their own operations and the operations of all subcontractors as specified in Section 80, paragraph 80-04, *Limitation of Operations*. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in Section 70, paragraph 70-15, *Contractor's Responsibility for Utility Service and Facilities of Others*.

b. With respect to their own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport in accordance with the construction safety and phasing plan (CSPP) and the safety plan compliance document (SPCD).

c. When the contract requires the maintenance of an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep the road, street, or highway open to all traffic and shall provide maintenance as may be required to accommodate traffic. The Contractor, at their expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (http://mutcd.fhwa.dot.gov/), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways. Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.

40-06 Removal of existing structures. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the various contract items.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Resident Project Representative (RPR) shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the RPR in accordance with the provisions of the contract.

Except as provided in Section 40, paragraph 40-07, *Rights in and Use of Materials Found in the Work*, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or

grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the Owner when so used in the work.

40-07 Rights in and use of materials found in the work. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be embankment, the Contractor may at their own option either:

a. Use such material in another contract item, providing such use is approved by the RPR and is in conformance with the contract specifications applicable to such use; or,

b. Remove such material from the site, upon written approval of the RPR; or

c. Use such material for the Contractor's own temporary construction on site; or,

d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the RPR's approval in advance of such use.

Should the RPR approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at their expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.

Should the RPR approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of their own exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 Final cleanup. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of the property Owner.

END OF SECTION 40

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Section 50 Control of Work

50-01 Authority of the Resident Project Representative (RPR). The RPR has final authority regarding the interpretation of project specification requirements. The RPR shall determine acceptability of the quality of materials furnished, method of performance of work performed, and the manner and rate of performance of the work. The RPR does not have the authority to accept work that does not conform to specification requirements.

50-02 Conformity with plans and specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans, or specifications.

If the RPR finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications, but that the portion of the work affected will, in their opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the RPR will advise the Owner of their determination that the affected work be accepted and remain in place. The RPR will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. Changes in the contract price must be covered by contract change order or supplemental agreement as applicable.

If the RPR finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the RPR's written orders.

The term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the RPR's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the RPR's opinion, such compliance is essential to provide an acceptable finished portion of the work.

The term "reasonably close conformity" is also intended to provide the RPR with the authority, after consultation with the Sponsor and FAA, to use sound engineering judgment in their determinations to accept work that is not in strict conformity, but will provide a finished product equal to or better than that required by the requirements of the contract, plans and specifications.

The RPR will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 Coordination of contract, plans, and specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. If electronic files are provided and used on the project and there is a conflict between the electronic files and hard copy plans, the hard copy plans shall govern. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If

any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the RPR for an interpretation and decision, and such decision shall be final.

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, Contractor shall immediately notify the Owner or the designated representative in writing requesting their written interpretation and decision.

50-04 List of Special Provisions. None.

50-05 Cooperation of Contractor. The Contractor shall be supplied with **one (1)** hard copy or an electronic PDF of the plans and specifications. The Contractor shall have available on the construction site at all times one hardcopy each of the plans and specifications. Additional hard copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the RPR and their inspectors and with other Contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as their agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the RPR or their authorized representative.

50-06 Cooperation between Contractors. The Owner reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with their own contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange their work and shall place and dispose of the materials being used to not interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join their work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-07 Construction layout and stakes. The Engineer/RPR shall establish necessary horizontal and vertical control. The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor. Contractor is responsible for preserving integrity of horizontal and vertical controls established by Engineer/RPR. In case of negligence on the part of the Contractor or their employees, resulting in the destruction of any horizontal and vertical control, the resulting costs will be deducted as a liquidated damage against the Contractor.

Prior to the start of construction, the Contractor will check all control points for horizontal and vertical accuracy and certify in writing to the RPR that the Contractor concurs with survey control established for the project. All lines, grades and measurements from control points necessary for the proper execution and control of the work on this project will be provided to the RPR. The Contractor is responsible to establish all layout required for the construction of the project.

Copies of survey notes will be provided to the RPR for each area of construction and for each placement of material as specified to allow the RPR to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. Surveys will be provided to the RPR prior to commencing work items that cover or disturb the survey staking. Survey(s) and notes shall be provided in the following format(s): pdf and dwg.

Laser, GPS, String line, or other automatic control shall be checked with temporary control as necessary. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the Owner.

No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses. The cost shall be included in the price of the bid for the various items of the Contract.

50-08 Authority and duties of Quality Assurance (QA) inspectors. QA inspectors shall be authorized to inspect all work done and all material furnished. Such QA inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. QA inspectors are not authorized to revoke, alter, or waive any provision of the contract. QA inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

QA Inspectors are authorized to notify the Contractor or their representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the RPR for a decision.

50-09 Inspection of the work. All materials and each part or detail of the work shall be subject to inspection. The RPR shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the RPR requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor's expense.

Provide advance written notice to the RPR of work the Contractor plans to perform each week and each day. Any work done or materials used without written notice and allowing opportunity for inspection by the RPR may be ordered removed and replaced at the Contractor's expense.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) Owner, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 Removal of unacceptable and unauthorized work. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the RPR as provided in paragraph 50-02, *Conformity with Plans and Specifications*.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of Section 70, paragraph 70-14, *Contractor's Responsibility for Work*.

No removal work made under provision of this paragraph shall be done without lines and grades having been established by the RPR. Work done contrary to the instructions of the RPR, work done beyond the lines shown on the plans or as established by the RPR, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply with any order of the RPR made under the provisions of this subsection, the RPR will have authority to cause unacceptable work to be remedied or removed and replaced; and unauthorized work to be removed and recover the resulting costs as a liquidated damage against the Contractor.

50-11 Load restrictions. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor, at their own expense, shall be responsible for the repair to equal or better than preconstruction conditions of any damage caused by the Contractor's equipment and personnel.

50-12 Maintenance during construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

50-13 Failure to maintain the work. Should the Contractor at any time fail to maintain the work as provided in paragraph 50-12, *Maintenance during Construction*, the RPR shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the RPR's notification, the Owner may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the Owner, shall be recovered as a liquidated damage against the Contractor.

50-14 Partial acceptance. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, the Contractor may request the RPR to make final inspection of that unit. If the RPR finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the RPR may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-15 Final acceptance. Upon due notice from the Contractor of presumptive completion of the entire project, the RPR and Owner will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and specifications, such

inspection shall constitute the final inspection. The RPR shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the RPR will notify the Contractor and the Contractor shall correct the unsatisfactory work. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the RPR will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 Claims for adjustment and disputes. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the RPR in writing of their intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the RPR is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the RPR has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the RPR who will present it to the Owner for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

END OF SECTION 50

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Section 60 Control of Materials

60-01 Source of supply and quality requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish documentation to the RPR as to the origin, composition, and manufacture of all materials to be used in the work. Documentation shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the RPR's option, materials may be approved at the source of supply before delivery. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that meets the requirements of the specifications; and is listed in AC 150/5345-53, *Airport Lighting Equipment Certification Program* and *Addendum*, that is in effect on the date of advertisement.

60-02 Samples, tests, and cited specifications. All materials used in the work shall be inspected, tested, and approved by the RPR before incorporation in the work unless otherwise designated. Any work in which untested materials are used without approval or written permission of the RPR shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the RPR, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests will be made by and at the expense of the Owner in accordance with the cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), federal specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the RPR. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the RPR.

A copy of all Contractor QC test data shall be provided to the RPR daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the RPR showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

60-03 Certification of compliance/analysis (COC/COA). The RPR may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's COC stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified. The COA is the manufacturer's COC and includes all applicable test results.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the RPR.

When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "or equal," the Contractor shall be required to furnish the manufacturer's certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

a. Conformance to the specified performance, testing, quality or dimensional requirements; and,

b. Suitability of the material or assembly for the use intended in the contract work.

The RPR shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

The RPR reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 Plant inspection. The RPR or their authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the RPR conduct plant inspections, the following conditions shall exist:

a. The RPR shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.

b. The RPR shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

c. If required by the RPR, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Place office or working space in a convenient location with respect to the plant.

It is understood and agreed that the Owner shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The RPR shall have the right to reject only material which, when retested, does not meet the requirements of the contract, plans, or specifications.

60-05 Engineer/ Resident Project Representative (RPR) field office. An Engineer/RPR field office is not required.

60-06 Storage of materials. Materials shall be stored to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the RPR. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans and/or CSPP, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the RPR. Private property shall not be used for storage purposes without written permission of the Owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the RPR a copy of the property Owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at their expense, except as otherwise agreed to (in writing) by the Owner or lessee of the property.

60-07 Unacceptable materials. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the RPR.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the RPR has approved its use in the work.

60-08 Owner furnished materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

END OF SECTION 60

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Section 70 Legal Regulations and Responsibility to Public

70-01 Laws to be observed. The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the Owner and all their officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.

70-02 Permits, licenses, and taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

70-03 Patented devices, materials, and processes. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or Owner. The Contractor and the surety shall indemnify and hold harmless the Owner, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the Owner for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 Restoration of surfaces disturbed by others. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) must be shown on the plans and is indicated as follows: none.

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the RPR.

Should the Owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such Owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the RPR, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal Participation. The United States Government has agreed to reimburse the Owner for some portion of the contract costs. The contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator. No requirement of this contract shall be construed as making the United States a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-06 Sanitary, health, and safety provisions. The Contractor's worksite and facilities shall comply with applicable federal, state, and local requirements for health, safety and sanitary provisions.

70-07 Public convenience and safety. The Contractor shall control their operations and those of their 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 maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to their own operations and those of their own subcontractors and all suppliers in accordance with Section 40, paragraph 40-05, *Maintenance of Traffic,* and shall limit such operations for the convenience and safety of the traveling public as specified in Section 80, paragraph 80-04, *Limitation of Operations*.

The Contractor shall remove or control debris and rubbish resulting from its work operations at frequent intervals, and upon the order of the RPR. If the RPR determines the existence of Contractor debris in the work site represents a hazard to airport operations and the Contractor is unable to respond in a prompt and reasonable manner, the RPR reserves the right to assign the task of debris removal to a third party and recover the resulting costs as a liquidated damage against the Contractor.

70-08 Construction Safety and Phasing Plan (CSPP). The Contractor shall complete the work in accordance with the approved Construction Safety and Phasing Plan (CSPP) developed in accordance with AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP is on sheet(s) 004-011 of the project plans.

70-09 Use of explosives. The use of explosives is not permitted on this project.

70-10 Protection and restoration of property and landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the Engineer/RPR has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

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, the Contractor shall restore, at their 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 an acceptable manner.

70-11 Responsibility for damage claims. The Contractor shall indemnify and hold harmless the Engineer/RPR and the Owner and their officers, agents, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of their own contract considered necessary by the Owner for such purpose may be retained for the use of the Owner or, in case no money is due, their own surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the Owner, except that money due the

Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 Third party beneficiary clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third-party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 Opening sections of the work to traffic. Not applicable.

70-14 Contractor's responsibility for work. Until the RPR's final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with Section 50, paragraph 50-14, *Partial Acceptance*, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at their own expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 Contractor's responsibility for utility service and facilities of others. As provided in paragraph 70-04, *Restoration of Surfaces Disturbed by Others*, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government 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 their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and/or in the contract documents. **none**.

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 the 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 their plan of operations. Such notification shall be in writing addressed to "The Person to Contact" as provided in this paragraph and paragraph 70-04, *Restoration of Surfaces Disturbed By Others*. A copy of each notification shall be given to the RPR.

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

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such Owner of their 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 RPR.

The Contractor's failure to give the two days' notice 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 hand excavation methods within 3 feet (1 m) 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 RPR 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 RPR 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 their operations whether 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 their own surety.

70-15.1 FAA 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 execution of the project work, shall comply with the following:

a. 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.

b. The Contractor shall provide notice to the FAA Air Traffic Organization (ATO)/Technical Operations/System Support Center (SSC) Point-of-Contact through the airport Owner a minimum of 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.

c. If execution of the project work requires a facility outage, the Contractor shall contact the FAA Point-of-Contact a minimum of 72 hours prior to the time of the required outage.

d. Any damage to FAA cables, access roads, or FAA facilities during construction caused by the Contractor's equipment or personnel whether by negligence or accident will require the Contractor to repair or replace the damaged cables, access road, or FAA facilities to FAA requirements. The Contractor shall not bear the cost to repair damage to underground facilities or utilities improperly located by the FAA.

e. If the project work requires the cutting or splicing of FAA owned cables, the FAA Point-of-Contact shall be contacted a minimum of 72 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA 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 specifications and require approval by the FAA Point-of-Contact as a condition of acceptance by the Owner. The Contractor is hereby advised that FAA restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

70-16 Furnishing rights-of-way. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

70-17 Personal liability of public officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the Engineer, RPR, their authorized representatives, or any officials of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-18 No waiver of legal rights. Upon completion of the work, the Owner will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the Owner from correcting any measurement, estimate, or certificate made before or after completion of the work, nor shall the Owner be precluded or stopped from recovering from the Contractor or their surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill their obligations under the contract. A waiver on the part of the Owner of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the Owner for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the Owner's rights under any warranty or guaranty.

70-19 Environmental protection. The Contractor shall comply with all federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, asphalts, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

All materials shall be properly disposed of in accordance with federal, state, and local regulations; this includes all hazardous and universal wastes. Owner highly encourages the recycling of all materials such as scrap metal and electronic waste.

70-20 Archaeological and historical findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during their operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the RPR. The RPR will immediately investigate the Contractor's finding and the Owner will direct the Contractor to either resume operations or to suspend operations as directed.

Should the Owner order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in Section 40, paragraph 40-04, *Extra Work,* and Section 90, paragraph 90-05, *Payment for Extra Work*. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with Section 80, paragraph 80-07, *Determination and Extension of Contract Time*.

70-21 Insurance Requirements. See Article 19 of Section 00500 Construction Contract.

END OF SECTION 70

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Section 80 Execution and Progress

80-01 Subletting of contract. The Owner will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the Resident Project Representative (RPR).

The Contractor shall perform, with his organization, an amount of work equal to at least twenty-five (25**)** percent of the total contract cost.

Should the Contractor elect to assign their contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the Owner, and shall be consummated only on the written approval of the Owner.

The Contractor shall provide copies of all subcontracts to the RPR fourteen (14) days prior to being utilized on the project. As a minimum, the information shall include the following:

- Subcontractor's legal company name.
- Subcontractor's legal company address, including County name.
- Principal contact person's name, telephone and fax number.
- Complete narrative description, and dollar value of the work to be performed by the subcontractor.
- Copies of required insurance certificates in accordance with the specifications.
- Minority/ non-minority status.

80-02 Notice to proceed (NTP). The Owners notice to proceed will state the date on which contract time commences. The Contractor is expected to commence project operations within ten (10) days of the NTP date. The Contractor shall notify the RPR at least twenty-four (24) hours in advance of the time contract operations begins. The Contractor shall not commence any actual operations prior to the date on which the notice to proceed is issued by the Owner.

80-03 Execution and progress. Unless otherwise specified, the Contractor shall submit their coordinated construction schedule showing all work activities for the RPR’s review and acceptance at least ten (10) days prior to the start of work. The Contractor’s progress schedule, once accepted by the RPR, will represent the Contractor's baseline plan to accomplish the project in accordance with the terms and conditions of the Contract. The RPR will compare actual Contractor progress against the baseline schedule to determine that status of the Contractor's performance. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the RPR’s request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the RPR at least twenty-four (24)hours in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the NTP is issued by the Owner.

The project schedule shall be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or other format, or as otherwise specified. It shall include information on the sequence of work activities, milestone dates, and activity duration. The schedule shall show all work items identified in the project proposal for each work area and shall include the project start date and end date.

The Contractor shall maintain the work schedule and provide an update and analysis of the progress schedule on a twice monthly basis, or as otherwise specified in the contract. Submission of the work schedule shall not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

80-04 Limitation of operations. The Contractor shall control their operations and the operations of their subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct their operations within an AOA of the airport, the work shall be coordinated with airport operations (through the RPR) at least **[** 48 hours **]** prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the RPR and until the necessary temporary marking, signage and associated lighting is in place as provided in Section 70, paragraph 70-08, *Construction Safety and Phasing Plan (CSPP)*.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; and immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AOA until satisfactory conditions are provided. The areas of the AOA identified in the Construction Safety Phasing Plan (CSPP) and as listed below, cannot be closed to operating aircraft to permit the Contractor's operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows:

The contractor shall attend the weekly airfield coordination meetings at 1pm CST on Wednesdays to coordinate closures for the following week. All airfield pavement closures must be approved by the Owner.

The Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction and the approved CSPP.

80-04.1 Operational safety on airport during construction. All Contractors' operations shall be conducted in accordance with the approved project Construction Safety and Phasing Plan (CSPP) and the Safety Plan Compliance Document (SPCD) and the provisions set forth within the current version of AC 150/5370-2, Operational Safety on Airports During Construction. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a SPCD that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine checks to assure compliance with the safety plan measures.

The Contractor is responsible to the Owner for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and SPCD and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP and SPCD unless approved in writing by the Owner. The necessary coordination actions to review Contractor proposed modifications to an approved CSPP or approved SPCD can require a significant amount of time.

80-05 Character of workers, methods, and equipment. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the RPR, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the RPR, be removed immediately by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the RPR.

Should the Contractor fail to remove such person or persons, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the RPR may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall not cause injury to previously completed work, adjacent property, or existing airport facilities due to its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless otherwise authorized by the RPR. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the RPR to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the RPR determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the RPR may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this paragraph.

80-06 Temporary suspension of the work. The Owner shall have the authority to suspend the work wholly, or in part, for such period or periods the Owner may deem necessary, due to unsuitable weather, or other conditions considered unfavorable for the execution of the work, or for such time necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Owner, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the

effective date of the written order to suspend work to the effective date of the written order to resume the work. Claims for such compensation shall be filed with the RPR within the time period stated in the RPR's order to resume work. The Contractor shall submit with their own claim information substantiating the amount shown on the claim. The RPR will forward the Contractor's claim to the Owner for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather or for any other delay provided for in the contract, plans, or specifications.

If it becomes necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-07 Determination and extension of contract time. The number of calendar days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the Contract Time.

If the contract time requires extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

Contract time based on calendar days. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the Notice to Proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Owner's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

80-08 Failure to complete on time. For each calendar day or working day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in paragraph 80-07, *Determination and Extension of Contract Time*) the sum specified in the contract and proposal as liquidated damages (LD) will be deducted from any money due or to become due the Contractor or their own surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the Owner should the Contractor fail to complete the work in the time provided in their contract.

Schedule	Liquidated Damages Cost	Allowed Construction Time
Substantial Completion	$5,000 per Day or any portion thereof	335 calendar days
Final Completion and Demobilization Phase	$1,000 per Day or any portion thereof	45 calendar days

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a wavier on the part of the Owner of any of its rights under the contract.

80-09 Default and termination of contract. The Contractor shall be considered in default of their contract and such default will be considered as cause for the Owner to terminate the contract for any of the following reasons, if the Contractor:

a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or

b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or

c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or

d. Discontinues the execution of the work, or

e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or

h. Makes an assignment for the benefit of creditors, or

i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the Owner consider the Contractor in default of the contract for any reason above, the Owner shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the Owner will, upon written notification from the RPR of the facts of such delay, neglect, or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the RPR will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Owner the amount of such excess.

80-10 Termination for national emergencies. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the RPR.

Termination of the contract or a portion thereof shall neither relieve the Contractor of their responsibilities for the completed work nor shall it relieve their surety of its obligation for and concerning any just claim arising out of the work performed.

80-11 Work area, storage area and sequence of operations. The Contractor shall obtain approval from the RPR prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate work in accordance with the approved CSPP and SPCD.

END OF SECTION 80

Section 90 Measurement and Payment

90-01 Measurement of quantities. All work completed under the contract will be measured by the RPR, or their authorized representatives, using United States Customary Units of Measurement or the International System of Units.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet (0.8 square meters) or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the RPR.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

When requested by the Contractor and approved by the RPR in writing, material specified to be measured by the cubic yard (cubic meter) may be weighed, and such weights will be converted to cubic yards (cubic meters) for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the RPR and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Measurement and Payment Terms

Term	Description
Excavation and Embankment Volume	In computing volumes of excavation, the average end area method will be used unless otherwise specified.
Measurement and Proportion by Weight	The term “ton” will mean the short ton consisting of 2,000 pounds (907 km) avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, independently certified scales by competent, qualified personnel at locations designated by the RPR. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the RPR directs, and each truck shall bear a plainly legible identification mark.

Term	Description
Measurement by Volume	Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.
Asphalt Material	Asphalt materials will be measured by the gallon (liter) or ton (kg). When measured by volume, such volumes will be measured at 60°F (16°C) or will be corrected to the volume at 60°F (16°C) using ASTM D1250 for asphalts. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When asphalt materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, will be used for computing quantities.
Cement	Cement will be measured by the ton (kg) or hundredweight (km).
Structure	Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.
Timber	Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.
Plates and Sheets	The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.
Miscellaneous Items	When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.
Scales	Scales must be tested for accuracy and serviced before use. Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end. Scales shall be accurate within 0.5% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the RPR before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed 0.1% of the nominal rated capacity of the

Term	Description
	scale, but not less than one pound (454 grams). The use of spring balances will not be permitted. In the event inspection reveals the scales have been "overweighing" (indicating more than correct weight) they will be immediately adjusted. All materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of 0.5%. In the event inspection reveals the scales have been under-weighing (indicating less than correct weight), they shall be immediately adjusted. No additional payment to the Contractor will be allowed for materials previously weighed and recorded. Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the RPR can safely and conveniently view them. Scale installations shall have available ten standard 50-pound (2.3 km) weights for testing the weighing equipment or suitable weights and devices for other approved equipment. All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.
Rental Equipment	Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered in connection with extra work will be measured as agreed in the change order or supplemental agreement authorizing such work as provided in paragraph 90-05 *Payment for Extra Work*.
Pay Quantities	When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the RPR. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 Scope of payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of Section 70, paragraph 70-18, *No Waiver of Legal Rights*.

When the "basis of payment" subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-03 Compensation for altered quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are

concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in Section 40, paragraph 40-02, *Alteration of Work and Quantities,* will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from their own unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 Payment for omitted items. As specified in Section 40, paragraph 40-03, *Omitted Items,* the RPR shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the Owner.

Should the RPR omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the RPR's order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the RPR's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the RPR's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

90-05 Payment for extra work. Extra work, performed in accordance with Section 40, paragraph 40-04, *Extra Work*, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

90-06 Partial payments. Partial payments will be made to the Contractor at least once each month as the work progresses. Said payments will be based upon estimates, prepared by the RPR, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with paragraph 90-07, *Payment for Materials on Hand*. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

Retainage will not be withheld on this project. No retainage will be withheld by the Owner from progress payments due the prime Contractor. Retainage by the prime or subcontractors is prohibited, and no retainage will be held by the prime from progress due subcontractors.

The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. A subcontractor's work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the Owner. When the Owner has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

When at least 95% of the project work has been completed to the satisfaction of the RPR, the RPR shall, at the Owner's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based on quantities of work in excess of those provided in the proposal or covered by approved change

orders or supplemental agreements, except when such excess quantities have been determined by the RPR to be a part of the final quantity for the item of work in question.

No partial payment shall bind the Owner to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in paragraph 90-09, *Acceptance and Final Payment*.

The Contractor shall deliver to the Owner a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the Owner to indemnify the Owner against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the Owner may be compelled to pay in discharging any such lien or claim.

90-07 Payment for materials on hand. Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the Owner. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the RPR at or on an approved site.

b. The Contractor has furnished the RPR with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the RPR with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the Owner legal title (free of liens or encumbrances of any kind) to the material stored or stockpiled.

e. The Contractor has furnished the Owner evidence that the material stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the Owner's payment for such stored or stockpiled materials shall in no way relieve the Contractor of their responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this paragraph.

90-08 Payment of withheld funds. At the Contractor's option, if an Owner withholds retainage in accordance with the methods described in paragraph 90-06 *Partial Payments*, the Contractor may request that the Owner deposit the retainage into an escrow account. The Owner's deposit of retainage into an escrow account is subject to the following conditions:

a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the Owner.

b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the Owner and having a value not less than the retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the Owner.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 Acceptance and final payment. When the contract work has been accepted in accordance with the requirements of Section 50, paragraph 50-15, *Final Acceptance*, the RPR will prepare the final estimate of the items of work actually performed. The Contractor shall approve the RPR's final estimate or advise the RPR of the Contractor's objections to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement. The Contractor and the RPR shall resolve all disputes (if any) in the measurement and computation of final quantities to be paid within 30 calendar days of the Contractor's receipt of the RPR's final estimate. If, after such 30-day period, a dispute still exists, the Contractor may approve the RPR's estimate under protest of the quantities in dispute, and such disputed quantities shall be considered by the Owner as a claim in accordance with Section 50, paragraph 50-16, *Claims for Adjustment and Disputes*.

After the Contractor has approved, or approved under protest, the RPR's final estimate, and after the RPR's receipt of the project closeout documentation required in paragraph 90-11, *Contractor Final Project Documentation*, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of Section 50, paragraph 50-16, *Claims for Adjustments and Disputes,* or under the provisions of this paragraph, such claims will be considered by the Owner in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 Construction warranty.

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work, except as noted. If the Owner takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the Owner takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work. Light Emitting Diode emitting diode (LED) light fixtures with the exception of obstruction lighting, must be warranted by the manufacturer for a minimum of four (4) years after date of installation inclusive of all electronics. See technical specifications for additional equipment with extended warranties.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Owner real or personal property, when that damage is the result of the Contractor's failure to conform to contract requirements; or any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The Owner will notify the Contractor, in writing, within seven (7) days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within fourteen (14) days after receipt of notice, the Owner shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the Owner, as directed by the Owner, and (3) Enforce all warranties for the benefit of the Owner.

h. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

90-11 Contractor Final Project Documentation. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the RPR approves the Contractor's final submittal. The Contractor shall:

a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with Section 40, paragraph 40-08, *Final Cleanup*.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer's certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.

j. Project Operation and Maintenance (O&M) Manual(s).

k. Security for Construction Warranty.

l. Equipment commissioning documentation submitted, if required.

END OF SECTION 90

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Section 150 General Provisions Addendum

150-10 GENERAL PROVISIONS ADDENDUM - Section 10 Definition of Terms

Whenever the following terms are used in these specifications, in the contract, in any documents or other instruments pertaining to construction of the project where these specifications govern, the intent and meaning shall be interpreted as follows; and whenever one of the following capitalized words, terms or phrases is used herein, it shall be interpreted or construed first as defined in Specification Section GP-10, second as defined below, third according to its generally accepted meaning in the construction industry, and fourth according to its common and customary usage.

150-10-101 ACCESS ROAD

As defined in GP-10 and shall further be defined to include "or an internal roadway for construction or maintenance."

150-10-102 ADDENDA

Written or graphic instructions issued prior to the opening of Proposals, which clarify, correct or change the bidding documents or the Contract Documents.

150-10-103 AIRPORT OPERATIONS or OPERATIONS

Depending on use, airport operations may refer to a department of the Airport Authority or the movement of aircraft on, or approaching the airfield.

150-10-104 BID ITEMS

The proposal provides for quotation of a price, for one or more bid items, which may be lump sum bid prices, alternate bid prices, unit bid prices, or a combination thereof. No payment will be made for items not set up in the proposal, unless otherwise provided by contract amendment. Bidders are cautioned that they should include in the prices quoted for various bid items all necessary allowances for the performance of all work required for the satisfactory completion of the project.

150-10-105 BUILDER

A term to be used interchangeably with "Contractor."

150-10-106 CONTRACT AMENDMENT

A term to be used interchangeably with "Change order."

150-10-107 CONTRACT FOR PROFESSIONAL SERVICES

A written agreement between the Owner and a Professional for provision of services and related items required to design, engineer or program manage all or part of a Project.

150-10-108 DEFECTIVE

An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any Inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to the Program Manager's recommendation of final payment.

150-10-109 DRAWINGS

A term to be used interchangeably with “Plans.”

150-10-110 ENGINEER or PROFESSIONAL

As defined in GP-10 and shall further be defined to include “Engineer will not supervise, direct, control, or have authority over or be responsible for Contractors means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with laws and regulations applicable to performance of the Work. Ross Witt pllc is the Engineer for this Project.”

150-10-111 FINAL COMPLETION

The stage of construction when the Work has been 100% completed including all punch list items, record drawings, O&M manuals, lien waivers, maintenance training, warranties, consent of surety to final payment, and all other required closeout documentation.

150-10-112 GP

Abbreviation for General Provision.

150-10-113 HAZARDOUS SUBSTANCES

The term "Hazardous Substance" shall have the same meaning and definition as set forth in the Comprehensive Environmental Response Compensation and Liability Act as amended, 42 U.S.C. § 6901 *et seq*, and regulations promulgated thereunder (collectively "CERCLA") and any corresponding state or local law or regulation, and shall also include: (a) any Pollutant or Contaminant as those terms are defined in CERCLA; (b) any Solid Waste or Hazardous Constituent as those terms are defined by, or are otherwise identified by, the Resource Conservation and Recovery Act as amended, 42 U.S.C. § 6901 *et seq*, and regulations promulgated thereunder (collectively "RCRA") and any corresponding state or local law or regulation; (c) crude oil, petroleum and fractions of distillates thereof; (d) any other material, substance or chemical defined, characterized or regulated as toxic or hazardous under any applicable law, regulation, ordinance, directive or ruling; and (e) any infectious or medical waste as defined by any applicable federal or state laws or regulations.

150-10-114 INTENTION OF TERMS

As defined in GP-10 and shall further be defined to include “The use of any such term shall not be effective to assign to Program Manager any duty or authority to supervise or direct the furnishing or performance of the work. Wherever in the specifications or on the drawings the words "install," "furnish," "provide," or words of like import are used, they mean the Contractor shall install, furnish, or provide, as the case may be complete and ready for Owner's use.”

150-10-115 LUMP SUM PRICE

The dollar amount for which a Contractor agrees to perform the Work or a specific component of the Work as set forth in a Contract for construction.

150-10-116 MAJOR SUBCONTRACTOR

A major subcontractor shall be any subcontractor who is responsible for 15 percent or more of the full amount of the contract.

150-10-117 OWNER or SPONSOR

As defined in GP-10 and shall further be defined to include “The Owner shall mean the Memphis-Shelby County Airport Authority.”

150-10-118 PARTIAL 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 when the Owner can satisfactorily occupy or beneficially use a finite portion of completed Work for its intended purpose. Partial completion and acceptance of a finite portion of the work will in no way imply the overall project is substantially complete or start of the project warranty.

150-10-119 PROGRAM MANAGER

The individual, partnership, firm, or corporation duly authorized by the Owner (sponsor) to be responsible for engineering supervision during construction and acting directly or through an authorized representative. The term Program Manager means the person, person or organization named by the Owner to act as their representative. Program Manager will not supervise, direct, control, or have authority over or be responsible for Contractors means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with laws and regulations applicable to performance of the Work. All authority granted to the Engineer by these construction documents shall also be available to the Program Manager, at the discretion of the Owner. Parsons is the Program Manager for this Project.

150-10-120 PUNCHLIST ITEM

Any item of work, in whole or in part, which the Program Manager has identified as being unsatisfactory after an inspection of the project. A punch-list item may be further classified as being either "major" or "minor". A "major" punch-list item is defined as any punch-list item the correction of which is, in the Program Manager's determination, necessary for the Owner to use the completed project for its intended purpose. A "minor" punch-list item is defined as any punch-list item not classified as "major" by the Program Manager.

150-10-121 SHOP DRAWINGS

All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for the Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a supplier, manufacturer, subcontractor or fabricator and submitted by the Contractor to illustrate material or equipment for some portion of the Work.

150-10-122 SITE

The geographical location of a Project, usually defined by legal boundary lines, and the location characteristics including, but not limited to, grades and lines of streets, alleys, pavements and adjoining structures, rights-of-way, restrictions, easements, encroachments, zoning, deed restrictions, existing buildings and improvements, and service and utility lines.

150-10-123 SUBSTANTIAL COMPLETION

The stage in the progress of the Work when the Work is substantially complete in accordance with the Contract Documents and the Owner can occupy or beneficially use satisfactorily completed Work for its intended purpose.

150-20 GENERAL PROVISIONS ADDENDUM - PROPOSAL REQUIREMENTS AND CONDITIONS

150-20-01 ADVERTISEMENT (NOTICE TO BIDDERS)

General Provisions 20-01 shall include: "See Section LEGAL NOTICE TO BIDDERS for the ADVERTISEMENT notifying prospective Bidders of this project."

150-20-05 INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES

General Provisions 20-05 shall include: "The proposal provides for quotation of a price, for one or more bid items, which may be lump sum bid prices, alternate bid prices, unit bid prices, or a combination thereof. No payment will be made for items not set up in the proposal, unless otherwise provided by contract amendment. Bidders are cautioned that they should include in the prices quoted for various bid items all necessary allowances for the performance of all work required for the satisfactory completion of the project."

150-20-07 PREPARATION OF PROPOSAL.

General Provisions 20-07 shall include "The bidder shall state the unit price and extension, written in ink or typed, for which he proposes to do each pay item furnished in the proposal. In case of conflict between the unit price and extension, the unit price, unless obviously incorrect, shall govern."

150-20-09 IRREGULAR PROPOSALS

General Provisions 20-09 item f) shall include:

f. If the proposal does not meet the DBE participation requirement specified in Section DBE REQ.

150-20-10 BID GUARANTEE.

General Provisions 20-10 shall include

"Each proposal shall be accompanied by either a cashier's check or a certified check drawn on a solvent bank, or a Bidder's bond executed by the Bidder and a surety company acceptable to the Memphis-Shelby County Airport Authority, in the amount of not less than five (5) percent of the total bid price, made payable without conditions to the Memphis-Shelby County Airport Authority, as a guarantee that if the proposal is accepted, the Bidder will enter into a contract and execute a Performance and Payment Bond with legally responsible surety within ten (10) days after contract award is made by the Memphis-Shelby County Airport Authority. Bidder's Bond (if used) shall be executed on the form prescribed within these documents.

"In the event that the Bidder's proposal is accepted and the contract is awarded by the Memphis-Shelby County Airport Authority, and the Bidder fails or refuses to execute the contract and furnish the required Performance and Payment Bond within ten (10) days after such award is made by the Memphis-Shelby County Airport Authority, unless given a written extension of time by the Memphis-Shelby County Airport Authority, then the Bidder will be considered as having abandoned his proposal, and his proposal guarantee will be retained by the Memphis-Shelby County Airport Authority as liquidated damages and not as a penalty, IT NOW BEING AGREED that the amount of the proposal guarantee is a fair estimate of the amount of damages that the Memphis-Shelby County Airport Authority will sustain in case the Bidder fails to enter into the contract and furnish the required Performance and Payment Bond within ten (10) days after receiving notice of such award."

150-20-14 DISQUALIFICATION OF BIDDERS.

General Provisions 20-14 item d) shall include:

d. Failure to show evidence of possessing a valid state of Tennessee Contractor's License, as required by law.

150-20-15 EXPLANATIONS AND INTERPRETATIONS OF CONTRACT DOCUMENTS

All explanations desired by Bidders regarding the meaning or interpretation of the drawings and specifications must be requested with sufficient time allowed for a written reply to reach them before the submission of their bids. Oral explanation or instructions will not be given. All necessary explanations or interpretations will be made in the form of written addenda to the specifications or drawings, and will be furnished to all Bidders, and the receipt thereof shall be acknowledged by each Bidder on his proposal.

150-20-16 DBE REQUIREMENTS

All Bidders shall submit with his/her proposal the DBE's Assurance Statement/Letter of Intent for each DBE subcontractor (subcontractors' signatures not required) Subcontractors' bids to the Prime Contractor with items included in the bid either circled and/or highlighted, DBE's Current Certification for each DBE Subcontractor, Respondent DBE Goals Accomplishment Statement, and Information on All Firms that Provide Bids or Quotes, which have been provided in the bid envelope. There must be one DBE's Assurance Statement/Letter of Intent for each proposed DBE subcontractor properly completed and signed by the Bidder.

Within 24 hours of the proposal submittal deadline, all Bidders shall submit the DBE's Assurance Statement/Letter of Intent for each DBE subcontractor (subcontractors' signatures required). There must be one DBE's Assurance Statement/Letter of Intent for each proposed DBE subcontractor properly completed and signed by the DBE subcontractor, and if applicable the 2nd/3rd Tier Subcontractor's, and the Bidder.

See specification section DISADVANTAGED BUSINESS ENTERPRISE (DBE) REQUIREMENTS for additional proposal requirements and conditions.

150-40 GENERAL PROVISIONS ADDENDUM - SCOPE OF WORK

150-40-04 EXTRA WORK.

General Provisions 40-04 shall include “When determined by the Program Manager to be in the Owner's best interest, the Owner may order the Contractor to proceed with extra work by time and materials as provided in Section GP-150-90.”

150-50 GENERAL PROVISIONS ADDENDUM - CONTROL OF WORK

150-50-04 COOPERATION OF CONTRACTOR.

General Provisions 50-04 shall include “The Owner shall allocate the work and designate the sequence of construction in case of controversy between contractors.”

150-70 GENERAL PROVISIONS ADDENDUM - LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

150-70-01 LAWS TO BE OBSERVED.

General Provisions 70-01 shall include "Applicable laws, ordinances, regulations, orders, and decrees shall be considered as MINIMUM requirements, and everything shown or specified in excess of these minimum requirements shall be installed in excess thereof, as shown or specified. No instructions given in the contract documents shall be construed as an authorization to violate any law, ordinance, regulation, order, or decree.

"If the Contractor observes that the drawings or specifications are at variance with any applicable law, ordinance, regulation, order, or decree, he shall immediately notify the Program Manager in writing, and obtain the Program Manager's decision before proceeding with the portion of the work involved.

"The Contract shall be governed by the law of the State of Tennessee. Any action brought which involves the Contract, the Work or the Project shall be brought and determined in accordance with the Laws of the State of Tennessee."

150-70-14 CONTRACTOR'S RESPONSIBILITY FOR WORK

General Provisions 70-14 shall include "The Program Manager shall not be responsible for the methods and means employed by the Contractor in the performance of the Contractor's work. The Program Manager shall have no responsibility for the safety of workmen and others who may be injured during the course of the Contractor's work."

150-70-21 CONTINUANCE OF WORK NOTWITHSTANDING DISPUTES, ETC.

Unless otherwise agreed in writing, the Contractor shall, notwithstanding any dispute, proceeding, or litigation, proceed forthwith in accordance with the Program Manager's written decision and/or direction and shall continue the Work and maintain its progress. The Owner shall continue to make payments to the Contractor to the extent that the sums due and owing the Contractor are not in dispute, in accordance with the Contract Documents.

150-70-22 SCOPE OF PROGRAM MANAGER'S RESPONSIBILITES TO CONTRACTOR AND OWNER

The Program Manager is to act as Owner's representative, and shall have the duties and responsibilities and the rights and authority assigned to Program Manager in the Contract in connection with completion of the Work in accordance with the Contract. Neither the Program Manager's authority to act under the Contract, nor any decision made by him in good faith either to exercise or not to exercise authority under the Contract, shall give rise to any duty or responsibility of the Program Manager to the Contractor, any Subcontractor, any of their agents or employees. However, nothing contained herein shall exculpate in any manner nor relieve the Program Manager of his duties and responsibilities to the Owner in accordance with the Contract and in accordance with any other agreements between the Program Manager and Owner establishing the Program Manager's duties and responsibilities to properly administer the Contract and to correctly apply the requirements of the Contract to the Work.

150-80 GENERAL PROVISIONS ADDENDUM - PROSECUTION AND PROGRESS

150-80-01 SUBLETTING OF CONTRACT

General Provisions 80-01 shall include "The Contractor shall obtain prior approval from the Owner before subcontracting any portion of this contract. Only those subcontractors who are known for doing quality, first class airport work of the type required of the subcontract will be approved by the Owner. For each proposed subcontract, the Contractor shall supply the Program Manager with the subcontractor's name, the amount of the subcontract, their previous, related experience, their available appropriate equipment both owned and leased, and their available personnel. The Contractor shall also submit to the Program Manager those items of the contract to be performed directly by his own organization. The amounts of these items and the amounts of all items awarded to all subcontractors shall correspond to the contract price for the entire project. The Owner reserves the right to withhold approval of any subcontractor who, in the Owner's opinion, is not qualified to perform the work. If the Owner withholds approval of a subcontractor the Contractor shall be required to find an alternate subcontractor that meets the approval of the Owner or he shall perform the work himself. In either event, contract pay items shall not be adjusted. The contract will not be signed until all major subcontractors have been approved by the Owner. In case of approval, the Contractor shall file copies of all subcontracts with the Program Manager."

150-80-07 DETERMINATION AND EXTENSION OF CONTRACT TIME

General Provisions 80-07 shall include "Time extension for delays caused by the effects of inclement weather are justified only when rains or other excessive inclement weather conditions or related adverse soil conditions prevent the Contractor from productively performing critical activities of work resulting in:

1. The Contractor being unable to work at least 50% of the normal work day on pre-determined critical path items due to adverse weather conditions or;

2. The Contractor being required to make major repairs to the work damaged by excessive weather, provided that the damage was not attributable to the Contractor's negligence or failure to perform, and provided that the Contractor was unable to work an available day as defined under GP-10.

"The Contractor will be granted a time extension based on weather days in excess of the anticipated days during the original contract completion. After the new contract completion date has been established by the Program Manager, additional anticipated days as identified by SC-120 Section 3.05 paragraph E for the months covered within the contract extension period will be granted. Once the Contractor reaches the revised completion date and has not completed the project due to additional weather delays, the Contractor will be granted, only the verified lost weather days leading to the revised contract completion. No other weather days will be granted beyond the established final completion date.

"If the Contractor finds it impossible for reasons beyond his/her control to complete the work within the contract time as specified or as extended he may, within ten (10) days after commencement of the cause of delay make a written request to the Program Manager for an extension of time setting forth the reasons which he believes will justify the granting of his/her request; otherwise, such claim will be waived. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the Program Manager finds that the work was delayed because of conditions beyond the control and without the fault of the Contractor, he may recommend the Owner extend the time for completion in such amount as the conditions justify. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion. Should the contract time require extension it shall be by change order or supplemental agreement"

150-80-09 DEFAULT AND TERMINATION OF CONTRACT

General Provisions 80-09 shall include "The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause. Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

a. Cease operations as directed by the Owner in the notice;

b. Take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

c. Except for the Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing Subcontractors and purchase orders and enter into no further Subcontracts and purchase orders.

“In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner for Work executed and for proven loss with respect to materials, equipment, tools and construction equipment and machinery, including reasonable overhead, profit and damages.”

150-90 GENERAL PROVISIONS ADDENDUM - MEASUREMENT AND PAYMENT

150-90-05 PAYMENT FOR EXTRA WORK OR TIME AND MATERIALS WORK

General Provisions 90-05 shall include:

"EXTRA Work and TIME and MATERIALS Work will be paid in accordance with the paragraphs below and will include documented costs for labor, labor burden, insurance and taxes, materials, equipment, plus a set allowance for combined overhead and profit to be included in the total cost to the Owner. The Contractor is responsible for preparing detailed daily reports documenting all labor, material, and equipment charges incurred and signed by both Contractor and Program Manager for all TIME and MATERIALS work.

When the change order or supplemental agreement authorizing extra work or time and materials work is prepared, compensation will be based on actual expended labor, equipment, and materials costs as follows:

a. Labor. For all labor (skilled and unskilled) and foremen in direct charge of a specific time and materials item, the Contractor shall receive the rate of wage (or scale) for every hour that such labor or foreman is actually engaged in the specified time and materials work. Such wage (or scale) shall be the same U.S. Secretary of Labor wage determination as is included in the originally awarded contract.

The Contractor shall receive the actual costs paid to, or on behalf of workers by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits, when such amounts are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the work.

The Contractor shall submit an audited labor burden percentage for review and approval which, after approval, will also be paid to the Contractor based upon actual labor costs expended. The Contractor's audited labor burden rate will include any and all insurance costs not paid by OCIP, unemployment insurance contributions, and social security taxes paid on the employees behalf. The Contractor shall furnish satisfactory evidence of the rate or rates paid for such insurance and taxes.

c. Materials. For materials accepted by the Program Manager and used exclusively for the Extra or Time and Materials Work, the Contractor shall receive the actual cost of such materials delivered on the work, including transportation charges paid by him (exclusive of machinery rentals as hereinafter set forth) and applicable sales or use tax.

d. Equipment. For any machinery or special equipment (other than small tools) including fuel, lubricants, and transportation costs, the use of which has been authorized by the Program Manager, the Contractor shall receive the current published "Blue Book" rental rates for the actual time that such equipment is committed to the work.

e. Miscellaneous. No additional allowance will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.

The Contractor and the Program Manager shall compare records of the cost of TIME AND MATERIALS WORK at the end of each day. Agreement shall be indicated by signature of the Contractor and the Program Manager or their duly authorized representatives. Failure to obtain the Program Manager's signature shall constitute a waiver on the part of the Contractor of any right to collect reimbursement for such costs.

No payment will be made for work performed on an EXTRA WORK or TIME AND MATERIALS basis until the Contractor has furnished the Program Manager with itemized statements and all required backup documentation of the cost of such extra or time and materials work.

The fixed percentage allowance for combined overhead and profit to be added to the total of the labor, materials, and equipment costs above will be based on the following schedule:

a. For the Contractor, for Work performed by the Contractor's own forces, ten percent (10%) of the cost.

b. For the Contractor, for Work performed by the Contractor's Subcontractor, five percent (5%) of the amount due the Subcontractor.

c. For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's or Sub-subcontractor's own forces, fifteen percent (15%) of the cost.

d. For each Subcontractor, the Work performed by the Subcontractor's Subcontractor, five percent (5%) of the amount due the Subcontractor's Subcontractor.

The total payment will be based on the total documented labor, material, and equipment cost plus the fixed percentages for combined overhead and profit specified above. This total payment shall constitute full compensation for all items of expense not specifically provided for the extra work or time and materials work.

150-90-07 PAYMENT FOR MATERIALS ON HAND

General Provisions 90-07 shall include "Request for partial payments must be accompanied by a completed, accurate stored material work sheet. The stored material work sheet will be supplied by the Program Manager upon request by the Contractor."

END OF SECTION GP-150

ITEM C-100 CONTRACTOR QUALITY CONTROL PROGRAM (CQCP)

100-1 General. Quality is more than test results. Quality is the combination of proper materials, testing, workmanship, equipment, inspection, and documentation of the project. Establishing and maintaining a culture of quality is key to achieving a quality project. The Contractor shall establish, provide, and maintain an effective Contractor Quality Control Program (CQCP) that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The Contractor shall establish a CQCP that will:

- **a.** Provide qualified personnel to develop and implement the CQCP.
- **b.** Provide for the production of acceptable quality materials.
- **c.** Provide sufficient information to assure that the specification requirements can be met.
- **d.** Document the CQCP process.

The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the CQCP has been reviewed and approved by the Program Manager. No partial payment will be made for materials subject to specific quality control (QC) requirements until the CQCP has been reviewed and approved.

The QC requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the quality assurance (QA) testing requirements. QA testing requirements are the responsibility of the Program Manager or Contractor as specified in the specifications.

A Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Program Manager, Contractor, subcontractors, testing laboratories, and Owner must be held prior to start of construction. The QC/QA workshop will be facilitated by the Contractor. The Contractor shall coordinate with the Airport and the Program Manager on time and location of the QC/QA workshop. Items to be addressed, at a minimum, will include:

- **a.** Review of the CQCP including submittals, QC Testing, Action & Suspension Limits for Production, Corrective Action Plans, Distribution of QC reports, and Control Charts.
- **b.** Discussion of the QA program.
- **c.** Discussion of the QC and QA Organization and authority including coordination and information exchange between QC and QA.
- **d.** Establish regular meetings to discuss control of materials, methods and testing.
- **e.** Establishment of the overall QC culture.

100-2 Description of program.

- **a. General description.** The Contractor shall establish a CQCP to perform QC inspection and testing of all items of work required by the technical specifications, including those performed by

subcontractors. The CQCP shall ensure conformance to applicable specifications and plans with respect to materials, off-site fabrication, workmanship, construction, finish, and functional performance. The CQCP shall be effective for control of all construction work performed under this Contract and shall specifically include surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of QC.

b. Contractor Quality Control Program (CQCP). The Contractor shall describe the CQCP in a written document that shall be reviewed and approved by the Program Manager prior to the start of any production, construction, or off-site fabrication. The written CQCP shall be submitted to the Program Manager for review and approval at least 14 calendar days before the CQCP Workshop. The Contractor's CQCP and QC testing laboratory must be approved in writing by the Program Manager prior to the Notice to Proceed (NTP).

The CQCP shall be organized to address, as a minimum, the following:

1. QC organization and resumes of key staff
2. Project progress schedule
3. Submittals schedule
4. Inspection requirements
5. QC testing plan
6. Documentation of QC activities and distribution of QC reports
7. Requirements for corrective action when QC and/or QA acceptance criteria are not met
8. Material quality and construction means and methods. Address all elements applicable to the project that affect the quality of the pavement structure including subgrade, subbase, base, and surface course. Some elements that must be addressed include, but is not limited to mix design, aggregate grading, stockpile management, mixing and transporting, placing and finishing, quality control testing and inspection, smoothness, laydown plan, equipment, and temperature management plan.

The Contractor must add any additional elements to the CQCP that is necessary to adequately control all production and/or construction processes required by this contract.

100-3 CQCP organization. The CQCP shall be implemented by the establishment of a QC organization. An organizational chart shall be developed to show all QC personnel, their authority, and how these personnel integrate with other management/production and construction functions and personnel.

The organizational chart shall identify all QC staff by name and function, and shall indicate the total staff required to implement all elements of the CQCP, including inspection and testing for each item of work. If necessary, different technicians can be used for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the CQCP, the personnel assigned shall be subject to the qualification requirements of paragraphs 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The QC organization shall, as a minimum, consist of the following personnel:

a. Program Administrator. The Contractor Quality Control Program Administrator (CQCPA) must be a **full-time on-site** employee of the Contractor, or a consultant engaged by the Contractor. The CQCPA

must have a minimum of five (5) years of experience in QC pavement construction with prior QC experience on a project of comparable size and scope as the contract.

The CQCPA must have full authority to institute any and all actions necessary for the successful implementation of the CQCP to ensure compliance with the contract plans and technical specifications. The CQCPA authority must include the ability to immediately stop production until materials and/or processes are in compliance with contract specifications. The CQCPA must report directly to a principal officer of the construction firm. The CQCPA may supervise the Quality Control Program on more than one project provided that person can be at the job site within two (2) hours after being notified of a problem.

b. QC technicians. A sufficient number of QC technicians necessary to adequately implement the CQCP must be provided. These personnel must be either Engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II in Civil Engineering Technology or higher, and shall have a minimum of two (2) years of experience in their area of expertise.

The QC technicians must report directly to the CQCPA and shall perform the following functions:

(1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by paragraph 100-6.

(2) Performance of all QC tests as required by the technical specifications and paragraph100-8.

(3) Performance of tests for the Program Manager when required by the technical specifications.

Certification at an equivalent level of qualification and experience by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

c. Staffing levels. The Contractor shall provide sufficient qualified QC personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The CQCP shall state where different technicians will be required for different work elements.

100-4 Project progress schedule. Critical QC activities must be shown on the project schedule as required by General Contract Provision Section 80, paragraph 80-03, *Execution and Progress*.

100-5 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include as a minimum:

a. Specification item number

b. Item description

c. Description of submittal

d. Specification paragraph requiring submittal

e. Scheduled date of submittal

100-6 Inspection requirements. QC inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by paragraph 100-9.

Inspections shall be performed as needed to ensure continuing compliance with contract requirements until completion of the particular feature of work. Inspections shall include the following minimum requirements:

a. During plant operation for material production, QC test results and periodic inspections shall be used to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment used in proportioning and mixing shall be inspected to ensure its proper operating condition. The CQCP shall detail how these and other QC functions will be accomplished and used.

b. During field operations, QC test results and periodic inspections shall be used to ensure the quality of all materials and workmanship. All equipment used in placing, finishing, and compacting shall be inspected to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The CQCP shall document how these and other QC functions will be accomplished and used.

100-7 Contractor QC testing facility.

a. For projects that include Item P-401, Item P-403, Item P-404, Item S-401, and Item S-402 the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM D3666, *Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*:

- Equipment Calibration and Checks;
- 8.1.9 Equipment Calibration, Standardization, and Check Records;
- 8.1.12 Test Methods and Procedures

b. For projects that include P-501, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation:

- 7 Test Methods and Procedures
- 8 Facilities, Equipment, and Supplemental Procedures

100-8 QC testing plan. As a part of the overall CQCP, the Contractor shall implement a QC testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional QC tests that the Contractor deems necessary to adequately control production and/or construction processes.

The QC testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

a. Specification item number (e.g., P-401)

b. Item description (e.g., Hot Mix Asphalt Pavements)

c. Test type (e.g., gradation, grade, asphalt content)

d. Test standard (e.g., ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)

e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated)

f. Responsibility (e.g., plant technician)

g. Control requirements (e.g., target, permissible deviations)

The QC testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The Program Manager shall be provided the opportunity to witness QC sampling and testing.

All QC test results shall be documented by the Contractor as required by paragraph 100-9.

100-9 Documentation. The Contractor shall maintain current QC records of all inspections and tests performed. These records shall include factual evidence that the required QC inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.

These records must cover both conforming and defective or deficient features and must include a statement that all supplies and materials incorporated in the work are in full compliance with the terms of the contract. Legible copies of these records shall be furnished to the Program Manager daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the CQCPA.

Contractor QC records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily inspection reports. Each Contractor QC technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician's daily reports shall provide factual evidence that continuous QC inspections have been performed and shall, as a minimum, include the following:

(1) Technical specification item number and description
(2) Compliance with approved submittals
(3) Proper storage of materials and equipment
(4) Proper operation of all equipment
(5) Adherence to plans and technical specifications
(6) Summary of any necessary corrective actions
(7) Safety inspection.
(8) Photographs and/or video (as needed or required)

The daily inspection reports shall identify all QC inspections and QC tests conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible QC technician and the CQCPA. The Program Manager shall be provided at least one copy of each daily inspection report on the work day following the day of record. When QC inspection and test results are recorded and transmitted electronically, the results must be archived.

b. Daily test reports. The Contractor shall be responsible for establishing a system that will record all QC test results. Daily test reports shall document the following information:

(1) Technical specification item number and description
(2) Test designation
(3) Location
(4) Date of test
(5) Control requirements
(6) Test results

(7) Causes for rejection

(8) Recommended remedial actions

(9) Retests

Test results from each day's work period shall be submitted to the Program Manager prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical QC charts. When QC daily test results are recorded and transmitted electronically, the results must be archived.

100-10 Corrective action requirements. The CQCP shall indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action shall include both general requirements for operation of the CQCP as a whole, and for individual items of work contained in the technical specifications.

The CQCP shall detail how the results of QC inspections and tests will be used for determining the need for corrective action and shall contain clear rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and use statistical QC charts for individual QC tests. The requirements for corrective action shall be linked to the control charts.

100-11 Inspection and/or observations by the Program Manager. All items of material and equipment are subject to inspection and/or observation by the Program Manager at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate QC system in conformance with the requirements detailed here and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to inspection and/or observation by the Program Manager at the site for the same purpose.

Inspection and/or observations by the Program Manager does not relieve the Contractor of performing QC inspections of either on-site or off-site Contractor's or subcontractor's work.

100-12 Noncompliance.

a. The Program Manager will provide written notice to the Contractor of any noncompliance with their CQCP. After receipt of such notice, the Contractor must take corrective action.

b. When QC activities do not comply with either the CQCP or the contract provisions or when the Contractor fails to properly operate and maintain an effective CQCP, and no effective corrective actions have been taken after notification of non-compliance, the Program Manager will recommend the Owner take the following actions:

(1) Order the Contractor to replace ineffective or unqualified QC personnel or subcontractors and/or

(2) Order the Contractor to stop operations until appropriate corrective actions are taken.

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.

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

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ITEM C-102 TEMPOARARY AIR AND WATER POLLUTION, SOIL EROSION, AND SILTATION CONTROL

DESCRIPTION

102-1. This item shall consist of temporary control measures as shown on the plans or as ordered by the Program Manager during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be designed, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

102-2 Tennessee Department of Environment and Conservation. The Contractor must perform and certify that an inspection, as described in section 3.5.8.2 of the General Permit for Stormwater Discharges from Construction Activities ("Permit") has been performed at least twice every calendar week and documented on form CN-1173 (Rev. 6-16), provided in the Contractor Storm Water Pollution Prevention Plan (SWPPP). The Contractor must certify the inspection of erosion and sediment controls and of outfall points was performed; and whether or not all planned and designed erosion and sediment controls are installed and in working order. The certification must be executed by a person who meets the signatory requirements described in Section(s) 3.5.8.2(g) and 7.7.2 of the General NPDES Permit for Discharges of Stormwater Associated with Construction Activities also referred to as the construction general permit (CGP). Inspections must be performed at least 72 hours apart. Inspection documentation will be maintained on-site and made available upon request. Inspection reports must be submitted to the Tennessee Department of Environment and Conservation (TDEC) – Division of Water Resources within 10 days of a request.

The record of inspections must be submitted to the following address:

Tennessee Department of Environmental and Conservation
Division of Water Resources – Memphis Environmental Field Office
8383 Wolf Lake Drive
Bartlett, TN 38133

MATERIALS

102-2.1 Grass. Seeding not allowed as a temporary erosion control. Selected grass species shall not create a wildlife attractant. Rye grass, of any variety, shall not be allowed.

102-2.2 Mulches. Mulches shall be a cellulose-fiber or wood-pulp, commercially available spray applied suitable material reasonably clean and free of noxious weeds and deleterious materials. Mulches shall not create a wildlife attractant.

102-2.3 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all federal and state regulations, to the standards of the Association of Official Agricultural Chemists.

102-2.4 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

102-2.5 Silt fence. Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

102-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the Program Manager before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

102-3.1 General. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations shall apply.

The Program Manager shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

102-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Program Manager.

102-3.3 Construction details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans. Except where future construction operations will damage slopes, the Contractor shall perform the permanent sodding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The Program Manager shall limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, sodding, and other such permanent control measures current with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the Program Manager.

The Contractor shall provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment as directed by the Program Manager. If temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or directed by the Program Manager, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The Program Manager may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

The Contractor shall provide equipment wash out areas and these areas will be so constructed and protected so as to not allow any discharge of silt, fuels, lubricants and other harmful materials into any waterways, impoundments or into natural or manmade channels.

The Contractor shall periodically inspect the pollution control features at the intervals stated in the approved SWPPP, and immediately after each rainfall and at least daily during prolonged rainfall and immediately correct any deficiencies. The Contractor shall review the location of pollution control features for effectiveness. If deficiencies exist, the Contractor shall correct as directed by the Program Manager.

The Contractor shall remove sediment deposits when the deposit reaches approximately 1/2 of the volume capacity of the sediment control feature, or as otherwise directed by the Program Manager. The Contractor shall also remove all sediment deposits when the sediment control feature is removed on completion of the project or applicable construction phase. The Contractor shall grade and dress the area and restore it to its pre-construction condition or the proposed finish grade, as called for on the plans. Sediment removal operations shall be considered normal maintenance operations for BMP's, incidental to the item requiring its use, and shall not be measured separately for pay.

Contractor shall continuously maintain permanent and temporary pollution control features. Maintenance shall include periodic watering and mowing of grassed areas. There shall be no additional or separate compensation paid to the Contractor for such work.

If construction is suspended, the Contractor shall inspect, maintain and operate temporary and permanent pollution control features during such suspension. If suspension is part of the project phasing and sequencing plan, or if the suspension is requested by the Contractor, the Contractor shall not be paid additional or separate compensation for, nor relieved of the responsibility to inspect, maintain and operate the pollution control facilities.

The Contractor is responsible for the removal of all temporary erosion and pollution control facilities as well as the restoration of those sites. This work shall include the repair of any trenching for silt fence, removal of all silt build-up, the removal of fencing, barriers and silt bales and the associated stakes and appurtenances, and the placing of seeding or sodding to restore those sites. All inlets, catch basins and manholes constructed for this project shall be cleaned and the new drainage pipes flushed. All materials taken from the facilities or flushed from the new piping system shall be collected by the Contractor and disposed of off-site.

102-3.4 Installation, maintenance and removal of silt fence. Silt fences shall extend a minimum of 26 inches and a maximum of 34 inches above the ground surface. Posts shall be set no more than 10 feet on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch overlap and securely sealed. A trench shall be excavated approximately 6 inches deep by 4 inches wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the Program Manager.

102-3.5 Fugitive Dust Control. The Contractor shall be responsible for providing temporary measures as needed to adequately control fugitive dust during construction. Dust, as discussed herein, may be from blowing soil, Portland cement, lime, dry grass, or other such materials.

Several methods of controlling dust and other air pollutants include:

- **a.** Exposing the minimum area of erodible earth.
- **b.** Applying temporary mulch with or without seeding.
- **c.** Using water sprinkler trucks.
- **d.** Using covered haul trucks
- **e.** Using dust palliatives or penetration asphalt on haul roads.
- **f.** Using Plastic sheet coverings.

Dust control at an operational airfield is of the utmost importance because excessive dust can restrict sight distance and damage aircraft engines. The Program Manager reserves the right to shut down or restrict construction operations when excessive dust, as determined by the Program Manager, could impact air navigation or airfield operations. Such a restriction or shut-down may not be the basis for additional costs or contract time.

The cost of temporary measures to control dust shall be incidental to the contract and no separate payment will be made for these measures.

102-3.6 Suspended Solid Control. The Contractor shall address and remove, to the Program Managers satisfaction, suspended solids in collected stormwater runoff which will been detained for sediment removal in the proposed temporary sediment basins for the project prior to release to stormwater systems. The Contractor shall be responsible for obtaining the services of a professional or a laboratory to analyze the soil and/or construction storm water and to recommend an effective blend of polymer flocculant and the application rate to be used for this site to promote effective sediment removal.

BASIS OF PAYMENT

102-5.1 Lump Sum Project

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.

Advisory Circulars (AC)

AC 150/5200-33 *Hazardous Wildlife Attractants on or Near Airports*

AC 150/5370-2 *Operational Safety on Airports During Construction*

ASTM International (ASTM)

ASTM D6461 *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM C-102

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Part 2 – General Construction Items

Item C-105 Mobilization

105-1 Description. This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-2 Mobilization limit. See sections 00405 and 01100 for additional information.

105-3 Posted notices. Prior to commencement of construction activities, the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster "Equal Employment Opportunity is the Law" in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL "Notice to All Employees" Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

105-4 Engineer/RPR field office. An Engineer/RPR field office is not required.

METHOD OF MEASUREMENT

105-5 Basis of measurement and payment (Mobilization). Based upon the contract lump sum price for "Mobilization" partial payments will be allowed as follows:

a. With first pay request, 50%.

b. When 25% or more of the original contract is earned, an additional 25%.

c. When 50% or more of the original contract is earned, an additional 25%.

105-6 Basis of measurement and payment (Demobilization). Based upon the contract lump sum price for "Demobilization" payment will be allowed as follows:

a. The Fixed Lump Sum amount for "Demobilization" shall be payable to the Contractor when the items described and included generally in paragraph 3.01 of Section 01100 have been, in the sole opinion of the Program Manager, satisfactorily completed.

END OF ITEM C-105

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DIVISION 1 – SECTION 01100

SUMMARY OF THE WORK, SEQUENCE OF CONSTRUCTION & LIQUIDATED DAMAGES

PART 1 GENERAL

Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to Division 0 and Division 1 and other Sections of these Specifications.

1.01 SUMMARY

SUMMARY OF WORK

A. The "Project," of which the "Work" of this Contract is a part, is titled Glycol Management Program - Control Facility - Construction, MSCAA Project 08-1260-05.

B. The "Work" of this Contract is defined in the Contract Documents to include, but not be limited to, site preparation, site drainage, water main installation, sanitary sewer, concrete and asphalt paving driving services, and fencing. Building Work consists of concrete and steel structural members, masonry, glazing, drywall, acoustical tile ceilings, carpentry, painting, electrical, plumbing, HVAC, fire protection, data cabling, camera and door security, and specialty equipment as detailed in the construction documents.i

C. FAA Inspection and Review: 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.

D. Subcontracts: The Contractor shall insert in each of his subcontracts the provisions contained in paragraphs C of this section and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts which they may enter into, together with a clause requiring this insertion in any further subcontracts that may in turn be made.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 PROJECT PHASING AND COMPLETION

A. This is a fixed-duration Contract required to be substantially completed within one hundred and twenty (335) calendar days from the Notice to Proceed ("NTP") date. The project scope of work is as stated in Paragraphs 1.01 (A) and (B) above. Final Completion of the project shall be within forty-five (45) days of the Substantial Completion Date.

"Substantial Completion" of the project shall be defined as the stage of construction when work is substantially completed and excludes all minor punch list items, record drawings, O&M manuals, lien waivers, maintenance training, warranties, consent of surety to final payment, and all other required closeout documentation.

"Final Completion" of the project shall be defined as work that is 100% complete including all minor punch list items, record drawings, O&M manuals, lien waivers, maintenance training, warranties, consent of surety to final payment, and all other required closeout documentation. Final Completion shall include Demobilization.

"Demobilization" shall consist of all activities by the Contractor and subcontractors necessary for 100% completion of the work and final contract closeout as listed above and all cleanup work and operations, including but not limited to, removal of personnel, equipment, contractor-owned stockpiles, supplies, and incidentals from the project site; return of any and all airport-issued security identification badges; cleanup of all offices, buildings, batch plant, staging/lay-down areas, and other facilities; and restoration of all areas to preconstruction condition or better or to other condition as stipulated in the project plans and specifications; completion and delivery to the Owner of all contract closeout documentation and any other documentation request by Owner, including but not limited to, Operations and Maintenance Manuals, Warranties, Final Lien-waivers, Owner Controlled Insurance Program closeout paperwork, DBE paperwork, Final Project Record Documents and finalization of any and all punch list items. The Demobilization lump sum amount becomes fixed and will not change for the duration of contract.

B. The actual NTP date will be negotiated and mutually agreed by both parties (Owner and Contractor) prior to issuance of the NTP. If mutual agreement cannot be reached between the parties, the Owner reserves the right to establish the actual Notice to Proceed date. The NTP letter will state the date on which the Contractor will begin construction and from which date contract time will be charged. Contractor shall be able to start mobilization efforts on the date stated in the Notice to Proceed.

C. "Mobilization" shall consist of all preparatory work and operations needed to begin construction activities on the date mutually agreed including but not limited to, badging, submittals, material procurement, movement of personnel, equipment, stockpiles, supplies and incidentals to the project site; the establishment of all offices, buildings, batch plant, staging/lay-down areas and other facilities necessary for work on the project; all other work and operations which must be performed or costs incurred prior to beginning work on the various items on the project site, and utility services for all offices, buildings, batch plant, staging/ lay-down areas, and other facilities. The Mobilization lump sum amount becomes fixed and will not change for the duration of contract.

D. All days are calendar days.

E. The work site will be available as described on the plans and applicable sections of these specifications. Work is permitted 24 hours per day, 7 days per week except that only non-noise producing activities shall be permitted between 11:00 PM and 6:00 AM, except with prior written approval of the Owner.

F. The Contractor shall proceed with the work at such rate of progress to ensure full completion within the specified duration. It is expressly understood and agreed, by and between the Contractor and the Owner, that the contract time for the completion of the work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the work.

G. If the Contractor experiences weather related delays, he shall submit a report documenting the weather conditions and delays, if any, experienced during any calendar month.

H. If the Contractor is prevented from working due to any other legitimate reason he shall notify the Owner in writing as per the Lump Sum Construction Contract of the delay and request a corresponding increase in the number of contract days.

I. The Owner shall be the sole judge as to whether or not a request for a contract time extension is legitimate.

J. The Owner reserves the right to adjust limits of construction to accommodate the Owner's requirements for maintenance of Airport Operations and Public Traffic with minimum interruption during the construction of this project. Any required adjustment of limits of construction will be at

no additional cost to the Owner.

3.02 LIQUIDATED DAMAGES

A. The OWNER and the CONTRACTOR recognize that time is an essential element of this contract and that delay in completing this project will result in damages due to public inconvenience, obstruction to aviation and vehicular traffic, interference with businesses both on and off the airport, increased operational costs to airport users, and increased costs to the OWNER associated with engineering services, inspections, testing, and project administration. It is therefore agreed that in view of the difficulty of making a precise determination of such damages, the CONTRACTOR will pay the OWNER, sums of money in the amounts herein stipulated, not as a penalty, but as Liquidated Damages for not meeting the schedule for specific critical Project Milestones.

B. If the CONTRACTOR fails to deliver equipment or materials, or perform any services within the times and dates specified in this Contract to achieve the established Milestones, or any extensions granted in writing, the CONTRACTOR shall pay to the OWNER as Liquidated Damages, the sums specified in Table 1, below:

Table 1

Milestone	*Completion Date*	*Liquidated Damages*
Substantial Completion	335 days	$5,000 per Day or any portion thereof
Final Completion and Demobilization Phase	45 days	$1,000 per Day or any portion thereof

D. Application of Liquidated Damages is not a Change to the Contract. The application of any Liquidated Damages to one Milestone shall not effect a change in the subsequent Contract Milestone dates or relieve CONTRACTOR of his responsibility to meet all construction schedules. If multiple Milestone dates are missed, Liquidated Damages for more than one Milestone will be imposed concurrently.

E. If Liquidated Damages are imposed, the OWNER shall deduct the same from any amounts due the CONTRACTOR at the time Liquidated Damages are imposed. If sufficient amounts are not due to the CONTRACTOR to cover such Liquidated Damages, then the OWNER shall invoice the CONTRACTOR for the amounts due to the OWNER. Such invoices shall become due and payable immediately upon receipt by the CONTRACTOR.

F. Liquidated Damages are in addition to any other damages or penalties which may be assessed and withheld under other provisions of this contract.

3.03 COMPLETION BONUS

NO completion bonus has been budgeted for this project.

END OF SECTION 01100

DIVISION 1 – SECTION 01210

ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. To provide adequate budget and bonding to cover items not precisely determined by the Owner prior to bidding, allow within the proposed Contract Sum the amounts described in this Section.

B. Unless stated otherwise herein, all allowances are to be paid as Time and Materials Work per GP-150.

C. Related Work:

1. Documents affecting Work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.
2. Other provisions concerning Allowances may be stated in other Sections of these Specifications.

1.02 SPECIFIC ALLOWANCES – The following cash allowances are included within this Contract:

A. **Utility Allowance –** The Contractor shall pay all utility design and connection fees as required by the project. This fee shall be used at the sole discretion of the Program Manager.

B. **IT Allowance** – Types and locations shall be determined as required by the project. This allowance shall be used at the sole direction of the Program Manager.

C. **Interior Furnishings** – Types and locations shall be determined as required by the project. This allowance shall be used at the sole direction of the Program Manager.

END OF 01210

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DIVISION 1 – SECTION 01230

ALTERNATES

PART 1 GENERAL

1. 01 SUMMARY

A. This selection includes identification of each Alternate by number, and describes the basic changes to be incorporated into the Work if a particular Alternate is made a part of the Work by specific provisions in the Agreement between the Owner and the Contractor.

B. Related Work:

1. Documents affecting Work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2. Materials and methods to be used in the Base Bid and in the Alternates also may be described on the Drawings and/or in pertinent other Sections of these Specifications.

3. Method for stating the proposed Contract Sum is shown on the Bid Form.

1.02 SUBMITTALS

A. All Alternates described in this Section are required to be reflected on the Bid Form as submitted by the Bidder.

B. Do not submit Alternates other than as described in this Section.

1.03 SELECTION OF ALTERNATES

A. Immediately after award of the Contract, or as soon thereafter as the Owner has made a decision on which, if any, of the Alternates will be selected, thoroughly and clearly advise necessary personnel and suppliers as to the nature of Alternates selected by the Owner.

B. If the Owner elects to proceed on the basis of one or more of the described Alternates, make modifications to the Work required in providing the selected Alternate or Alternates to the approval of the Owner and at no additional cost to the Owner except as proposed in the Bid.

1.04 ADVANCE COORDINATION

A. Immediately after award of the Contract, or as soon thereafter as the Owner has made a decision on which, if any, of the Alternates will be selected, thoroughly and clearly advise necessary personnel and suppliers as to the nature of Alternates selected by the Owner.

PART 2 ALTERNATES – The following alternates are included within this Contract:

A. None.

END OF SECTION 01230

DIVISION 1 – SECTION 01250

AMENDMENT PROCEDURE

PART 1 GENERAL

1.01 SUMMARY

A. Make such changes in the Work, in the Contract Price, in the Contract Time, or any combination thereof, as are described in written Amendments signed by the Owner and the Contractor and issued after execution of the Construction Contract, in accordance with the provisions of this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1, and other Sections of these Specifications.

2. Any proposal for a change in the Work shall include DBE participation consistent with the required DBE percentage for this Contract. If the Contractor is unable to meet said DBE percentage, a written justification of the good faith efforts made shall be submitted along with the response to the Engineer's or Owner's proposal request.

3. Engineer or Owner supplemental instructions:

a. From time to time during progress of the Work the Engineer or Owner may issue supplemental instructions, which interpret the Contract Documents or order minor changes in the Work without change in Contract Sum or Contract Time.

b. Should the Contractor consider that a change in Contract Sum or Contract Time is required, he shall submit an itemized proposal to the Engineer or Owner immediately and before proceeding with the Work. If the proposal is found to be satisfactory and in proper order, the supplemental instructions in that event will be superseded by an Amendment.

4. Proposal requests:

a. From time to time during progress of the Work the Engineer or Owner may issue a Request for Proposal (RFP) proposal request for an itemized quotation for changes in the Contract Price and/or Contract Time incidental to proposed modifications to the Contract Documents.

b. This will not be an Amendment, and will not be a direction to proceed with the changes described therein.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such measures as are needed to assure familiarity of the Contractor's staff and employees with these procedures for processing Amendment data.

1.03 PROCESSING PROPOSAL REQUESTS

A. Make timely written reply to the Engineer or Owner in response to each proposal request. Proposal requests will be numbered in sequence and dated.

1. State proposed change in the Contract Sum, if any.

2. State proposed change in the Contract Time of Completion, if any.

3. Clearly describe other changes in the Work, if any, required by the proposed change or desirable therewith.

4. State amount of DBE participation applicable to the proposed changes.

5. Include full backup data such as subcontractor's letter of proposal or similar information.

6. Submit this response in single copy.

B. When cost or credit for the change has been agreed upon by the Owner and the Contractor, or the Owner has directed that cost or credit be determined in accordance with provisions of Division 0 and Division 1 Specifications, the Engineer or Owner will prepare an Amendment for execution by the Owner and Contractor.

1.04 PROCESSING AMENDMENTS

A. Amendments will be numbered in sequence, and dated.

1. The Amendment will describe the change or changes, will refer to the proposal requests or supplemental instructions involved, and will be signed by the Contractor and Owner, in sequence.

2. The Engineer or Owner will issue two copies of each Amendment to the Contractor.

   a. The Contractor shall promptly sign all copies and return all copies to the Engineer or Owner for further processing by the Owner.
   b. The Engineer or Owner will forward all copies to the Owner with a request for complete processing.
   c. The Owner will sign and return a copy to the Contractor for distribution.

END OF SECTION 01250

DIVISION 1 – SECTION 01310

PROJECT MANAGEMENT AND COORDINATION

PART 1 PROJECT MANAGEMENT

1.01 DESCRIPTION

A. The Contractor will be required to utilize an integrated construction project management software platform for coordination, meeting organization, submittals, payment applications, project records, drawings, specifications, reports, punch-lists, and schedules throughout the duration of the project.

1. Project Management software platform utilized for this project will be Procore.

B. The project management software will be provided by the Owner. The Contractor will be allowed seat licenses with access to the project management software as needed for the duration of the project.

C. Any training required in order for the Contractor to become proficient in the utilization of the construction project management software, shall be the responsibility of the Contractor at no additional cost to the Owner.

PART 2 PRECONSTRUCTION CONFERENCE

2.01 SUMMARY

A. To help clarify construction contract administration procedures, the Engineer or Owner will schedule a Preconstruction Conference prior to start of the Work, as described in this Section.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0 and Division 1 Specification Sections.

2.02 AGENDA AND MEETING SUMMARIES

A. To the maximum extent practicable, advise the Engineer or Owner at least 24 hours in advance of the Conference as to items to be added to the agenda.

B. The Engineer or Owner will compile summaries of the Conference, and will furnish copies of the summaries to the Contractor. The Contractor may make and distribute such other copies as he wishes.

2.03 QUALITY ASSURANCE

A. For those persons designated by the Contractor, his subcontractors, and suppliers to attend the Pre-Construction Conference, provide required authority to commit the entities they represent to schedules and solutions agreed upon in the Conference.

2.04 PRECONSTRUCTION CONFERENCE

A. The Conference will be held at a time and date established by the Engineer or Owner. If requested by the Engineer or Owner, additional conferences will be held.

B. Attendance:

1. Insure attendance by authorized representatives of the Contractor and major Subcontractors.

2. The Engineer or Owner will advise other interested parties, including the Owner, and request their attendance.

C. Minimum agenda:

1. Organizational arrangement of Contractor's forces and personnel and those of subcontractors, material suppliers, and the Engineer or Owner;

2. Channels and procedures for communications;

3. Construction schedule, including sequence of critical work;

4. Contract Documents, including distribution of required copies of Drawings and revisions;

5. Processing of Shop Drawings and other data submitted to the Engineer or Owner for review;

6. Processing of field decisions and Change Orders;

7. Rules and regulations governing performance of the Work;

8. Procedures for safety and first aid, security, quality control, housekeeping, and related matters; and

9. Reports required and schedule for submittal.

10. Items requiring long lead time and special requirements.

PART 3 PROGRESS MEETINGS

3.01 DESCRIPTION

A. Work included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Engineer or Owner will conduct project meetings throughout the construction period.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Provisions, and other Sections of these Specifications.

2. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content.

3.02 SUBMITTALS

A. Agenda items: To the maximum extent practicable, advise the Engineer or Owner at least 24 hours in advance of project meetings regarding items to be added to the agenda.

B. Summaries:

1. The Engineer or Owner will compile summaries of each project meeting, and will furnish copies to the Contractor and the Owner.

2. Recipients of copies may make and distribute such other copies as they wish.

3.03 QUALITY ASSURANCE

A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

PART 4 EXECUTION

4.01 MEETING SCHEDULE

A. Project meetings will be held at times as determined by the Engineer or Owner.

B. Coordinate as necessary to establish a mutually acceptable schedule for meetings.

4.02 MEETING LOCATION

A. The Engineer or Owner will establish the meeting location.

4.03 PROJECT MEETINGS

A. Attendance:

1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.

2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum agenda:

1. Review, revise as necessary, and approve summaries of previous meetings.

2. Review progress of the Work since last meeting, including status of outstanding submittals.

3. Identify problems which may impede planned progress.

4. Develop corrective measures and procedures to reestablish planned schedule.

5. Discuss other current business.

C. Revisions to summaries:

1. Unless published summaries are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.

2. Persons challenging published summaries shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of summaries.

3. Challenge to summaries shall be settled as priority portion of "old business" at the next

regularly scheduled meeting.

END OF SECTION 01310

DIVISION 1- SECTION 01320

SCHEDULES AND REPORTS

PART 1 GENERAL

1.01 SUMMARY

A. The work under this Contract shall be planned, scheduled and reported using computerized precedence diagram format of the Critical Path Method in calendar days, unless otherwise specifically provided in the Contract Documents. The Detailed Construction Schedule shall be developed by using the latest revision of Microsoft Project, or approved equal computer software.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, general Provisions, and other Sections of these Specifications.

2. Other provisions concerning Schedules and Reports are stated to Specification Sections:
   01100 - Sequence of Construction & Liquidated Damages
   GP-60 - Control of Materials
   GP-90 - Measurement and Payment

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Work under this Contract shall be planned, scheduled, executed, reported and accomplished using the computerized precedence diagram format (PDM) of the critical path method (CPM), in calendar days, unless otherwise specifically provided in the Contract. The Detailed Construction Schedule shall be developed by using the latest revision of Microsoft Project or approved equal computer software that is compatible with Owner's scheduling software.

B. The primary objectives of the requirements of this section are:

1. to insure adequate planning and execution of the Work by Contractor;
2. to assist Owner and Engineer in evaluating the progress of the Work;
3. to provide for optimum coordination by Contractor of his trades, Subcontractors and suppliers, and of his Work with the work or services provided by any separate contractors;
4. to permit the timely prediction or detection of events or occurrences, which may affect the timely prosecution of the Work;
5. to provide a mechanism or tool for use by the Owner, Engineer and Contractor in determining and monitoring any actions of the Contractor which may be required in order to comply with the requirements of the Contract relating to the completion of the various portions of the Work;

C. The Detailed Construction Schedule, defined in Paragraph 3.04, shall represent the Contractor's commitment and intended plan for completion of the Work in compliance with the Contract Times specified. The Detailed Construction Schedule shall take into account all foreseeable activities to be accomplished by any separate contractors, and interface dates with utility owners, the Owner's operations and others. The Detailed Construction Schedule shall anticipate all necessary

manpower and resources to accomplish the activities within the durations set forth therein. The Contractor will not:

1. Misrepresent to the Owner its planning, scheduling, and coordination of the work;

2. Utilize schedules different from those provided to the Owner and Engineer for the direction, execution and coordination of the work;

3. Utilize schedules which are not feasible or realistic; or

4. Prepare schedules, updates, revisions or reports which do not accurately reflect the Contractor's actual intent or the Contractor's reasonable and actual expectations as to: the sequences of activities, labor availability, productivity, or efficiency; expected or reasonably foreseeable inclement weather conditions; the percentage complete of any activity or path of activities; completion of any item of work or activity; projected dates of completion; delays, slippage, or problems encountered or expected; Subcontractor requests for time extensions.

D. Once reviewed by the Engineer, the Detailed Construction Schedule will become the Schedule of Record for coordinating the work, scheduling the work, monitoring the work, issuing progress payments, evaluating time extension requests, and all other objectives listed in Paragraph 3.01.B. The Contractor is required to employ whatever means he deems necessary to implement the Detailed Construction Schedule and to comply with the requirements of this Section. Updates shall be provided to the Engineer and Owner at each construction progress meeting or as requested by the Engineer or Owner. Updates shall be both electronic media and hard copy.

E. Contractor is responsible for determining the sequence of activities, the time estimates of the detailed construction activities and the means, methods, techniques and procedures to be employed. Each construction schedule shall represent the Contractor's best judgment of how he will prosecute the Work in compliance with the Contract.

F. Contractor shall consult with his Subcontractors and Suppliers (if any) relating to the preparation of each construction schedule. Subcontractors shall receive copies of each construction schedule and shall be continually advised of any updates or revisions to each construction schedule as the Work progresses. Contractor shall be solely responsible for ensuring that all Subcontractors and Suppliers comply with the requirements of each construction schedule for their portions of the Work.

G. When there are separate contractors working concurrently on the Program whose work must interface or be coordinated with the Work of Contractor, Contractor shall coordinate his activities with the activities of the separate contractors and shall, prior to the submission of any construction schedule to the Engineer or Owner, obtain written approval of his construction schedule by the separate contractors

H. To carry out the intent of this Section, the Contractor agrees that the reasonable exercise of any rights under this Section by the Engineer or Owner shall not be grounds for any claim by Contractor or any of his Suppliers, Subcontractors or Sub-subcontractors of alleged interference, lack of cooperation, delay, disruption, negligence or hindrance by Owner or Engineer, and Contractor covenants not to sue therefor.

I. It is understood and agreed that the Detailed Construction Schedule, defined in Paragraph 3.04, is to represent Contractor's best plan and commitment for the Work; however, Contractor acknowledges that the Detailed Construction Schedule may have to be revised from time-to-time as progress proceeds. Contractor further acknowledges and agrees that the Owner and Engineer do not guarantee that:

1. Contractor may start work activities on the "Early Start" or "Late Start" dates or complete work activities on the "Early Finish" or "Late Finish" dates shown in the Detailed Construction Schedule or as same may be updated or revised;

2. Contractor can proceed at all times in the sequence established by the Detailed Construction Schedule, or that Contractor can rely upon the utilization of only the resources and manpower he initially plans for the performance of the Work;

3. Contractor's Detailed Construction Schedule will not have to be modified in order to obtain the agreement of any separate contractors to the schedule; or

4. Any changes, modifications or adjustments to any schedule by Contractor can only be made by the written approval of the Engineer and Owner.

J. The Contractor acknowledges and agrees that each Construction Schedule must be flexible in order to accommodate and allow for his coordination with the operations of the Owner and the work of separate contractors relating to the Program. The Engineer or Owner will review each construction schedule for compatibility with Owner operations and the work of separate contractors. Contractor agrees to hold meetings with the Owner and separate contractors to resolve any conflicts between any Contractor's construction schedule and the operations of the Owner or work of separate contractors. Contractor agrees to fully cooperate with Owner and separate contractors to resolve such conflicts and to revise any construction schedule as reasonably required with no additional costs, including Impact Expenses, to the Owner.

K. The Contract Times allowed for each phase or sub-phase as set forth in the Contract and in Section 01100 represent only the major items of Work and may include interface times with the operations of the Owner, the work of separate contractors or others. Contract Times are Contract requirements and are of the essence to this Contract and to the coordination of the Work by Contractor. Contract Times represent the allowable start or completion time for those portions of the Work to which each specific time relates. The Contract Times are not intended to be a complete listing of all Work under this Contract or of all interfaces with work performed by other separate contractors, the Owner or others. Contractor shall determine the time requirements for all such interfaces and shall be responsible for planning, scheduling and coordinating the Work in order to complete in accordance with those requirements.

M. It is understood and agreed that should the Engineer or Owner provide the Contractor, with any advice or counsel relating to the scheduling or coordination of the Work or any other matter that:

1. Owner and Engineer shall not be liable to Contractor for any errors, omissions, negligence or deficiencies which may in any way occur because of same;

2. Such advice or counsel are provided solely as aids in the development by Contractor of a representation of Contractor's actual construction plan and schedule in accordance with the requirements of the Contract Documents, and Owner and Engineer shall not be liable to Contractor should Contractor rely on such advice or counsel to his detriment;

3. Such advice or counsel shall not relieve Contractor of any responsibility under Paragraph 3.01.E hereof for all construction means, methods techniques, sequences and procedures and for planning, scheduling and coordinating all portions of the Work; and

4. Any advice or counsel provided by the Engineer or the lack or alleged untimeliness thereof will not in any way take the place of or relieve the Contractor of full responsibility for compliance with all requirements of the Contract, including, but not limited to the obligations to complete the Work within the Contract Times stated elsewhere in the Contract.

N. Approval or acceptance by the Owner or Engineer of any Contractor's construction schedule, or any revisions or updates thereto, shall not relieve the Contractor of the responsibility for accomplishing each portion of the Work by the Project Substantial Completion Date.

O. If any Contractor's construction schedule indicates that Owner or a separate contractor is to complete any activity or perform certain preceding work by a particular date, or within a certain duration, Owner and Engineer, or any separate contractor shall not be bound to said date or duration unless Owner expressly and specifically agrees in writing to same. Contractor is further on notice that no representative, agent or employee of the Engineer has any right or authority to agree to any schedule commitment or obligation on the part of Owner, and all such agreements or commitments in writing must be executed by the Owner's authorized representative as provided elsewhere in the Contract.

P. Contractor shall be solely responsible for expediting the delivery of all materials and equipment to be furnished by him so that the progress of construction shall be maintained according to the currently approved construction schedule for the Work. Contractor shall notify the Owner or Engineer in writing, and in a timely and reasonable manner, whenever Contractor determines or anticipates that the delivery date of any material or equipment to be furnished by Contractor will be later than the delivery date indicated by the currently approved construction schedule, or the current update thereof as herein provided.

3.02 ORIENTATION SESSION

A. Contractor shall, upon notification from the Owner or Engineer, attend an orientation session relating to the Schedules and Reports requirements for this project. This orientation meeting is designed to assist the Contractor in planning his Work and in developing his Detailed Construction Schedule. This session will normally be held within three (3) days after the date of the determination of lowest responsive responsible bidder by Owner and will be conducted by the Engineer. Contractor shall arrange for his project manager and superintendent(s), major Subcontractors and Suppliers, and any scheduling consultants that he may employ, to attend the orientation session.

B. At the Orientation Session the Engineer and Owner will, among other things, review:

1. the objectives of the Schedules and Reports requirements;
2. the procedures and requirements for the preparation of the Detailed Construction Schedule Draft, the Detailed Construction Schedule and cost loading of the schedule;
3. how the requirements of the Contract Documents will be monitored and enforced by the Engineer; and
4. long-lead items and time requirements for Work by Subcontractors.

C. It is understood and agreed that the Engineer has no authority to waive any requirements of the Contract at this orientation meeting, and all requirements of the Contract remain applicable to Contractor’s Work whether or not discussed at this session.

3.03 DETAILED CONSTRUCTION SCHEDULE DRAFT

A. No later than two (2) weeks prior to estimated Notice to Proceed, the Contractor shall complete a draft of the Detailed Construction Schedule in accordance with the requirements of this Paragraph 3.03.

B. Except for procurement activities, Contractor shall differentiate activities of the Detailed Construction Schedule Draft so that no single activity shown has a duration longer than twenty-eight (28) calendar days, unless the Engineer, in its sole discretion, shall approve a longer duration for certain specific activities.

C. The Detailed Construction Schedule Draft shall represent the Contractor's commitment and intended plan for completion of the Work in compliance with Contract Times listed elsewhere in the Contract. The Detailed Construction Schedule Draft shall take into account all foreseeable activities to be accomplished by any separate contractors, and interface dates with utility owners, the Owner's operations and others. The Detailed Construction Schedule Draft shall anticipate all necessary manpower and resources to accomplish the activities within the durations set forth therein.

D. The Detailed Construction Schedule Draft shall consist of a time-scaled, detailed network graphic representation of all activities, which are part of the Contractor's construction plan. The Detailed Construction Schedule Draft submission shall include, but not be limited to, the following information:

1. Project name;
2. Activities of completed Work ready for use by next trade, Owner, etc.;
3. Activities relating to different areas of responsibility, such as subcontracted Work, which is distinctly separate from that being done by the Contractor directly;
4. Activities relating to different categories of Work as distinguished by craft or crew requirements;
5. Activities relating to different categories of Work as distinguished by equipment requirements;
6. Activities relating to different categories of Work as distinguished by materials;
7. activities relating to distinct and identifiable subdivisions of Work;
8. Activities relating to locations of Work within the Project that necessitates different times or crews to perform;
9. Activities relating to outage schedules for existing utility services that will be interrupted during the performance of the Work;
10. Activities relating to acquisition and installation of equipment, materials and supplies installed by the Owner and/or separate contractors;
11. Activities relating to material to be stored on site;
12. Contract Times consistent with those required in the contract;
13. A legible time scaled network diagram;
14. Activity durations not exceeding twenty-eight (28) calendar days for all activities for which the Contractor will perform actual field work. Material procurement, submittals, concrete curing and other similar activities may exceed twenty-eight (28) calendar days for this draft submission only.

3.04 DETAILED CONSTRUCTION SCHEDULE

A. Prior to any monthly Application for Payment, the Contractor shall complete the Detailed Construction Schedule to the satisfaction of the Owner or Engineer.

B. The Detailed Construction Schedule shall represent the Contractor's commitment and intended plan for completion of the Work in compliance with Contract. The Detailed Construction Schedule shall take into account all foreseeable activities to be accomplished by any separate contractors, and interface dates with utility owners, the Owner's operations and others. The Detailed Construction Schedule shall anticipate all necessary manpower and resources to accomplish the activities within the durations set forth therein.

C. Contractor shall submit, as a part of the data submitted to the Engineer, a narrative report indicating anticipated allocation by Contractor of the following resources and work shifts for each activity which he proposes to be utilized on the Project:

1. Labor resources;
2. Equipment resources; and

3. Whether the proposed work will be performed on single, double or triple shifts, and whether the work performance will be done on a 5-, 6- or 7-day workweek basis.
4. Production rates.

This narrative report is for the use of the Engineer in determining the reasonableness of the Detailed Construction Schedule. The actual Detailed Construction Schedule is not required to be loaded with labor and equipment resources.

D. Engineer shall have the right to require the Contractor to modify any portion of the Contractor's Detailed Construction Schedule, or Recovery Schedule, as herein required, with Contractor bearing the costs and Impact Expense thereof, which the Engineer reasonably determines to be:

1. Impracticable;
2. Based upon erroneous calculations or estimates;
3. Unreasonable;
4. Not in compliance with other provisions of the Contract;
5. Required in order to ensure proper coordination by Contractor of the Work of his Subcontractors and with the work or services being provided by any separate contractors;
6. Necessary to avoid undue interference with the Owner's operations or those of any utility owners or adjoining property owners;
7. Necessary to ensure completion of the Work by the Contract Times set forth in the Contract;
8. Required in order for Contractor to comply with the requirements of Paragraph 3.05 or any other requirements of the Contract;
9. Not in accordance with the Contractor's actual operations.

Modifications as given above must be completed, accurate and returned to the Engineer within 14 days of notification. If the Contractor does not make the required changes within the allotted time, the Engineer may elect to hold and not process the Contractors monthly pay application.

E. The Owner/Engineer reserves the right to require the Contractor to furnish such manpower, materials facilities and equipment and shall work such hours, including additional shifts and overtime operations as may be necessary, to insure completion of the Work or specified portions thereof within the specific dates as set forth in the Contract Documents. If it becomes apparent to the Owner or Engineer that the work, or any required portion thereof, will not be completed by any such dates, the Contractor shall undertake the following actions, at no additional cost to the Owner, and comply with the requirements as set forth in Section 01320, 3.07 and 3.08, in order to ensure that it complies with all completion requirements:

1. Increase the quantity of manpower, materials, trades, crafts, and equipment and facilities on the site;
2. Increase the number of working hours per shift, shifts per working day, or any combination of the foregoing; and
3. Reschedule activities to achieve maximum activity accomplishment.

3.05 DETAILED CONSTRUCTION SCHEDULE CONTENT

A. The Detailed Construction Schedule shall consist of a time-scaled, detailed network graphic representation of all activities, which are part of the Contractor's construction plan and an accompanying listing of each activity's dependencies and interrelationships. The Detailed Construction Schedule submission shall include, but not be limited to, the following information:

1. Project name;
2. Activities of completed Work ready for use by next trade, Owner, etc.;
3. Activities relating to different areas of responsibility, such as subcontracted Work, which is distinctly separate from that being done by the Contractor directly;

4. Activities relating to different categories of Work as distinguished by craft or crew requirements;
5. Activities relating to different categories of Work as distinguished by equipment requirements;
6. Activities relating to different categories of Work as distinguished by materials;
7. Activities relating to distinct and identifiable subdivisions of Work;
8. Activities relating to locations of Work within the Project that necessitates different times or crews to perform;
9. Activities relating to outage schedules for existing utility services that will be interrupted during the performance of the Work;
10. Activities relating to acquisition and installation of equipment, materials and supplies installed by the Owner and/or separate contractors;
11. Activities relating to material to be stored on site;
12. Contract Times consistent with the requirements of the Contract;
13. A tabular report listing all predecessor and successor activities for each activity;
11. A legible time scaled network diagram;
15. Activity durations not exceeding fourteen (14) calendar days for all activities for which the Contractor will perform actual fieldwork. Material procurement, submittals, concrete curing and other similar activities may exceed fourteen (14) calendar days if approved by the Engineer;
16. An accounting of the number of work days anticipated to be lost due to weather. This accounting shall be in accordance with Paragraph 3.05.E.

B. The Detailed Construction Schedule submission will contain the following minimum information for each activity:

1. Activity number, description and estimated duration in calendar days;
2. Anticipated start and finish dates; and
3. Responsibility for activity.

C. For all major equipment and materials to be fabricated or supplied for the Project, the Detailed Construction Schedule shall show a sequence of activities including:

1. Preparation of shop drawings and sample submissions;
2. A reasonable time for review of shop drawings and samples or such time as specified in the Contract;
3. Shop fabrication, delivery, and storage;
4. Erection or installation; and
5. Testing of equipment and materials.

Additionally, the schedule shall reflect the following information for each submittal item: (1) description; and (2) a reference to the applicable paragraph(s) in the technical specifications or the contract drawing(s) number that requires the submittal.

D. The Detailed Construction Schedule shall include late completion dates for the Work that are no later than the required Contract Times. The time-scaled graphic network shall be submitted based upon the early start dates of activities shown on the graphic.

E. The Contractor shall anticipate and account for, as a minimum, the potential loss of the number of **calendar** days listed below for each calendar month due to weather and shall schedule the work accordingly.

January	12	July	6
February	10	August	6
March	9	September	4
April	6	October	5
May	8	November	6
June	5	December	10

The preceding days were derived from historical data provided by the National Climatic Data Center regarding rainfall at Memphis International Airport. They represent a number less than the actual number of days of measurable rainfall that can be expected to occur during a twenty-four (24) hour period for the months indicated. **The Contractor shall make his own determination as to the likely impact of weather on his operation and shall include as part of the Detailed Construction Schedule submission an accounting of how the impact of anticipated weather was determined and accounted for in the schedule.** These values listed above are the minimum number of weather related days the Contractor shall consider in developing his Detailed Construction Schedule. It is further understood that said calendar day period shall be derived through assuming that work will take place on a calendar day basis.

The Owner or Engineer will continually monitor the effects of weather and when found justified, grant time extensions, if required, at the end of the Contract. In the event fewer weather days are actually encountered than provided for in this section, those days will accrue to subsequent months of the phase or contract and be balanced against actual weather. In accordance with the Contract Documents, weather days occurring during the extension beyond the original completion date will be compensated day for day, if justified. No weather days will be granted beyond the final Contract completion date as computed herein.

F. All activity durations shall be given in calendar days.

G. Contractor shall plan his operations and schedule the work to ensure that the critical path runs through on-site construction activities and that off-site procurement activities do not control the critical path of the Detailed Construction Schedule, unless approved in writing by the Owner or Engineer.

H. Once reviewed by the Owner and Engineer, the Detailed Construction Schedule will become the Schedule of Record for coordinating the work, scheduling the work, monitoring the work, evaluating time extension requests, and all other objectives listed in Paragraph 3.01.B.

3.06 UPDATING OF CONSTRUCTION SCHEDULE/PROGRESS REPORTS

A. Contractor shall arrange for his Project Manager and Superintendent and necessary Subcontractors and Suppliers to attend monthly schedule meetings with the Engineer to review Contractor's report of actual progress. Prepared by Contractor, said report shall set forth up-to-date and accurate progress data and shall be based upon Contractor's best judgment. Said report shall be prepared by Contractor in consultation with all principal Subcontractors and Suppliers.

B. The progress report of Contractor shall show the activities, or portions of activities, completed during the reporting period, the actual start and finish dates for these activities, remaining durations and/or estimated completion dates for activities currently in progress, and quantities of material installed during the reporting period.

C. Contractor shall submit a narrative with the progress report which shall include, but not be limited to; a description of problem areas; current and anticipated delaying factors and their impact to

critical activities; explanations of corrective actions taken or planned, any proposed newly planned activities or changes in sequence; and proposed logic for a Recovery Schedule, if required, as further described herein.

The report shall also include:

1. A narrative describing actual Work accomplished during the reporting period;
2. A list of major construction equipment used on the Project during the reporting period;
3. The total number of men by craft actually engaged in the Work during the reporting period, with such total stated separately as to office, supervisory, and field personnel;
4. A manpower and equipment forecast for the succeeding thirty (30) days, stating the total number of men by craft, and separately stating such total as to office, supervisory and field personnel;
5. A list of Contractor-supplied materials and equipment, indicating current availability and anticipated job site delivery dates; and
6. Changes or additions to Contractor's supervisory personnel since the preceding progress report.

D. At the monthly schedule meeting a total review of the Project will take place including but not limited to, the following:

1. Schedule
2. Critical items pending
3. Change orders
4. Coordination with other separate contractors and the Owner
5. Excessive weather delay report (If the Contractor fails to provide said report by this date, it is understood that the Contractor accepts the Engineer’s accounting of weather days for the month and waives their right to appeal the Engineer’s decision.)

E. Application for Payment: Contractor understands and agrees that the submission and approval of progress update information and the receipt of progress reports are an integral part and basic element of the Applications for Payment; and that Contractor will not be entitled to any progress payment under this Contract unless Contractor has fully complied with the requirements of this Section.

G. If the actions taken by the Contractor in accordance with 3.04, paragraph D, are not satisfactory to the Engineer for the timely completion of the project, the Owner may direct the Contractor to take any and all other actions necessary to ensure completion of the work or designated portions thereof within the specific dates and contract time, without additional cost to the Owner, including the requirement for additional equipment and/or overtime work by the Contractor or his Subcontractor. Notwithstanding such direction from the Owner, the Contractor shall have full responsibility for its performance and for completion of the work within the specific dates or contract time.

3.07 RECOVERY SCHEDULE

A. Should the updated Detailed Construction Schedule, at any time during Contractor's performance, show, in the sole opinion of the Owner or Engineer, that the Contractor is seven (7) or more days behind schedule for any location or category of work, or should Contractor be required to undertake actions under Paragraph 3.04.D hereof, the Contractor shall prepare a Recovery Schedule explaining and displaying how Contractor intends to reschedule his Work in order to regain compliance with the Approved Detailed Construction Schedule during the immediate subsequent pay period.

3.08 SCHEDULE REVISIONS

A. Should Contractor desire to or be otherwise required under the Contract to make modifications or changes in his method of operation, his sequence of Work or the durations of the activities in his Construction Schedule, he shall do so in accordance with Paragraph 3.04 of this specification. The approved Detailed Construction Schedule may only be revised by the written approval of the Owner or Engineer as provided herein.

B. Contractor shall submit requests for revisions to the Detailed Construction Schedule to the Engineer, together with written rationale for revisions and description of logic for rescheduling work and substantiate that the Contract Times will be met as listed in the Contract. Proposed revisions acceptable to the Engineer and Owner will be approved in writing and incorporated by the Contractor into the Detailed Construction Schedule or Recovery Schedule as the case may be.

C. Requests for revision will be accompanied by evidence (such as written rationale for the revisions and descriptions of logic for rescheduling the work) acceptable to the Owner or Engineer that the Contractor's Suppliers, Subcontractors and Sub-Subcontractors are in agreement with the proposed revisions.

D. If there are separate contractors on the Project, prior to the submission by the Contractor of his proposed schedule revisions, he shall meet with and gain written approval of the separate contractors to make the revisions which shall be evidenced by the signatures of said separate contractors on the proposed schedule revisions. If accepted by the Engineer and Owner, the revisions shall be binding upon Contractor and all separate contractors on the Project.

3.09 FLOAT TIME

A. Float or slack time associated with one chain of activities is defined as the amount of time between earliest start date and latest start date or between earliest finish date and latest finish date for such activities, as calculated as part of the currently approved construction schedule. Float or slack time shown on the currently approved construction schedule is not for exclusive use or benefit of either the Owner or the Contractor and is available for use by either of them according to whichever first needs the benefit of the float to facilitate the effective use of available resources and to minimize the impact of Project problems, delays or Changes in the Work which may arise during performance. Contractor specifically agrees that float time may be used by the Owner or Engineer in conjunction with their review activities or to resolve Project problems. Contractor agrees that there will be no basis for any modification of the Contract Times or an extension of the Contract Time, or a claim for additional compensation as a result of any Project problem, Change Order or delay which only results in the loss of available float on the currently approved construction schedule.

B. Float time shown on any construction schedule shall not be used arbitrarily by Contractor in a manner which, in the opinion of the Engineer, unnecessarily delays separate contractors from proceeding with their work, or in a way which is detrimental to the interests of the Owner.

3.10 CONTRACTOR'S ORGANIZATION

A. Contractor shall maintain as part of his organization or hire a Subcontractor with: (1) a competent staff of sufficient size who are knowledgeable in the use, application and implementation of the precedence diagram format of the critical path method as required by the Contract; and (2) who is acceptable to Owner or Engineer. It shall be the responsibility of this staff to prepare input information for the construction schedules, monitor progress, provide input for updating and revising logic diagrams when necessary and otherwise assist the Contractor in fulfilling his obligations hereunder.

END OF SECTION 01320

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DIVISION 1 – SECTION 01321

CONSTRUCTION SURVEYING

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the Owner's airport survey grid and surveying requirements.

B. Related Work:
   1. Documents affecting work of this Section include, but are not necessarily limited to the General Provisions and other Sections of these Specifications.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTIONS

3.01 EXISTING SURVEY CONTROL MONUMENTS

A. The Owner has established an airport-wide survey grid consisting of both first order and second order survey monuments. The monuments are distributed both inside and outside the Air Operations Area fence.

B. The monuments are tied to the Tennessee State Plane Coordinate System in U.S. Survey feet with the North American Datum, 1983.

C. Survey control monuments typically, but not always, consist of aluminum disks stamped with identifying codes, set in concrete, and marked by orange witness posts.

D. The Contractor may obtain the current Survey Control Monument Manual from the Program Manager.

3.02 REQUIREMENTS

A. Contractor is responsible for all construction surveying.

B. Any deviations from the existing grades shall be immediately reported to the Program Manager.

C. Contractor shall tie the project to the survey grid as established by the monuments described in section 3.01.

D. Contractor shall protect all survey monuments within the vicinity of the project and all survey monuments used for survey while they are occupied.

E. The Contractor shall, at his expense, have a Tennessee Professional Land Surveyor replace any monument disturbed or destroyed by Contractor's construction activities (using first order techniques); replaced monuments shall be located at least ten feet, but not more than fifty feet, from the location of the disturbed monument. New monuments shall consist of aluminum disks stamped with an identifying code, set in concrete using a procedure approved by Program Manager, and marked by an orange witness post. Replaced-monument survey information shall be provided to Owner in exact format as contained within Owner's Survey Control Monument Manual.

END OF SECTION 01321

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DIVISION 1- SECTION 01322

AERIAL PHOTOGRAPHS

PART 1 GENERAL

1.01 SUMMARY

A. Provide photographs taken at specified stages during construction, and in accordance with provisions of this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Provisions and other Sections of these Specifications.

1.02 SUBMITTALS

A. Except as otherwise directed and paid for, submit one electronic file of each photograph.

1.03 QUALITY ASSURANCE

A. Secure the services of a professional photographer who is skilled and experienced in construction photography and whose work samples are acceptable to the Engineer.

B. Do not replace the photographer without the Engineer's written approval.

PART 2 PRODUCTS

2.01 AERIAL PHOTOGRAPHS

A. Provide electronic files, at a quality and resolution capable of printing the photographs at a size up to 36” x 24”.

B. Record each electronic file’s filename in a manner to show:

1. Job number;

2. Location from which photographed;

3. Date of photograph;

C. Do not permit photographs to be issued for any other purpose without specific written approval from the Engineer.

PART 3 EXECUTION

3.01 AERIAL PHOTOGRAPHY

A. Except as otherwise specifically approved by the Engineer, make the photographs within three calendar days of the date of each Application for Payment.

1. To the maximum extent practicable, make photographs at approximately the same time of day throughout progress of the Work.

2. When inclement weather is anticipated, consult with the Engineer and determine acceptable alternative arrangements.

B. Except as otherwise specifically approved by the Engineer, take the photographs from four (4) directions. The photographs required shall be oblique aerial photographs. One shall be taken from the north, one from the south, one from the east and one from the west looking at the entire project, or as directed by the Engineer.

1. Select the locations to provide diversified overall views of the Work, from positions, which are expected to remain accessible throughout progress of the Work.

2. Identify each location by word description, by marked drawing, or by such other means as acceptable to the Engineer, to enable future photographs to be taken from the same position.

3. When so directed by the Engineer because of the stage of construction, change one or more of the locations as the Engineer directs.

C. Make each photograph clear, in focus, with high resolution and sharpness, and with minimum distortion.

END OF SECTION 01322

DIVISION 1 – SECTION 01325

DELAYS AND EXTENSIONS OF TIME

1.01 DESCRIPTION

A. Work included:

1. Delays and extensions of time.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to the General Provisions, and other Sections of these Specifications.

1.02 OBLIGATION OF OWNER AND PROGRAM MANAGER

A. Neither the Owner nor the Program Manager shall be obligated or liable to the Contractor for any damages, cost or expenses of any type which the Contractor, its subcontractors, sub-subcontractors, or any other person may incur as a result of any disruption or delay from any cause, regardless of the actual source of delay, whether avoidable or unavoidable, it being understood and agreed that the Contractor's sole and exclusive remedy in such event shall be an extension of the Contract Time, but in accordance with provisions of the Contract Documents.

B. Except for weather delays, any claim for extension of time shall be made in writing to the Program Manager not more than ten (10) days after commencement of such delay, otherwise, such claim will be waived. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the Work.

C. The time during which the Contractor is delayed in performance of the work caused by the acts or omissions of the Owner, Program Manager or their employees or agents, or by acts of God, fires, floods, epidemics, quarantine restrictions, riots, civil commotions or freight embargoes, or other conditions beyond the Contractor’s control which the Contractor could not have reasonably foreseen and provided against shall be added to the Contract Time; however, the Contractor must submit his claim for such delays in accordance with the requirements of this Section and any other applicable provisions of these Contract Documents in order to be considered for an extension of time.

D. The Contract Time shall be adjusted only for changes in the work pursuant to GP-40, suspensions of the work, excusable delays or emergencies. Whenever the Contractor requests an extension of the Contract Time, the Contractor shall furnish such justification and supporting evidence as required by this section and such other and additional information as the Owner may deem necessary to determine whether the Contractor is entitled to an extension of the Contract Time. All such requests shall conform to all of the requirements of the Contract Documents, shall include evidence that the reasons for the requested Contract Time extension were beyond the control of the Contractor, and the Contractor shall bear the burden of substantiating and proving the necessity of an extension to the Contract Time. The Owner, with the assistance of the Program Manager, shall review all requests for Contract Time extensions and shall advise the Contractor of its decision and finding of fact in writing. If the Owner determines that the Contractor is entitled to an extension of the Contract Time, the length of the extension shall be based upon the currently approved detailed construction schedule and on all other relevant data, which data shall be incorporated into and from the basis for revision to the construction schedule.

The Contractor acknowledges and agrees that the actual delays due to said changes, suspension of the work, or excusable delays in activities which, according to the detailed construction schedule, do not affect the Contract Time, shall not affect the Contract Time, and therefore, cannot form the basis for an extension in the Contract Time or a change in the construction schedule.

E. The Contractor shall be entitled to an extension of the Contract Time but no increase in the Contract sum, for delays arising from unforeseeable causes beyond the control and without the fault of negligence of the Contractor or its Subcontractors as follows:

1. Acts of God, tornadoes, fires, blizzards, earthquakes, or floods that severely damages completed work or stored materials.

2. Acts of the public enemy; acts of the state, federal or local governments in their sovereign capacities; and acts of a separate contractor in the performance of a separate contract with the Owner relating to this or another project.

F. The Contractor shall not be entitled to any extension of Contract Time resulting from any condition or cause unless the Contractor strictly complies with the requirements of this Section and the Contractor must submit to the Program Manager within ten (10) days of the first instance of the delay a written request for an extension in the Contract Time which shall include the following information: (a) the nature of the delay; (b) the date of anticipated date of commencement of the delay; (c) activities on the schedule affected by the delay, and/or new activities created by the delay and their relationship with existing activities; (d) identification of persons or organizations or events responsible for the delay; and (e) recommended action to avoid or minimize the delay.

G. No claim for delay shall be allowed and the Contractor waives any such claim if the Contractor fails to furnish the written request, required by this or other sections, within the period of time specified therein.

END OF SECTION 01325

DIVISION 1 – SECTION 01330

SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the process for handling Contractor submittals.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1, and other Sections of these Specifications

1.02 SUBMITTALS

A. Except as otherwise specified below, as soon as practicable after contract award and without causing delay in the work, submit at least 7 bound copies of submittals of all items for which submittals are specified in other sections, and for all major submittal equipment whether specified in other sections or not. Alternatively, all Submittals may be submitted electronically in lieu of hard copies, if possible. Each submittal shall be clearly marked with the project name, dated, and accompanied by a letter of transmittal listing all items included in the submittal and referencing the project specification page and article numbers applicable to each item.

1. Submittals shall include all test results and/or certificate necessary to show that the item conforms to the standards specified. Such standards shall include ASTM, AASHTO, FAA, PCA, Federal Specifications or any other standard listed in these specifications.

1.03 QUALITY ASSURANCE

A. Before submission to the Engineer or Owner, the Contractor shall check the submittals of all items furnished directly by him, and the applicable Subcontractor shall check the submittals of all items furnished by the Subcontractor involved, as follows: check the submittal drawings for completeness and compliance with the contract documents; check and verify all dimensions, field conditions certifications relating to the submittals and certify in writing that these checks have been made.

1. The Engineer or Owner will return for resubmission, all submittals without the above specified approval and certification, and all submittals which in the Engineer's or Owner's opinion contain numerous discrepancies and/or have not been checked by the Contractor or Subcontractor.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.01 SUBMITTAL REVIEW

A. After the Owner or Engineer has reviewed the submittals, except as otherwise specified below, submittals will be dated, and three sets will be returned to the Contractor. If submittals are rejected, four sets will be returned to the Contractor, with indications of the required corrections and changes made on one of the sets. Make such corrections and changes as indicated. Resubmit

submittals as specified above, as often as required by the Engineer or Owner to complete the review. No correction or change indicated on submittals shall be considered as an order for extra work.

B. Submittals reviewed by the Owner or Engineer will be a general review only, and acceptance will not relieve Contractor or Subcontractor of responsibility for accuracy of submittals, proper fitting, coordination, construction or work, and furnishing materials and work required by Contract but not indicated on submittals. Review of submittals shall not be construed as accepting departures from Contract requirements.

C. Any material ordered, or work performed prior to obtaining an approved submittal shall be at the Contractor's risk and subject to rejection.

END OF SECTION 01330

DIVISION 1 – SECTION 01351

STORAGE AND PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Protect products scheduled for use in the Work by all means including, but not necessarily limited to, those described in this Section.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, and Division 1 of these Specifications.

2. Additional procedures may also be prescribed in other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.03 MANUFACTURERS' RECOMMENDATIONS

A. Except as otherwise approved by the Owner or Engineer, determine and comply with manufacturers' recommendations on product handling, storage, and protection.

1.04 PACKAGING

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time of use.

2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace same with material meeting the specified requirements, at no additional cost to the Owner.

B. The Owner or Engineer may reject as non-complying such material and products as do not bear identification satisfactory to the Owner or Engineer such as manufacturer, grade, quality, and other pertinent information.

1.05 PROTECTION

A. Protect finished surfaces, materials, trenches, earthwork, etc. from weather, construction operations, etc.

B. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.06 REPAIRS AND REPLACEMENTS

A. In event of damage, promptly make replacements and repairs to the approval of the Owner or Engineer and at no additional cost to the Owner.

B. Additional time required to secure replacements and to make repairs will not be considered by the Owner or Engineer to justify an extension in the Substantial Completion Date.

END OF SECTION 01351

DIVISION 1 – SECTION 01353

RADIO COMMUNICATIONS

1.01 DESCRIPTION

A. Work Included

1. Provide radio communication with Airport Control Tower.

B. Documents affecting work of this Section include, but are not necessarily limited to General Provisions, and other Sections of these Specifications.

1.02 RADIO COMMUNICATIONS

A. When required by the Contract Documents, and when work under this Contract is in progress within the Air Operations Area (AOA), the Contractor's job superintendent or other authorized representative of the Contractor on the job site shall coordinate such work with the Program Manager and the Program Manager shall maintain approved 2-way radio communication with the Airport Control Tower, for coordination of work with airport operations in progress.

END OF SECTION 01353

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DIVISION 1 – SECTION 01455

QUALITY CONTROL AND QUALITY ASSURANCE TESTING PROGRAMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes quality control and quality assurance testing and inspections required to be provided by the Contractor and the Owner.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2. Requirements for testing are described in various Sections of these Specifications.

1.02 QUALITY CONTROL and QUALITY ASSURANCE TESTING PROGRAMS

A. Contractor Quality Control Testing: At his own expense, the Contractor shall make separate arrangements for and be fully responsible for all quality control testing as required by the technical specifications and General Construction Items C-100.

B. Owner Quality Assurance Testing: At no cost to the Contractor, the Owner will make arrangements for the services of an independent testing laboratory for quality assurance testing of work and materials. This testing is for the Owner's use only and will only be performed after the Contractor’s quality control testing program has tested and approved materials and workmanship to be in full compliance with the quality standards of the Specifications. The Owner Quality Assurance testing services shall in no way relieve the Contractor of the responsibility for providing the quality materials, workmanship and testing required for compliance with these specifications.

C. Determination of Specification Compliance: In all cases of conflicting test results, the Owner's quality assurance test results shall govern. All retesting shall be conducted by Owner's testing laboratory at the Contractor's expense. The amount and location of any retesting shall be as directed by the Owner or Engineer. Unsatisfactory work or materials shall be retested as often as necessary until retests indicate that the failed work or materials have achieved conformity with the Plans and Specifications. The Owner or Engineer shall make the final determination as to whether any work or materials, which do not conform to the Plans and Specifications upon initial testing, are to be removed from the site or reworked. The Owner or Engineer shall also make the final determination as to whether the retesting indicates that work or materials initially rejected have been corrected to meet the requirements of the Plans and Specifications. All removal, replacement, rolling, watering, aeration, reworking, etc. required to bring rejected work or materials into conformance with the Plans and Specifications shall be at the Contractor's expense.

D. Retesting Expense: The Owner will bear the expense of the initial quality assurance testing of certain items of work or materials as required by the technical specifications. Any retesting of these items of work or materials which upon initial testing fail to meet the standards specified or indicated on the plans shall be at the Contractor's expense.

E. Laboratory Inspection and Testing: If this contract requires laboratory inspection, testing, and stamping of concrete pipe, concrete fittings, or any other material, the cost of that laboratory inspection, testing, and stamping shall be borne by the Contractor and included in the cost of the work.

F. Prior to starting concrete operations the Contractor shall name his source of supply for concrete materials and submit representative samples and reports of quality tests for approval.

G. The Owner shall engage and pay for the services of an independent testing laboratory to perform the following services:

1. Slump test, ASTM C143, shall be taken with every set of cylinders and as often as required to provide the specified consistency of concrete.

2. Determine air content with every set of cylinders, ASTM C231, or as required.

3. Cast and test a set of at least 6 cylinders for each day's pour or for each 100 cubic yards or fraction thereof for each class of concrete. Cylinders shall be made and cured, ASTM C31, and tested, ASTM C39, in accordance with ASTM specifications for control tests. Cylinders shall be tested at 7 and 28 days. The Contractor shall provide insulated storage room with heat when necessary to store control cylinders and a protected space for storage of "field" cylinders which approximates the condition of curing of the concrete being sampled. Cylinders designated as "field" cylinders shall be used to determine safe stripping and loading of members. On all pours in excess of 25 cubic yards, continuous laboratory inspection shall be provided at the job site for checking materials, deliveries and concrete consistencies.

H. The testing laboratory shall observe the materials and the manufacturer of concrete as specified and shall report to the Contractor and Designer the progress thereof. Also, when it appears that the material furnished and the work performed by the Contractor fails to fulfill the specified requirements and Con-tract, the testing laboratory shall direct the attention of the Contractor and Designer to such failure or infringement. Such observation shall not relieve the Contractor of any obligation to furnish acceptable materials or to provide the concrete quality in the structure that is in strict accordance with plans and specifications. The testing laboratory is not authorized to revoke, alter, relax, enlarge or release the requirements of the specifications, nor to issue instructions contrary to the plans and specifications; nor to approve or accept any portion of the work but in case of any dispute arising between the testing laboratory and the Contractor as to materials furnished or in the manner of performing the work, the testing laboratory shall have the authority to reject materials or suspend the work until the question at issue can be referred to the Designer. The testing laboratory shall not act as foreman or perform other duties for the Contractor. In no case shall any advice or oversight on the part of the testing laboratory relieve the Contractor of responsibility for completing the work in accordance with plans and specifications and the fulfillment of the Contract. The work will be observed as it progresses, but failure to report to the Designer any defective work or materials shall not in any way prevent later rejection when such a defect is discovered or obligate the Owner for final acceptance. Any expense incident to the investigation and determination of actual quality of any questionable material shall be borne by the Contractor.

I. In the event that concrete tests fail to meet strength requirements of these specifications the designer may require, at no additional cost to the Owner, tests in accordance with the "Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete", ASTM C42, or order load tests in accordance with Chapter 20 of the ACI Building Code 318, to be made on the portions of the structure containing questionable concrete. Suitable appliances and methods of loading the measuring shall be provided by the Contractor under the direction of the testing laboratory. The portions of the structure which are found by the Designer to contain defective concrete shall be removed and reconstructed in a satisfactory manner at the Contractor's expense. Concrete strength tests are to conform to Chapter 5 of the ACI Building Code 318.

J. The laboratory shall have free access to material stockpiles, batching and mixing plants, and job site. The Contractor shall provide adequate assistance to the laboratory in securing specified samples for tests.

K. Contractor shall give the Designer and laboratory reasonable notice before beginning any pours (at least 24 hours).

L. The laboratory shall supply a daily report of concrete and materials testing and inspection to the designer (two copies) and Contractor (one copy).

M. Concrete batched away from the job and delivered in mixer or agitator trucks shall conform to requirements of ASTM C94.

N. Sampling and Testing:

1. All materials shall be sampled, tested in accordance with appropriate ASTM Standards, and approved before inclusion in any work on this project.

2. Samples for testing shall be furnished by the Contractor.

3. Rejected material shall be immediately removed from the site.

O. Standards: Comply with the following applicable standards:

1. ACI 211.1R: "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."

2. ACI 211.2 "Standard Practice for Selecting Proportions for Structural Lightweight Concrete."

3. ACI 301R: "Standard Specifications for Structural Concrete for Buildings".

4. ACI 304R: "Guide for Measuring, Mixing, Transporting, and Placing Concrete."

5. ACI 305R: "Hot Weather Concreting."

6. ACI 306R: "Cold Weather Concreting."

7. ACI 308R: "Standard Practice for Curing Concrete."

8. ACI 318: "Building Code Requirements for Structural Con-crete and Commentary."

P. Examine the substrate, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected.

Q. Inspection: Before placement of concrete, the Owner's Representative shall observe the placement of all reinforcing and give his approval.

END OF SECTION 01455

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DIVISION 1 – SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes construction facilities and temporary controls required for the Work.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0 and Division 1 Specifications,

1.02 REQUIREMENTS

A. Provide construction facilities and temporary controls needed for the Work including, but not necessarily limited to:

1. Sanitary facilities;

2. Temporary fencing of the construction site, if required.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

PART 2 PRODUCTS

2.01 UTILITIES

A. Water:

1. Provide necessary temporary piping and water supply and, upon completion of the Work, remove such temporary facilities.

2. Provide and pay for water used in construction.

B. Electricity:

1. Provide necessary temporary wiring and, upon completion of the Work, remove such temporary facility.

2. Provide area distribution boxes located so that the individual trades may furnish and use 100 ft maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.

3. Provide and pay for electricity used in construction.

C. Heating: Provide, maintain and pay for heat necessary for proper conduct of operations needed in the Work.

D. Telephone:

1. Make necessary arrangements and pay costs for installation and operation of telephone service to the Contractor's office at the site.

2. Make the telephone available to the Program Manager for use in connection with the Work.

2.02 FIELD OFFICES AND SHEDS

A. Sanitary facilities:

1. Provide temporary sanitary facilities in the quantity required for use by all personnel.

2. Maintain in a sanitary condition at all times.

2.03 ENCLOSURES

A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

2.04 TEMPORARY FENCING

A. If indicated provide and maintain for the duration of construction a temporary fence of design and type needed to prevent entry onto the Work by the public.

2.05 REMOVING AND REPLACING FENCES, SOD, ETC.

A. Where required to install the Work, carefully remove and store all interfering fences, mailboxes, culverts, etc. After installation of work and backfilling, reinstall these items and restore them to at least the conditions, which existed prior to the commencement of work, using materials and workmanship to match those of the original construction and installation.

B. Carefully remove and store all interfering shrubbery, trees, sod, flowers, and other planting, sufficiently in advance of construction. After installation of work and backfilling, reset and restore these items to at least the conditions that existed prior to the commencement of work.

PART 3 EXECUTION

3.01 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the Work.

B. Remove such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Owner or Engineer.

3.02 DUST CONTROL

A. During construction, haul roads and other disturbed construction areas shall be watered as required to prevent dust from damaging and/or becoming a nuisance to the terminal and other buildings, automobiles, aircraft, and residential and other built-up areas surrounding the project site.

END OF SECTION 01500

DIVISION 1 - SECTION 01600

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Contract, Division 0 and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing Contractor's selection of products for use in Project.

B. Related Sections: Following Sections contain requirements that relate to this Section:

1. Division 1 Section "Reference Standards and Definitions" specifies the applicability of industry standards to products specified.
2. Division 1 Section 01320 specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.
3. Division 1 Section "Product Substitution Procedures" specifies administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change meaning of other terms used in Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms such are self-explanatory and have well recognized meanings in construction industry.

1. **"Products"** are items purchased for incorporation in Work, whether purchased for Project or taken from previously purchased stock. Term "product" includes terms "material," "equipment," "system," and terms of similar intent.

    a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of date of Contract Documents.
    b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50% or more of value) outside of United States and its possessions; or produced or supplied by entities substantially owned (more than 50%) by persons who are not citizens of nor living within United States and its possessions.

2. **"Materials"** are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form part of Work.

3. **"Equipment"** is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.4 SUBMITTALS

A. Product List: Prepare list showing products specified in tabular form acceptable to Program Manager. Include generic names of products required. Include manufacturer's name and proprietary product names for each item listed.

1. Coordinate product list with Contractor's Construction Schedule and Schedule of Submittals.
2. Form: Prepare product list with information on each item tabulated under following column headings:

    a. Related Specification Section number.
    b. Generic name used in Contract Documents.
    c. Proprietary name, model number and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date, or time span of delivery period.

3. Initial Submittal: Within 30 days after date of commencement of Work, submit 3 copies of an initial product list. Provide written explanation for omissions of data and for known variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of Work, submit 3 copies of completed product list. Provide written explanation for omissions of data and for known variations from Contract requirements.

5. Engineer’s Action: Engineer will review and the Program Manager will respond in writing to Contractor within 2 wks of receipt of completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. Engineer’s review will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

B. Source Limitations: To fullest extent possible, provide products of same kind, from single source.

1. When specified products are available only from sources that do not or cannot produce quantity adequate to complete project requirements in timely manner, consult with Program Manager for determination by the Engineer of most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When determination has been made, select products from sources that produce products that possess these qualities, to fullest extent possible.

C. Compatibility of Options: When Contractor is given option of selecting between 2 or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other separate Contractors.
2. If dispute arises between Contractors over concurrently selectable, but incompatible products, Engineer will determine which products shall be retained and which are incompatible and must be replaced.

D. Foreign Product Limitations: Except under 1 or more of following conditions, provide domestic products, not foreign products, for inclusion in the Work:

1. No available domestic product complies with Contract Documents.
2. Domestic products that comply with Contract Document are only available at prices or terms that are substantially higher than foreign products that also comply with Contract Documents.

E. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on exterior.

F. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

G. Equipment Nameplates: Provide permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. Nameplate shall contain following information and other essential operating data:

1. Name of product and manufacturer.
2. Model and serial number.
3. Capacity.
4. Speed.
5. Ratings.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
3. Deliver products to site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
4. Inspect products upon delivery to ensure compliance with Contract Documents, and to ensure that products are undamaged and properly protected.
5. Store products at site in manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from Project structure in manner that will not endanger supporting construction.
   Store products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with Contract Documents, that are undamaged and, unless otherwise indicated, new at time of installation.

1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include following:

1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide product indicated. No substitutions will be permitted.
2. Semiproprietary Specification Requirements: Where 2 or more products or manufacturers are named, provide 1 of products indicated. No substitutions will be permitted.

    a. Where products or manufacturers are specified by name, accompanied by term "or equal," or "or approved equal" comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

3. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with an imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
4. Visual Matching: Where Specifications require matching an established Sample, Engineer's decision will be final on whether proposed product matches satisfactorily.

    a. Where no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of Contract Documents concerning "substitutions" for selection of matching product in another product category.

5. Visual Selection: Where specified product requirements include phrase "...as selected from manufacturer's standard colors, patterns, textures..." or similar phrase, select product and manufacturer that complies with other specified requirements. Engineer will select color, pattern and texture from product line selected.
6. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection, and for procedures required for processing such selections.

2.2 ASBESTOS-FREE REQUIREMENTS

A. The Contractor shall not use any asbestos containing material (ACM) at any time during the Project. The Contractor shall verify that all materials used on the Project are asbestos-free materials.

B. During the course of the Project, the Contractor shall routinely check products utilized on-site to ensure only asbestos-free products are utilized.

C. If the Owner suspects the presence of asbestos, the Owner will sample the suspect material to verify that no ACM was utilized. This testing shall be performed at the expense of the Owner. If ACM is subsequently found during the sampling, the Contractor shall remove and replace the product or material at his/her sole expense. No adjustment of the Contract Schedule will be provided to account for delays associated with removal and/or replacement of ACM. The Contractor shall reimburse Owner for any and all costs associated with the original testing and/or any re-testing that may be necessary.

D. Upon completion, a notarized certification statement shall be provided by the Contractor to the Owner certifying that all materials associated with this Project are asbestos free. See Specification 01771 Closeout Documents for certification document. If the Contractor does not submit the required asbestos-free certification, the Authority shall have a complete building survey performed by a qualified testing firm within the Project’s location. The cost of the survey and any subsequent removal/replacement of any ACM shall be deducted from the Contractor’s final payment at the sole discretion of the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS:

A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until time of Substantial Completion.

END OF SECTION 01600

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DIVISION 1 - SECTION 01630

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Contract, Division 0 and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of Contract.

B. Contractor's Construction Schedule and Schedule of Submittals are included under Section 01320.

C. Standards: Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

D. Procedural requirements governing Contractor's selection of products and product options are included under Section "Product Requirements."

E. Program Manager’s policy is to reject requests for substitution unless paragraph "Substitutions" under Article "Definitions" applies.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify meaning of other terms used in Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by Contractor after award of Contract are considered requests for "substitutions." Following are not considered substitutions:

1. Revisions to Contract Documents requested by Owner or Program Manager.
2. Specified options of products and construction methods included in Contract Documents.
3. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within 30 days after commencement of Work. Requests received more than 30 days after commencement of Work may be considered or rejected at discretion of Program Manager.

1. Submit 3 copies of each request for substitution for consideration. Submit requests on forms included at end of this Section.

2. Identify product, or fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with requirements for substitutions, and the following information, as appropriate:

    a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
    b. Samples, where applicable or requested.
    c. Detailed comparison of significant qualities of proposed substitution with those of Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
    d. Coordination information, including list of changes or modifications needed to other parts of Work and to construction performed by Owner and separate Contractors, that will become necessary to accommodate proposed substitution.
    e. Statement indicating substitution's effect on Contractor's Construction Schedule compared to schedule without approval of substitution. Indicate effect of proposed substitution on the overall Substantial Completion of the project.
    f. Cost information, including proposal of net change, if any in Contract Sum.
    g. Certification by Contractor that substitution proposed is equal-to or better in every significant respect to that required by Contract Documents, and that it will perform adequately in application indicated. Include Contractor's waiver of rights to additional payment or additional Contract time, that may subsequently become necessary because of failure of substitution to perform adequately.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: Contractor's substitution request will be received and considered by Program Manager when one or more of following conditions are satisfied, as determined by Program Manager; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.
2. Proposed changes are in keeping with general intent of Contract Documents.
3. Request is timely, fully documented and properly submitted.
4. Request is directly related to an "or equal" clause or similar language in Contract Documents.
5. Specified product or method of construction cannot be provided within Contract Time. Request will not be considered if product or method cannot be provided as result of failure to pursue Work promptly or coordinate activities properly.
6. Specified product or method of construction cannot receive necessary approval by governing authority, and requested substitution can be approved.
7. Substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities Owner may be required to bear. Additional responsibilities for Owner may include additional compensation to Program Manager and Engineer for redesign and evaluation services, increased cost of other construction by Owner or separate Contractors, and similar considerations.
8. Specified product or method of construction cannot be provided in manner that is compatible with other materials, and where Contractor certifies that substitution will overcome incompatibility.
9. Specified product or method of construction cannot be coordinated with other materials, and where Contractor certifies that proposed substitution can be coordinated.
10. Specified product or method of construction cannot provide warranty required by Contract Documents and where Contractor certifies that proposed substitution provide required warranty.

B. Contractor's submittal to the Program Manager and Engineer's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

C. See next page for "Request for Substitution" form.

REQUEST FOR SUBSTITUTION

To:

Attention:

From: _____
Name of Company

_____
Address

_____
City, State, Zip Code

_____
Phone

Fully answer all information requested below. Failure to answer any item may cause rejection of request for substitution. If requested by Program Manager, submit information about manufacturer and vendor history, financial stability, distribution and support systems. Use one form for each product requested. Only first product listed will be considered on forms with more than one product listed.

Specification Section Number: _____ Drawing Number: _____

Para Number: _____ Detail Number: _____

Specified Product: _____

Proposed Substitution: _____

Answer the following questions. Attach an explanation sheet on your company's letterhead when required.

Does the proposed substitution affect dimensions indicated on Drawings?

No _____ Yes _____ (If yes, explain below).

_____

_____

_____

Does the proposed substitution require changes in Drawings and/or design or installation changes?

No _____ Yes _____

If yes, is the cost of these changes included in the proposed amount? No ____ Yes ____

Does the proposed substitution affect other trades? No _____ Yes _____

(If yes, explain who and how)

_____

_____

_____

If the proposed product does affect the work of other trades, has the cost impact on their work been included in the price of the proposed substitution?

No _____ Yes _____

Does the proposed product's guarantee differ from that of the specified product's?

No _____ Yes _____ (If yes, explain below).

_____

_____

_____

Why is this proposal for substitution being submitted? List reasons below.

_____

_____

_____

Attach a listing of 3 projects using proposed substitution completed within the past 5 yrs in geographic and climatic region of Project. One of applications shall have been in service for at least 3 yrs.

Attach product data/brochures and Vendor Qualification Form for the specified and substitute product.

Undersigned has examined Construction Documents, is familiar with specified product, understands indicated application of product, and understands design intent of Engineer. Undersigned states that proposed substitution complies with Construction Documents and will perform at least equally to specified product within limitations stated above. Undersigned accepts responsibility for coordinating application and installation of proposed substitution and waives all claims for additional costs resulting from incorporation of proposed substitution into Project or its subsequent failure to perform according to specified requirements.

Submitted By: _____ _____

Typed Signature

Date: _____

END OF SECTION 01630

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DIVISION 1 – SECTION 01700

FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. Provide such field engineering services as are required for proper completion of the Work including, but not necessarily limited to:

1. Establishing and maintaining lines and levels;

2. Structural design of shores, forms, and similar items provided by the Contractor as part of his means and methods of construction.

All field engineering is incidental to the Item for which it applies. No direct pay will be made for field engineering.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2. Additional requirements for field engineering may be described in other Sections of these Specifications.

1.02 SUBMITTALS

A. Upon request of the Owner or Engineer, submit:

1. Data demonstrating qualifications of persons proposed to be engaged for field engineering services.

2. Documentation verifying accuracy of field engineering work.

3. Certification, signed by the Contractor's retained field engineer, certifying that elevations and locations of improvements are in conformance or nonconformance with requirements of the Contract Documents.

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 PROCEDURES

A. In addition to other procedures directed by the Contractor for proper performance of the Contractor's responsibilities:

1. Locate and protect control points before starting work on the site.
2. Preserve permanent reference points during progress of the Work.

3. Prior to commencing any work requiring location or grades, the Contractor shall establish

temporary bench marks (TBMs) at an interval not to exceed 1000 feet. TBMs are to be located in areas not anticipated to be disturbed by construction. Provide the Owner or Engineer copies of field notes, including peg test of level, and a listing of the adjusted coordinates and elevations of all TBMs.

4. Do not change or relocate reference points or items of the Work without specific approval from the Owner or Engineer.

5. Promptly advise the Owner or Engineer when a reference point is lost or destroyed, or requires relocation because of other changes in the Work.

    a. Upon direction of the Owner or Engineer, require the field engineer to replace reference stakes or markers.

    b. Locate such replacements according to the original survey control.

END OF SECTION 01700

DIVISION 1 – SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents, as described in paragraph 3.01 below and, upon completion of the Work, transfer the recorded changes to a set of Record Documents, as described in paragraph 3.02 below. This shall include Record Drawings.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Provisions and the Technical Sections of these Specifications.

2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these Specifications.

1.02 SUBMITTALS

A. The Program Manager's review of the current status of Project Record Documents is a prerequisite to the Program Manager's approval of requests for progress payments and request for final payment under the Contract.

B. Prior to submitting each Application for Payment, secure the Program Manager's review of the current status of the Project Record Documents.

C. The final project Record Documents must be submitted to the Program Manager and secure approval before final payment for demobilization can occur.

1.03 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Program Manager.

B. Accuracy of records:

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.

2. Accuracy of records shall be such that future searches for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

C. Make entries within 24 hours after receipt of information that the change has occurred.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the final Project Record Documents.

B. In the event of loss of recorded data, use any means necessary to again secure the data needed to comply with this section.

1. Such means shall include, if necessary in the opinion of the Program Manager, removal and replacement of concealing work or materials by Contractor at Contractor's expense.

PART 2 PRODUCTS

2.01 RECORD DOCUMENTS

A. Job set: Promptly following the Notice to Proceed, secure from the Program Manager at no charge to the Contractor one complete set of all Documents comprising the Contract.

PART 3 EXECUTION

3.01 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the job set described in Paragraph 2.01-A above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET."

B. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Program Manager.

2. Do not use the job set for any purpose except entry of new data and for review by the Program Manager, until start of transfer of data to final Project Record Documents.

3. Maintain the job set at the site of Work or at another site as designated by the Program Manager.

C. Making entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.

2. Date all entries.

3. Call attention to the entry by a "cloud" drawn around the area or areas affected.

4. In the event of overlapping changes, use different colors for the overlapping changes.

D. Make entries in the pertinent other Documents as approved by the Program Manager.

E. Drawings shall clearly show actual installed locations, depth, and sizes of:

1 Pipe work of all descriptions below ground outside of building and structures, including locations of culverts, storm & sewer lines, water lines, cleanouts, manholes, inlets, hydrants, and underground valves.

2. Underground electrical conduits, electrical ducts, and directly buried conductors light cables, FAA cables including locations of pull and junction boxes, electric manholes and handholes, pad mounted electrical equipment, utility poles, electrical outlets, and lighting fixtures.

3. All existing underground facilities unearthed by Contractors operations not accurately shown on the drawing.

F. Conversion of schematic layouts:

1. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, is shown schematically and is not intended to portray precise physical layout.

a. Final physical arrangement is determined by the Contractor, subject to the Program Manager's review.

b. However, design of future modifications of the facility may require accurate information as to the final physical layout of items, which are shown only schematically, on the Drawings. This information will be provided by the Contractor.

2. Show on the job set of Record Drawings, by dimension accurate to within one half foot, the centerline of each run of items such as are described in subparagraph 3.01-E above.

a. Clearly identify the item by accurate note such as "24 inch R.C. pipe drain", "4" conduit" and the like.

b. Show, by symbol or note, the vertical location of the item ("36 inches deep"), "exposed," and the like.

c. Make all descriptive identification so that it may be related reliably to the Specifications.

3. The Program Manager may waive the requirements for conversion of schematic layouts where, in the Program Manager's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Program Manager.

3.02 FINAL PROJECT RECORD DOCUMENTS

A. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Approval of recorded data prior to transfer to Program Manager:

1. Secure the Program Manager's review of all recorded data.

2. Make required revisions.

C. Transfer of data to other Documents:

1. If the Documents other than Drawings have been kept clean during progress of the Work, and if entries thereon have been orderly to the approval of the Program Manager, the job set of those Documents other than Drawings will be accepted as final Record Documents.

2. If any such Document is not so approved by the Program Manager, secure a new copy of that Document from the Program Manager at the Program Manager's usual charge for reproduction and handling, and carefully transfer the change data to the new copy to the

approval of the Program Manager.

D. Review and submittal:

1. Submit the completed set of Project Record Documents to the Program Manager as described in Paragraph 1.02-C above.

2. Participate in review meetings as required.

3. Make required changes and promptly deliver the final Project Record Documents to the Program Manager.

3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

END OF SECTION 01720

DIVISION 1 – SECTION 01730

CUTTING AND PATCHING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for cutting and patching.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Coordination" for procedures for coordinating cutting and patching with other construction activities.

2. Division 2 Section "Selective Demolition" for demolition of selected portions of the building for alterations.

3. Refer to other Sections for specific requirements and limitations applicable to cut-ting and patching individual parts of the Work.

a. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

a. Foundation construction.
b. Bearing and retaining walls.
c. Structural concrete.
d. Structural steel.
e. Lintels.
f. Timber and primary wood framing.
g. Structural decking.
h. Stair systems.
i. Miscellaneous structural metals.
j. Exterior curtain-wall construction.
k. Equipment supports.
l. Piping, ductwork, vessels, and equipment.
m. Structural systems of special construction in Division 13 Sections.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch

operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

    a. Primary operational systems and equipment.
    b. Air or smoke barriers.
    c. Water, moisture, or vapor barriers.
    d. Membranes and flashings.
    e. Fire protection systems.
    f. Noise and vibration control elements and systems.
    g. Control systems.
    h. Communication systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction in Division 13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

1. If possible retain the original Installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original Installer or fabricator, engage another recognized experienced and specialized firm.

    a. Processed concrete finishes.
    b. Stonework and stone masonry.
    c. Ornamental metal.
    d. Matched-veneer woodwork.
    e. Preformed metal panels.
    f. Firestopping.
    g. Window wall system.
    h. Stucco and ornamental plaster.
    i. Acoustical ceilings.
    j. Terrazzo.
    k. Finished wood flooring.
    l. Fluid-applied flooring.
    m. Carpeting.
    n. Aggregate wall coating.
    o. Wall covering.
    p. Swimming pool finishes.
    q. HVAC enclosures, cabinets, or covers.

1.4 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical mate-rials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patch-ing is to be performed before cutting. If unsafe or unsatisfactory conditions are en-countered, take corrective action before proceeding.

1. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

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

B. Protection: Protect existing construction during cutting and patching to prevent dam-age. Provide protection from adverse weather conditions for portions of the project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoin-ing areas.

D. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cut-ting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size

required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.

5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and re-place with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.

4. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.4 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely re-move paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore dam-aged pipe covering to its original condition.

END OF SECTION 01730

DIVISION 1 – SECTION 01741

CLEANING

PART 1 GENERAL

1.01 SUMMARY

A. Throughout the construction period, maintain the site in a standard of cleanliness including mowing of grass as described in this Section. All demolition or construction debris (FOD) shall be confined within the work site at all times.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, Division 0, Division 1 and other Sections of these Specifications.

2. In addition to the standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

3. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

1.02 QUALITY ASSURANCE

A. Conduct a daily inspection, and more often if necessary, to verify that cleanliness requirements are being met.

B. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

B. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

2.02 COMPATIBILITY

A. Use only cleaning materials and equipment compatible with the surface being cleaned and as recommended by the manufacturer of the material.

PART 3 EXECUTION

3.01 PROGRESS CLEANING

A. General:

1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.

2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.

3. Inspect all haul vehicles leaving the site to make sure no debris can fall from the vehicle during transportation.

4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:

1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage. Contractor shall document all daily inspections.

2. Weekly, and more often if necessary, remove, completely, all accumulated scrap, debris, and waste material from the site.

3. Maintain the site in a neat and orderly condition at all times.

4. Mowing of grass within the construction limits is required at a minimum of every two (2) weeks during the active growing season, or as directed by the Engineer or Owner.

3.02 FINAL CLEANING

A. "Clean," for the purpose of this section, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by material sweepers and vacuums.

B. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.01 above.

C. Site:

1. Unless otherwise specifically directed by the Owner or Engineer, broom clean paved areas on the site and public paved areas adjacent to the site.

2. Completely remove resultant debris.

D. Schedule final cleaning as approved by the Owner or Engineer to enable the Owner to accept a completely clean Work.

3.03 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof, prior to its completion by the Contractor, and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Engineer or Owner in accordance with the Division 0 and Division 1 Specifications.

3.04 INTERVENTION OF OWNER

A. If the Contractor fails to clean up any debris which is deposited as a result of construction/demolition operations, or fails to mow grass as stipulated, the Airport Authority will, after attempting one notification, immediately do so and the cost thereof will be charged to the Contractor at the rate of two hundred and fifty dollars ($250.00) per hour, per machine and per person additively. The Contractor shall assume full responsibility for failure to perform clean up operations required.

END OF SECTION 01741

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DIVISION 1 - SECTION 01770

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Procedures and requirements for closing out the Work.

1. Closeout submittals.
2. Final cleaning.
3. Record Documents.
4. Substantial completion.
5. Final inspection.
6. Final payment.
7. Warranties.

1.02 RELATED REQUIREMENTS AND SECTIONS

A. Section 01100 - Summary of Work, Sequence of Construction & Liquidated Damages.

1.03 CLOSEOUT SUBMITTALS

A. Record documents of the constructed work.

B. Certificate of Occupancy.

C. Warranties: This Section and applicable Sections of these Specifications.

D. Contractors Affidavit of Payment of Debts and Claims and Contractors Affidavit of Release of Liens.

E. Consent of Surety to Final Payment.

F. As-built drawings.

1.05 FINAL CLEANING

A. Clean work and storage areas free of trash. Broom clean and hose wash walks and pavements.

1.06 RECORD DOCUMENTS

A. Definition:

1. Dimensioned drawings showing in-place components and systems measured as accurately as practicable.

2. Product data and other documents clearly identifying proprietary product and equipment incorporated into the Work.

B. Maintain at job site one record copy of:

1. Contract Drawings and As-built Drawings.
2. Project Manual.

3. Addenda.
4. Approved shop drawings.
5. Contract Modifications.
6. Field test records.
7. Meeting minutes (notes).

C. Make documents available at all times for inspection by Engineer and Owner.

D. Marking Devices:

1. Use colored felt marking pens for marking prints and product data.

E. Label each document "PROJECT RECORD" in 1" high printed letters.

F. Record information concurrent with construction progress. Do not conceal any work until required information has been recorded.

G. Submittal of Record Documents:

1. At completion of the Work, deliver Record Documents to Owner or Engineer with request for Final Payment.
2. Accompany submittal with transmittal letter indicating:
   a. Date
   b. Project title
   c. Contractor's name and address
   d. Title and number of each record document
3. Submit one reproducible copy and one electronic copy of Record Documents, and provide one copy of other Record Documents.
4. Provide one AutoCAD Diskette

1.07 SUBSTANTIAL COMPLETION

A. When Contractor considers the Work to be substantially complete as defined in Conditions of the Contract, Contractor shall prepare and submit a list (punch list) of items to be completed or corrected. Upon receipt of Contractor's list, Owner or Engineer will decide if the Work is substantially complete and, if necessary, will prepare a supplemental list (punch list) of items to be completed or corrected.

B. Failure to include items on the punch list does not alter responsibility of Contractor to complete work according to Contract Documents.

C. Before Owner or Engineer issues a Certificate of Substantial Completion, Contractor shall provide certificate of Use and Occupancy and evidence of approval from applicable governing authorities.

1.08 FINAL INSPECTION

A. When Owner or Engineer receives written notice that the Work is ready for final inspection, and when final application for payment is received, Owner or Engineer shall promptly inspect to determine if the Work complies with the Contract Documents.

B. Provide Owner or Engineer with written status report of each punch list item before final inspection.

1.09 FINAL PAYMENT

A. Final payment will be made to contractor by Owner within 45 days after:

1. Completion of the Work.
2. Acceptance by Owner and Engineer of all work performed under the Contract.
3. Receipt of Project Record Documents.
4. Receipt of O & M data, manufacturer's instructions, service manual, parts manual, warranties, and other closeout submittals specified. O & M data must include a list of recommended vendors for any non-standard replacement parts and must include a detailed Preventative Maintenance guide with a schedule of suggested efforts.
5. Preparation by Contractor and approval of Owner of final statement of cost of the completed Work. Final statement shall indicate:
   a. Original Contract Sum.
   b. Previous Change Orders.
   c. Deductions for liquidated damages.
   d. Other applicable adjustments to Contract Sum.
   e. Total Contract Sum as adjusted.
   f. Previous Payments.
   g. Final payment remaining due.
6. Upon completion by Contractor of work covered by Contract Documents, and before final payment to Contractor for work performed, Contractor shall deliver to Owner an affidavit, indicating that all labor and material used on or for execution of the Work has been paid.

1.10 WARRANTIES

A. Provide duplicate notarized copies of warranties required by Contract Documents. Accumulate executed documents by subcontractors, suppliers, and manufacturers; provide table of contents and assemble in binder with durable plastic cover properly titled.

B. Warranties are in addition to and not a limitation of other rights Owner may have against Contractor under the Contract Documents.

C. Contractor shall bear costs of correcting work not complying with warranty requirements.

D. Duration of warranties required by individual Sections shall indicate minimum times and shall not relieve Contractor of obligations required under applicable statutes or other Conditions of the Contract.

   1. Warranty period begins on date of Substantial Completion, except where modified by Conditions of the Contract.
   2. Warranties are non-prorated unless stated otherwise in these Specifications.

E. Manufacturer's warranties shall be backed by assets of manufacturer and not a third party.

F. Warranties shall be transferable.

G. Submit warranties to Owner or Engineer for verification and submittal to Owner with Contractor's final Application for Payment.

H. Re-submit warranties that do not comply with Contract Documents.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION 01770

DIVISION 1 – SECTION 01771

AFFIDAVIT OF CONTRACTOR

STATE OF _____

COUNTY OF _____

_____, being duly sworn according to Law,
(Name of Affiant)

deposes and says that he is the _____of
(Title)
_____, the Contractor, in a
(Name of Contractor)
Construction contract entered into between the Contractor and Memphis-Shelby County Airport Authority, the Owner, for the construction of Glycol Management Program - Control Facility - Construction, MSCAA Project No. 08-1260-05, and that he is authorized to and does make this Affidavit on behalf of said Contractor in order to induce the Owner to make payment to the Contractor, in accordance with the provisions of the said Construction Contract.

Affiant further says that all persons who have furnished materials, labor, and equipment in connection with the construction of the facilities have been paid in full, and that the names of all manufacturers, materialmen, subcontractors and DBE subcontractors that furnished any material and/or services in connection with such construction and the kind of kinds of material and/or services so furnished are as listed hereinafter.

Affiant further certifies that he/she is familiar with the materials used in the construction of and incorporated into, the Project referenced above and attests that no asbestos-containing materials, either friable or otherwise, were used in the process of constructing or incorporated into the construction of the Project.

_____
(Signature of Affiant)

Sworn to and subscribed before me this _____ day of _____20____.

_____
(Notary Public)

My commission expires:_____

Name of Entity	Kind of Material and/or Service

END OF SECTION 01771

DIVISION 1 – SECTION 01772

FINAL LIEN WAIVER AND RELEASE
PRIME CONTRACTOR

STATE OF TENNESSEE
COUNTY OF SHELBY

The undersigned _____ (hereinafter "Contractor") has entered into a Contract with the Memphis-Shelby County Airport Authority ("Owner") for the construction of improvements known as the:

Glycol Management Program - Control Facility - Construction
Memphis International Airport
MSCAA Project No. 08-1260-05 (hereinafter "the Project").

Upon the receipt of the sum of $_____, the undersigned forever waives and releases any and all liens or claims of liens it has upon the foregoing described real property on account of labor, materials, equipment or services furnished for said Project. The undersigned certifies that all payments have been made for all work/materials performed to date for all subcontractors and suppliers with the exception of the amount due as a result of the payment amount shown above; and, that all subcontractors and suppliers will be paid all balances due upon receipt of the payment amount shown above. Further, the undersigned does hereby waive, release and relinquish any and all claims or demands against the Owner and Engineer of the above-described Project, the right to assert a mechanic's and materialmen's lien and/or any claim for quantum meruit or unjust enrichment, additional work, verbal agreements, increased cost, scheduling damages, including, but not limited to damages for delay, disruption, acceleration and/or interference, whether existing now or arising in the future.

The undersigned certifies and warrants that it has complied with all federal, state and local tax laws, including Social Security laws and Unemployment Compensation laws and workers' compensation laws insofar as applicable to the performance of the Project. Further, the undersigned certifies and warrants that it has paid all of its subcontractors, vendors, and materialmen for services rendered in connection with the construction and improvement of the Project and that all labor, materials and equipment are free and clear of claims, security interests, indebtedness or encumbrances. The undersigned agrees to indemnify and hold harmless the Owner and the Engineer from and against any and all claims, damages, losses and expenses, including but not limited to, attorney's fees, arising out of or resulting from any non-payment by the undersigned to any subcontractor, laborer, vendor or materialman for the Project.

As of this date, no mechanics' or materialmen's liens have been filed of record arising out of or related to the work performed by the undersigned.

Given under hand and seal this _____ day of _____, 20_____.

CONTRACTOR

_____

By:_____

Title:_____

STATE OF TENNESSEE
COUNTY OF SHELBY

Before me, a notary public of the state and county mentioned, personally appeared _____, with whom I am personally acquainted, and who, upon oath, acknowledged such person to be _____, an officer authorized to execute the instrument, of _____, the within named bargainor, a corporation, and that such officer, as such _____, executed the foregoing instrument for the purposes therein contained, by personally signing the name of the corporation as _____.

Witness my hand and seal, at office, this _____ day of _____, 20_____.

_____
Notary Public

My Commission Expires:

_____

END OF SECTION 01772

DIVISION 1 – SECTION 01774

CONTRACTOR WARRANTY FORM

PROJECT: MSCAA Project No. 08-1260-05, Glycol Management Program - Control Facility - Construction

LOCATION: Memphis International Airport, Shelby County, Tennessee

OWNER: Memphis-Shelby County Airport Authority

We _____ , Contractor
(Company Name)
for the above-reference project, do hereby warrant all labor and materials furnished and work performed are in accordance with the Contract Documents and authorized modifications thereto, and will be free from defects due to defective materials or workmanship for a period of one year.

This warranty commences on _____ and expires on _____.

This warranty covers that portion of the project described below:

ALL MATERIALS, LABOR, AND EQUIPMENT IN CONNECTION WITH THE CONSTRUCTION OF THE FACILITIES OF THE ABOVE REFERENCED CONTRACT.

The Contractor shall promptly correct all defective Work to comply with the Contract Documents whether observed before or after the substantial completion date and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting defective Work.

If, within one (1) year after the substantial completion date, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee or warranty required by the Contract Documents, any of the Work is found to be defective and not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner, or the Engineer to do so.

All defective or non-conforming Work shall be removed from the site of the Work if necessary, and the Work shall be corrected to comply with the Contract Documents without cost to the Owner. The Contractor also shall bear the cost of making good all work of other contractors destroyed or damaged by removal or correction of the defective Work of Contractor.

If the Contractor fails to timely and properly correct defective Work, the Owner may correct it and hold the Contractor liable for all costs, expenses and damages, including attorney's fees and litigation costs incurred by Owner in correcting it.

In addition to the foregoing warranty, a warranty period of one (1) year shall apply under the same terms and conditions as the original warranty, to any work, supplied in correction of defective work under warranty pursuant to the provisions of this Section 17.04 and the Contractor shall assign to the Owner any warranties, including extended warranties, which are available in connection with the performance of such correction of defective Work. The warranty period shall commence on the date the Owner accepts the corrective Work of the Contractor.

DATE: _____ FOR: _____
(Company Name)

BY: _____
TITLE: _____

END OF SECTION 01774

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DIVISION 1 – SECTION 01775

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

To: Memphis-Shelby County Airport Authority
2491 Winchester Road, Suite 113
Memphis, TN. 38116-3856

Regarding Contract for: Glycol Management Program - Control Facility - Construction

Project: 08-1260-05

Dated: _____

CONTRACTOR: _____

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the

_____
(here insert name and address of Surety Company)

_____, SURETY COMPANY,

on bond of _____
(here insert name and address of Contractor)

_____, CONTRACTOR,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety Company of any of its obligations to Memphis-Shelby County Airport Authority, OWNER.

IN WITNESS WHEREOF,
the Surety Company has hereunto set its hand this_____day of _____, 20_____

_____
Surety Company

_____
Signature of Authorized Representative

Attest:
(Seal):

_____
Title

END OF SECTION 01775

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DIVION 1 – SECTION 01783

ELECTRICAL CHARACTERISTICS, CAPACITIES AND WIRING DIAGRAMS

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the electrical characteristics, sizes, capacities, ratings and wiring diagrams required of electrically operated equipment.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to Division 0, Division 1 and other Sections of these Specifications.

1.02 SUBMITTALS

A. Furnish with each item of electrically operated equipment a wiring diagram showing all necessary electrical connections required to operate the equipment properly, in accordance with drawing and specification requirements.

B. Furnish a composite wiring diagram showing all necessary interlock and related wiring between the various items of electrically operated equipment and their controls, as required to operate interlocked equipment as specified in other sections of these specifications and as indicated.

1.03 CAPACITIES, RATINGS, SIZES, AND OTHER REQUIREMENTS NOT SPECIFIED:

A. For all items of material and/or equipment, the capacities, ratings, sizes, and other requirements thereof not specified shall be as indicated on the Contract drawings.

B. Where capacities, ratings, sizes, and other requirements for materials and/or equipment is neither specified nor indicated on the Contract drawings, refer each case to the Owner or Engineer before ordering the materials and/or equipment involved, or proceeding with the work involved. The Owner's or Engineer's decision shall govern.

1.04 ELECTRICAL CHARACTERISTICS AND SIZES OF ELECTRICALLY OPERATED EQUIPMENT

A. Each electrically operated item furnished under this contract shall operate proper on the electrical supply to which it is to be connected, as indicated on the electrical drawings.

B. All electrically operated equipment shall operate on a 60 hz alternating current supply, unless otherwise indicated. Prior to delivery to the job site, it shall be the joint responsibility of the Contractor under the applicable section and the equipment supplier to determine from the electrical drawings the characteristics of the electrical supply indicated to each individual electrically operated item, and to furnish each electrically operated item accordingly.

1. Where electrical characteristics are specified hereinafter, verify them from the electrical drawings. In the case of discrepancy between the specifications and the electrical drawings, the Electrical drawings shall govern.

2. Where electrical characteristics cannot be determined from the electrical drawings, refer each case to the Owner or Engineer, and the Owner's or Engineer‘s decision shall govern.

END OF SECTION 01783

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DIVISION 1 – SECTION 01784

MANUFACTURER'S SUPERVISION

1.01 DESCRIPTION

A. Work included:

1. Furnishing Manufacturer's Supervision

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to Division 0, Division 1, and other Sections of these Specifications.

1.02 SERVICES

A. Furnish the services of authorized qualified manufacturer's representatives as required to supervise the installation, testing, initial starting, adjusting, and initial operation of each equipment item or any other item designated by the Contract Documents and included in this Contract.

END OF SECTION 01784

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SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

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. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

1.3 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterestops.
5. Form-release agent.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Form Liners: Store form liners under cover to protect from sunlight.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

2.2 FORM-FACING MATERIALS

A. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 WATERSTOPS

A. Flexible PVC Waterstops: U.S. Army Corps of Engineers CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BoMetals, Inc.
    b. Sika Corporation.
    c. Vinylex Waterstop & Accessories.
2. Profile: Flat dumbbell with center bulb Flat dumbbell without center bulb.
3. Dimensions: 6 inches by 3/8 inch thick; nontapered.

2.4 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch , minimum.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

E. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301 .

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch .
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch .
3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch .

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings.

a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF 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.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Install reglets to receive 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.
4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
5. Clean embedded items immediate prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.

3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 03 30 00 "Cast-In-Place Concrete."
4. Secure waterstops in correct position at 12 inches on center.
5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.

    a. Miter corners, intersections, and directional changes in waterstops.
    b. Align center bulbs.
6. Clean waterstops immediately prior to placement of concrete.
7. Support and protect exposed waterstops during progress of the Work.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of the Work.

3.4 REMOVING AND REUSING FORMS

A. 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 has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.5 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

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. Steel reinforcement bars.
2. Welded-wire reinforcement.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For testing and inspection agency.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

2. Mechanical splice couplers.

C. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60 ASTM A706/A706M, deformed bars, assembled with clips.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 , plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: Plain.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3.
4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

    a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
2. Lap edges and ends of adjoining sheets at least one mesh spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. 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.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement welding.

C. Manufacturer's Inspections: Engage manufacturer of insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

ISSUED FOR BID

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Aggregates.
3. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

4. Vapor retarders.
5. Floor and slab treatments.
6. Liquid floor treatments.
7. Curing materials.
8. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.
8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
9. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
10. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
11. Intended placement method.
12. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Testing agency: Include copies of applicable ACI certificates.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

C. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
2. Obtain aggregate from single source.
3. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I Type III, gray.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride .

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder/Termite Barrier: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.03 perms; complying with ICC AC380. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Polyguard Products, Inc.
2. Low-Temperature Flexibility: Pass at minus 15 deg F; ASTM D146/D146M.
3. Puncture Resistance: 224 lbf minimum; ASTM E154/E154M.
4. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D570.
5. Hydrostatic-Head Resistance: 231 feet minimum; ASTM D5385.

2.4 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. BASF Corporation.
    b. Dayton Superior.
    c. Euclid Chemical Company (The); an RPM company.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. BASF Corporation.
    b. Dayton Superior.
    c. Euclid Chemical Company (The); an RPM company.
    d. Sika Corporation.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

    a. Ambient Temperature Below 50 deg F: Black.
    b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
    c. Ambient Temperature Above 85 deg F: White.

D. Water: Potable or complying with ASTM C1602/C1602M.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

5. Total of Pozzolans and Silica Fume: 35 percent by mass with pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture 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 concrete with a w/cm below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
5. Use permeability-reducing admixture in concrete mixtures where indicated.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure facilities for storage, initial curing, and field curing of test samples, including continuous electrical power.
4. Security and protection for samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF 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.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. Install reglets to receive 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.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.
3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

6. Space vertical joints in walls @ 25'-0"o.c.. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: 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 does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: 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 on Drawings.
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 Section 07 92 00 "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.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the 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. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 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 in accordance with manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.

2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

D. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
    a. Floors to Receive Curing and Sealing Compound:
        1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
        2) Recoat areas subjected to heavy rainfall within three hours after initial application.
        3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.10 TOLERANCES

A. Conform to ACI 117.

3.11 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s).
2. 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 joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.
2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 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 to solid concrete.
    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. 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 matches surrounding color.
    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
2. Repair finished surfaces containing surface defects, including 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.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with 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.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. 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.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
2. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
        1) Project name.
        2) Name of testing agency.
        3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
        4) Name of concrete manufacturer.
        5) Date and time of inspection, sampling, and field testing.
        6) Date and time of concrete placement.
        7) Location in Work of concrete represented by samples.
        8) Date and time sample was obtained.
        9) Truck and batch ticket numbers.
        10) Design compressive strength at 28 days.
        11) Concrete mixture designation, proportions, and materials.
        12) Field test results.
        13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
        14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Batch Plant Inspections: On a random basis, as determined by Architect.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .

a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Compression Test Specimens: ASTM C31/C31M:

a. Cast and laboratory cure two sets of three6-inch by 12-inch cylinder specimens for each composite sample.
b. Cast, initial cure, and field cure two sets of three standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M.

a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture 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 if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests:

a. 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.
b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to Architect.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION 03 30 00

ISSUED FOR BID

SECTION 04 10 00
MORTAR

PART 1 GENERAL

1.01 DESCRIPTION

A. The work under this Section includes furnishing materials, mixing, and application of mortar for masonry work as indicated on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Testing

1. Mortar mixes shall be tested.
2. Contractor shall provide access to all portions of work and cooperation with testing agency.
3. Proposed mortar mix designs shall be submitted to testing agency for approval prior to commencement of work.

B. Referenced Standards

1. ASTM C150 – Portland Cement
2. ASTM C91 – Masonry Cement
3. ASTM C5 – Quicklime for Structural Purposes
4. ASTM C270 – Hydrated Lime for Masonry Mortar
5. ASTM C144 – Aggregate for Masonry Mortar
6. ASTM C387 – Packaged, dry, combined Materials for Mortar and Concrete
7. ASTM C476 – Mortar and Grout for Reinforced Masonry

PART 2 PRODUCTS

2.01 MATERIALS

A. Mortar materials shall consist of the following:

1. Portland Cement: ASTM C150, normal-type, gray or white in color as required by project conditions. The free alkali content shall be 0.05 percent or less.
2. Masonry Cement: ASTM C91, for general and high strength uses. The free alkali content shall be 0.50 percent or less.
3. Aggregates (sand): ASTM C144 standard masonry type clean, dry, and protected against dampness, freezing, and foreign matter. Do not allow to be stored on bare earth without polyethylene sheet under element.
4. Hydrated Lime: ASTM C270, Type S
5. Quicklime: ASTM C5, non-hydraulic type
6. Premixed Mortar: ASTM C387 commercially prepared type, mortar type S, using gray or white cement, as required by project conditions.
7. Water: shall be potable.

B. Admixtures

1. Mortar Color: colored mortar masonry for exterior brick – veneer – color to be “Khaki”.
2. Plasticizers, accelerators, retardants, water repellent agents, or other admixtures shall not be used in mortar mixes unless otherwise stated in Paragraph C below, or specifically required.
3. Under no circumstances will calcium chloride be added to any mortar.

C. Mortar Mixes

1. As required by project conditions, mixes may consist of any of the following combinations:
   a. Portland cement, lime and fine aggregate
   b. Masonry cement, and fine aggregate
   c. Portland cement, masonry cement and fine aggregate
   d. Commercially prepared premix mortar and fine aggregate
2. Provide minimum 1,800 psi mortar for non-load-bearing unit masonry walls and partitions.

PART 3 EXECUTION

3.01 INSPECTION

A. Mortar ingredients shall be thoroughly mixed, in quantities needed for immediate use.

B. Coloring shall be added in accordance with manufacturer's recommendations. Care must be exercised to ensure uniformity of mixes and coloration.

C. Mortar shall be machine mixed in approved type mixer in which quantity of water can be accurately and uniformly controlled. Mixing time shall be not less than 5 minutes, approximately 2 minutes of which shall be for mixing dry materials and not less than 3 minutes continuing mixing after water has been added.

D. For work requiring only small batches of mortar or grout and when specifically approved by the Owner's Representative, mortar may be mixed by hand in watertight mortar mixing boxes. Materials of each batch shall be added, until mix is an even color throughout mass after which water shall be gradually added until a thoroughly mixed mortar of required plastically is obtained.

E. Mortar for grouting and poured fills shall have necessary portion of water added to achieve pouring consistency and shall be continuously stirred to prevent segregation of aggregate.

F. Point mortar shall be as dry as consistency as will produce mortar sufficiently plastic to be worked into joints.

G. All mixing boxes and equipment shall be kept clean. Mortar shall be prepared in batches or volumes that will be used before initial set takes place, and in no case longer than 45 minutes before delivery to point of use. Re-tempering will not be permitted.

H. Mortar must be used within 2 hours of mixing at temperature over 80 degrees F, and 2-1/2 hours at temperatures under 50 degrees F.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 04 20 25
BRICK VENEER

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Provide written technical data for brick veneer, fabricated wire reinforcement, and mortar.

1.02 QUALITY ASSURANCE

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

1.03 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

1.04 MASONRY MOCK-UP

A. A 48" square mock-up shall be constructed for architect/owner approval to show the brick veneer selected, the mortar (after curing, not "green") and the weep vents. The brick shall illustrate the modular vertical and horizontal coursing with full bed and full head joints with proper alignment in both directions. The mock-up shall also show the base flashing, insulation, mortar mesh, and brick ties to block backup. The sample should be cleaned and cured prior to inspection and the mortar shall be in its final appearance.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Veneer Brick: ASTM C216, Type FBX, Grade SW.
   1. Color and texture: “Citadel” – Freedom collection, Boral Brick.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M Type S.
   1. Colored mortar: Premixed cement as required to match Architect's color sample.
   2. Color – “Khaki” to match MSCAA mortar color.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, grade 40 (280) yield grade, deformed billet bars; galvanized.

B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Vertical adjustment: Not less than 3-1/2 inches.
   2. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.

2.04 FLASHINGS

A. Plastic Flashings: EPDM; 60 mil thick.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Weeps: vented cell, color dark bronze

C. Cavity Vents: Polyester mesh.

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

2.06 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

PART 3 EXECUTION

3.01 COURSING

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

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

C. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave at approximately 3/8” visible width.

3.02 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work. DO NOT TOOTH ANY BRICK, BUT RACK WORK AT CORNERS AND ANY VERTICAL TERMINATIONS.

3.03 WEEPS/CAVITY VENTS

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

B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.

3.04 CAVITY MORTAR CONTROL

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

3.05 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install anchorage and reinforcement system so that seismic anchors are spaced at 16 inches on center each way

3.06 MASONRY FLASHINGS

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

B. Extend EPDM, and other masonry flashings to outside of exterior face of masonry, then trim flush.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.4 INFORMATIONAL SUBMITTALS

A. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.5 FIELD CONDITIONS

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

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

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Do not use units which contain chips, cracks, or other defects.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight, unless otherwise indicated.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Aggregate for Mortar: ASTM C144.

F. Aggregate for Grout: ASTM C404.

G. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.5 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized-steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch diameter, hot-dip galvanized-steel wire.

C. Veneer Anchors: Provide galvanized seismic anchors spaced at 16”o.c. each way.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

2.7 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type M or Type S.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

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

C. Joints:

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

3.3 LAYING MASONRY WALLS

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

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

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

3.5 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

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

3.7 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

3.8 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 48 inches.

3.9 FIELD QUALITY CONTROL

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

B. Inspections: Special inspections according to Level C in TMS 602/ACI 530.1/ASCE 6.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing prior to construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof, minimum of 1 set of tests per day.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

I. Prism Test: For each type of construction provided, according to ASTM C1314 at 28 days.

3.10 REPAIRING, POINTING, AND CLEANING

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

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.11 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shear stud connectors.
3. Shrinkage-resistant grout.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Shop primer.
8. Galvanized-steel primer.
9. Etching cleaner.
10. Galvanized repair paint.
11. Shrinkage-resistant grout.

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

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Mill test reports for structural-steel materials, including chemical and physical properties.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.

    a. Select and complete connections using schematic details indicated and ANSI/AISC 360.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles : ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type N, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

C. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

A. Headed Anchor Rods: ASTM F1554, Grade 36 straight.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

B. Threaded Rods: ASTM A36/A36M.

1. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 PRIMER

A. Steel Primer:

1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#26.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: ASTM A780/A780M.

2.6 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.
6. Surfaces enclosed in interior construction.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 3.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
   a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      1) Liquid Penetrant Inspection: ASTM E165/E165M.
      2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      3) Ultrasonic Inspection: ASTM E164.
      4) Radiographic Inspection: ASTM E94/E94M.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION 05 12 00

ISSUED FOR BID

SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. K-series steel joist substitutes.
3. Joist accessories.

1.2 ACTION SUBMITTALS

A. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Manufacturer certificates.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. New Millennium Building Systems, LLC.
2. Valley Joist.
3. Vulcraft; Nucor Vulcraft Group.

2.2 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

2.3 COATINGS

A. Joists shall be galvanized.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

C. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 05 31 00
STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

1.2 ACTION SUBMITTALS

A. Shop Drawings:

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

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 ROOF DECK

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

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.

2.3 COMPOSITE FLOOR DECK

A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60] zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.

2.4 ACCESSORIES

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

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

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

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

E. Galvanizing Repair Paint: ASTM A 780/A 780M.

F. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

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

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

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

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

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

G. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

3.3 PROTECTION

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

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Fabricated steel handrails and guardrails.
3. Shelf angles.
4. Metal ladders.
5. Ladder safety cages.
6. Miscellaneous steel trim.
7. Loose bearing and leveling plates.
8. Loose steel lintels.
9. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
10. Steel weld plates and angles for casting into concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Manufactured metal ladders.
5. Ladder safety cages.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 METALS

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

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Bars and Shapes: ASTM A276/A276M.

D. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

E. Rolled-Stainless Steel Floor Plate: ASTM A793.

F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

H. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

I. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

J. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

K. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).

L. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semired brass).

M. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.2 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 or Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum, stainless steel or nickel silver.
2. Provide bronze fasteners for fastening bronze.

B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.3 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

A. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.6 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Hot-dip Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung.
6. Galvanize and prime exterior ladders, including brackets.

2.8 LADDER SAFETY CAGES

A. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless steel fasteners.

B. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.

C. Galvanize ladder safety cages, including brackets and fasteners.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize miscellaneous steel trim.

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize bearing and leveling plates.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize loose steel lintels located in exterior walls.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION 05 50 00

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials, and application instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.
   3. Roof Blocking: meet/exceed ES-1 and FM 1-49 requirements as a component of the Flashing and Coping systems.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Separate pressure-treated blocking from metal deck with roofing felt. Attach all pressure-treated blocking with hot-dipped galvanized fasteners.

C. Install blocking in manner to resist 200 PLF load in any direction with fastening per FM Global Standards to meet the wind criteria as indicated on the drawings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories – with colors as per the A7s of the Drawings. Field verify all required dimensions prior to fabrication of casework.

1.02 QUALITY ASSURANCE

A. Quality Certification: Provide AWI Quality Certification Program inspection report and quality certification of completed work.
   1. Arrange and pay for inspections required for certification.
   2. Replace, repair, or rework all work for which certification is refused.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

B. Plastic Laminate Faced Cabinets: Custom grade.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.04 COUNTERTOPS

A. Solid Surface Custom Countertops

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self-rests, polished chrome finish, for nominal 1-inch spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4-inch centers.

D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

E. Catches: Magnetic.

F. Drawer Slides:
   1. Static Load Capacity: Commercial grade.

G. Hinges: European style concealed self-closing type, steel with polished finish.

2.07 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

D. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use concealed joint fasteners to align and secure adjoining cabinet units.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 11 13
BITUMINOUS DAMPROOFING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work includes products and application of masonry dampproofing on CMU (concrete masonry units) non-loadbearing walls prior to installation of rigid insulation.

1.02 SUBMITTALS

A. Product Data: Submit product data that provides properties of primer, bitumen, and mastics.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Bituminous Dampproofing: Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition: ASTM D4479 Type I, minimum.
   2. VOC Content: Not more than permitted by local, State, and federal regulations.
   3. Applied Thickness: 1/16 inch, minimum, wet film.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.01 APPLICATION

A. Masonry Cavity Walls: apply dampproofing to exterior surface of CMU.

B. Perform work in accordance with NRCA Roofing and Waterproofing Manual.

C. All window openings shall be wrapped with a vapor permeable barrier and mesh per industry and local standards.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Provide product data on each type of insulation specified.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation at Perimeter of Foundation: Expanded polystyrene board.

B. Insulation Inside Cavity Walls: Extruded polystyrene board.

D. Insulation in Metal Framed Construction: Batt insulation.

E. Insulation Over Roof Deck: specified in another section

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene Board Insulation: ASTM C578; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Complies with fire-resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   4. Board Size: 16 x 96 inch.
   5. Board Thickness and Thermal Resistance: 2 inches at R10
   6. Board Edges: Square.
   7. Compressive Resistance: 5 psi.

B. Extruded Polystyrene Board Insulation: ASTM C578, Type X; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Board Size: 16 x 96 inch.
   4. Board Thickness and Thermal Resistance: 1.5 inches at R7.5
   5. Compressive Resistance: 15 psi.
   6. Board Density: 1.3 lb/cu ft.

2.03 BATT INSULATION MATERIALS

A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
   4. Thermal Resistance: R19
   5. Facing: Unfaced - VERY IMPORTANT, DO NOT PROVIDE BATT INSULATION WITH ANY FACING

2.04 ACCESSORIES

A. Tape for joints

B. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.

B. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.

B. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.

3.03 BATT INSTALLATION

A. Install complete and full in all respects in framed spaces without gaps or voids. Do not compress insulation.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 21 10
ROOFING INSULATION

PART 1 GENERAL

1.01 GENERAL

A. Section includes roofing insulation to be installed over metal decking for thermal barrier and a secure substrate for roofing system.

B. Roofing insulation shall be a component of a complete roofing system that is a FM Global RoofNav Assembly.

C. Coordinate work with Sections 06 10 00, 07 52 10, 07 62 00, and 07 72 00.

1.02 SUBMITTALS

A. Roofing Insulation shall be submitted to FM Global (as part of the FM Global Checklist – Section 07 68 80 - and in conjunction with other roofing system components) for review and approval prior to submittal to Design/Owner team. Complete manufacturer's specifications shall be submitted for approval to Design/Owner team once FM Global has approved the proposed RoofNav Assembly.

1.03 MANUFACTURERS

A. Approved Manufacturers:

1. GAF
2. Soprema Inc.
3. Johns Manville
4. Or Pre-Bid Approved Equal

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Roof insulation is to be installed over entire roof per A5 sheet series.

2.02 FOAM BOARD INSULATION MATERIALS

A. Polyisocyanurate Board Insulation with Facers Both Sides: Rigid cellular foam, complying with ASTM C1289; Type II, Class 2, polymer bonded glass fiber mat both faces. Basis of Design is GAF ENERGYGUARD ™ BARRIER POLYISO INSULATION. Alternate manufacturers shall meet or exceed specifications of the Basis of Design product.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Compressive Strength: 16 psi
4. Board Size: 48 x 96 inch. Board Edges: Square.
5. Board Thickness: 4.2 inches total or as required to achieve LTTR R-value, may be two layers for this total thickness.
6. LTTR R-value shall be 24.8

B. Tapered Insulation Basis of Design is GAF EnergyGuard™ NH Ultra Tapered Polyiso Insulation**.** Alternate manufacturers shall meet or exceed specifications of the Basis of Design product.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

3. Compressive Strength: 16 psi

B. Cover Board Basis of Design is GAF (GP) DensDeck Roof Board**.** Alternate manufacturers shall meet or exceed specifications of the Basis of Design product.
   1. Board Thickness: .75 inches
   2. R-value shall be .67

2.03 ACCESSORIES

A. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions if recommended by roofing manufacturer and per FM Global RoofNav.

B. Adhesive and fasteners: Type recommended by insulation manufacturer and per FM Global RoofNav for application.

PART 3 EXECUTION

3.01 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

A. Board Installation Over Roof Deck, General:
   1. Install roofing insulation mechanically secured to roof deck with fasteners in compliance with approved FM Global Roof Nav assembly.
   2. Secure Cover Board and Tapered Insulation in compliance with approved FM Global RoofNav assembly.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 41 14
STANDING SEAM METAL ROOF

PART 1 GENERAL

1.01 SUMMARY

A. Section includes standing-seam metal roof panels.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Complete engineered system by manufacturers engineering department including:

1. Calculate wind uplift using ASCE-10
2. Calculate clip spacing
3. Verify stress and deflection of panel meet project design load
4. Verify project design load conditions with ASTM 1592
5. Verify project design load conditions with UL580 class 90
6. Air Infiltration: No air infiltration with 20 psf pressure differential per ASTM E 1680
7. Air Exfiltration: No air exfiltration with 20 psf pressure differential per ASTM E 1680
8. Water Resistance: No water penetration under 5 gal/hr spray at 20 psf pressure differential per ASTM E 1646
9. UL90 Rating: 24 ga. steel or 0.032" aluminum panels with stainless steel clips at maximum of 3'-0" o.c. installed over Deck System.

1.03 SUBMITTALS

A. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

B. Samples:

1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.
2. Include similar Samples of trim and accessories involving color selection.

C. Qualification Data: For Installer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Installer of sheet metal roofing for a minimum of 10 years documented experience.

B. Panel Manufacturer: Minimum of 10 years' experience in manufacturing architectural roof panels in a permanent stationary indoor facility. Provide facility information if requested.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Store panels, flashings and accessories ion a safe, dry environment under a waterproof breathable covering to prevent water damage. Allow for adequate ventilation to prevent condensation. Panels and flashings with strippable film shall not be stored in direct sunlight.

D. Remove strippable protective covering on metal panels during installation.

E. Upon receipt of delivery of metal panel system, and prior to signing the delivery ticket, the installer is to examine each shipment for damage and for completion of the consignment.

1.06 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.07 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.08 WARRANTIES

A. Material and Workmanship Warranty: Manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.

b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Paint Finish Warranty: 30 years from date of Substantial Completion. If metallic colors are used, the “fade” part of the warranty shall be removed.

1. 30 years for Kynar type finish.

C. Installer’s Warranty: Submit installer's warranty, signed by Installer, covering the Work of this Section, including all components of roof panels for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion

D. Manufacturer’s Weather-tight Warranty:

1. Warranty Period: Twenty years from date of Substantial Completion

PART 2 PRODUCTS

2.1 PANEL DESIGN

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for a weathertight installation.

B. Roof panels shall be standing seam Tite Loc Plus(Peterson Aluminum, or equal), in 12” widths with 2” high seams that are mechanically seamed together at 180 degrees.

Panels to be produced with Factory supplied hot melt mastic in the seams.

- Panels to be produced:. With Striations
- Panels to be designed for attachment with concealed fastener clips, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for the expansion and contraction of the entire roof system resulting from variations in temperature.Forming: Use continuous end rolling method. No end laps on panels.

2.2 PRODUCTS

A. This project is detailed around the Tite Loc Plus Panel of Petersen Aluminum Corporation.

2.3 MATERIALS AND FINISHES

A. Preformed roofing panels shall be fabricated of 22 GA Galvalume Steel.
B. Color shall be UoM Blue
C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.
E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer or their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
F. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.
G. Accessories/Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces, except at designed points of roof panel fixity
H. Roofing Underlayment
    1. On all surfaces to be covered with roofing material, furnish and install a 40 mil “Peel & Stick membrane”, required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, by one of the following manufacturers:
        a. W.R Grace “Ice & Water Shield”
        b. Cetco Strongseal
        c. Carlisle CCW WIP 300HT
        d. Tamko TW Tile and Metal Underlayment
    2. Underlayment shall be laid in horizontal layers with joints lapped toward the eaves a minimum of 6”, and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
J. Sealants
    1. Exterior grade silicone sealant recommended by roofing manufacturer

2.4 FABRICATION

A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer’s standard product fabrication.

B. Fabricate components of the system in factory, ready for field assembly.
C. Fabricate components and assemble units to comply with fire performance requirements specified.
D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.
B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FASTENERS

A. Secure units to supports
B. Place fasteners as indicated in manufacturer's standards.

3.3 INSTALLATION

A. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

Payment will be made under:

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Concealed-fastener, Vertical and Horizontal metal wall panels.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each type of exposed finish, prepared on samples of size indicated below.

1 Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

2 Include Samples of trim and accessories involving color selection.

D. Qualification Data: For Installer.

E. Product Test Reports: For each product, for tests performed by a qualified testing agency.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

H. Maintenance Data: For metal panels to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.6 FIELD CONDITIONS

A. Field dimensions shall be taken prior to fabrication to verify jobsite conditions.

B. the Vertical and Horizontal panels will be installed as wall or fascia panels only.

C. Maximum panel length is 30'. Backer plate is required for butting the panels end to end, do not end lap panels, contact factory for details.

1.7 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Manufacturer Warranty: Manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.

b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Paint Finish Warranty: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Refer to Manufacturer's product data for specific performance criteria.

1. Air Infiltration: ASTM E283 0.010 cfm/ft2 @ 20 psf
2. Water Penetration: ASTM E331 No water leakage @ 20 psf
3. Structural Performance: ASTM E330

b. 24 ga Steel

i. 54.55 psf @ 24" spacing

ii. 33.33 psf @ 48" spacing

4. Class 4 impact: UL2218
5. Class A fire: UL790

2.2 MANUFACTURER

1. Fabral
2. Approved equal

2.3 CONCEALED-FASTENER, METAL WALL PANELS

A. Vertical Panel Profile

Select Series 12 Concealed Fastener Panel: (12-R0)

1. Galvanized Steel:

a. Material Gauge: 24 gauge.

b. Color: Refer to A2 Sheet series.

2. Panel Coverage: 12 inches.

3. Panel Depth: 1-1/2 inches.

B. Horizontal Panel Profile

Silhouette HCF Series Concealed Fastener Panel: (12-1)

1. Galvanized Steel:

a. Material Gauge: 24 gauge.

b. Color: Refer to A2 Sheet series.

2. Panel Coverage: 12 inches.

3. Panel Depth: 7/8 inches.

2.4 MATERIALS

A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality, preprinted by the coil-coating process to comply with ASTM A 755/A 755M.

2.5 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub framing and Furring: Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, framed openings, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are non staining, and do not damage panel finish.

2.6 FABRICATION

A. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

B. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.7 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. 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 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.

C. Steel Panels and Accessories:

1. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install sub framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air-or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Locate and space fastenings in uniform vertical and horizontal alignment.
4. Install flashing and trim as metal panel work proceeds.
5. Locate panel butt joints over structural supports. Stagger panel splices a four-panel lap splice condition.
6. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
7. Provide weathertight escutcheons for pipe-and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
2. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
3. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
4. Flash and seal panels with weather closures at perimeter of all openings.

6. Watertight Installation:

A. Provide sealant or tape between panels and protruding equipment, vents, and accessories.

B. At panel splices, nest panels with minimum 1/8” gap between panels at butt joint, sealed with sealant and integral backer splice plate.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

A. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.

B. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

ISSUED FOR BID

SECTION 07 42 57
PREFABRICATED METAL SUNSCREENS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fixed modular overhead prefabricated metal sunscreens.

1.02 SUBMITTALS

A. Shop Drawings: Submit shop drawings for components and application conditions of metal canopy units which are not fully dimensioned or detailed in product data. Provide sections and details at connections.

B. Samples: Submit a sample of the color to be matched in the A2 sheet series.

1.03 QUALITY ASSURANCE

A. General: Provide modular units, which are complete assemblies, produced by one manufacturer/fabricator.

B. All structural framework elements are single source responsibility of fabricator.

C. Fabricator's Qualifications: Where indicated units require custom fabrication, provide units fabricated by manufacturer, which is skilled, and with a minimum of five (5) years of experience in similar work. Where units cannot be fully shop-fabricated, complete fabrication work at project site.

1.02 WARRANTY

A. Louvers and fascia shall be warranted by the supplier for a minimum of 10 years. Labor to replace defective louvers or fascia shall be warranted for 1 year. Attachment shall be warranted against defective material and workmanship for a period of 1 year by canopy manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Smooth aluminum:

1. Extrusions: Meeting requirements of ASTM B221, alloy 6061-T6, 6063-T5, or 6063-T6.

B. Anchorage Fasteners, Neoprene washers, and Clips: Manufacturer's standard type, compatible with materials being secured, of size and spacing sufficient to resist indicated loads.

C. Sealants: Single component silicone, in color to match sheets and extrusions.

D. Accessories: Flashings, brackets, and other items as necessary for complete system.2.03

E. Louvered blades in pre-assembled sections (.11 extruded aluminum)

2.02 FINISHES

A. Factory Applied Polyester Paint Finish: Comply with AAMA, 603.8, chemically cleaned, conversion coated primer, followed by factory applied baked polyester enamel coating. Color: As specified in the A2 sheet series.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install metal canopy units in manner indicated to comply with manufacturer's instructions. Position units' level, plumb, secure at proper height and location relative to adjoining window units, openings and other related work. Secure anchor units with proper clips, brackets, and anchorages, suited to type of mounting indicated conversion.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

Payment will be made under:

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 42 65
PREFABRICATED METAL CANOPIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fixed modular overhead hanger rod style prefabricated metal canopies.

1.02 SUBMITTALS

A. Shop Drawings: Submit shop drawings for components and application conditions of metal canopy units which are not fully dimensioned or detailed in product data. Provide sections and details at connections.

B. Samples: Submit color charts showing range of colors to match A2 drawing series color.

C. Design Requirements:

1. Design Load: 20 pounds per sq. ft.
2. Design Wind Speed (Velocity): 90 mph.
3. Minimum Roof Deck Thickness: Capable of sustaining a concentrated walking load of 200lbs.
4. Maximum Deflection Limit: L/120 of span.

1.03 QUALITY ASSURANCE

A. General: Provide awning units, which are complete assemblies, produced by one manufacturer/fabricator.

B. All structural framework elements are single source responsibility of fabricator.

C. Fabricator's Qualifications: Where indicated units require custom fabrication, provide units fabricated by shop which is skilled, and with a minimum of five (5) years of experience in similar work. Where units cannot be fully shop-fabricated, complete fabrication work at project site.

1.02 WARRANTY

A. Decking and fascia/gutter shall be warranted by the supplier for a minimum of 10 years. Labor to replace defective decking or fascia/gutter shall be warranted for 1 year. Attachment shall be warranted against defective material and workmanship for a period of 1 year by canopy manufacturer.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURS

A. Parasol Awnings, LLC

B. Approved equal

2.02 MATERIALS

A. Smooth aluminum:

1. Extrusions: Meeting requirements of ASTM B221, alloy 6061-T6, 6063-T5, or 6063-T6.

B. Anchorage Devices, Clips and Fasteners: Manufacturer's standard type, compatible with materials being secured, of size and spacing sufficient to resist indicated loads. Above roof deck, utilize fasteners with neoprene washers.

C. Sealants: Single component silicone, in color to match sheets and extrusions.

D. Accessories: Flashings, brackets, and other items as necessary for complete system.2.03

2.03 FINISHES

A. Factory Applied Polyester Paint Finish: Comply with AAMA, 603.8, chemically cleaned, conversion coated primer, followed by factory applied baked polyester enamel coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install metal canopy units in manner indicated to comply with manufacturer's instructions. Position units level, plumb, secure at proper height and location relative to adjoining window units, openings and other related work. Secure anchor units with proper clips, brackets, and anchorages, suited to type of mounting indicated conversion.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

Payment will be made under:

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 42 93
VENTED METAL SOFFIT PANELS

PART 1 GENERAL

1.01 SUMMARY
A. Section includes: pre-finished, vented, prefabricated, through-fastened, concealed fastener soffit system and accessories.

1.02 REFERENCES
A. American Society for Testing and Materials (ASTM)
   1. ASTM A 792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process.
   2. ASTM B 209: Aluminum and Aluminum Alloy Sheet and Plate.
B. Sheet Metal and Air Condition Contractors National Association, Inc. (SMACNA)
   1. SMACNA Architectural Sheet Metal Manual, 1993 Edition.
C. American Iron and Steel Institute (AISI)
   1. AISI Cold Formed Steel Design Manual
D. Aluminum Association
   1. Aluminum Design Manual
E. Metal Construction Association (MCA)
   1. Preformed Metal Wall Guidelines
F. Code references
   1. ASCE, Minimum Loads for Buildings and Other Structures
   2. IBC International building Code

1.03 SYSTEM DESCRIPTION
A. Performance Requirements: Provide factory formed, pre-finished, through-fastened, concealed fastener, soffit system, that has been pre-tested and certified by manufacturer to comply with specified requirements under installed conditions.
   1. The metal roofing/siding system including required trim members shall meet the specified requirements for wind loads.
   2. The panel will have ⅜” deep ribs, 4¾" o.c. Adjacent panels shall lock into place, hiding the screws.
   3. The soffit panels are available in solid (non-perforated), fully vented (perforated), or 1/3 vented (perforated) form.
B. Structural Requirements: Engineer panels for structural properties in accordance with latest edition of American Iron and Steel Institute’s Cold Formed Steel Design Manual using “effective width" concept and Aluminum Association’s Aluminum Design Manual.

1.04 SUBMITTALS
A. Product Data: submit manufacturer's specifications, standard profile sheet, product data brochure and finish warranty.
B. Shop Drawings: shop drawings showing soffit with layout of panels, screws, underlayment and sections of each flashing/trim condition shall be submitted for approval prior to fabrication. Drawings shall contain material type, metal thickness and finish. Drawings shall distinguish between factory and field fabrication.
C. Samples:
   1. Submit sample 12" long x full width panel, showing proposed metal gauge, seam profile and specified finish.
   2. Submit manufacturers standard colors for Architect's selection.
D. Certification: Submit manufacturer's certification that materials and finishes meet specification requirements.

1.05 QUALITY ASSURANCE

A. Panel manufacturer shall have a minimum of ten (10) years of experience in manufacturing exposed fastener roofing and siding panels in a permanent stationary indoor facility.

B. Panel installer shall have a minimum of two (2) years experience in the installation of exposed fastener roofing and siding and show evidence of successful completion of at least three (3) projects of similar size, scope, and complexity.

1.06 DELIVERY, STORAGE, and HANDLING

A. Panels and flashings shall be protected and properly packaged to protect against transportation damage in transit to the jobsite.

B. Upon delivery, exercise care in unloading, stacking, moving, storing, and erecting panels and flashings to prevent twisting, bending, scratching, or denting.

C. Store panels and flashings in a safe, dry environment under a waterproof covering to prevent water damage. Allow for adequate ventilation to prevent condensation. Panels and flashings with strippable film shall not be stored in direct sunlight.

D. Upon installation immediately remove strippable film from panels and flashings. Protect panels and flashings from foot traffic and from all other trades.

1.09 WARRANTIES

A. Panel manufacturer shall provide a twenty (20) year warranty on the paint finish covering chalking, cracking, checking, chipping, blistering, peeling, flaking, and fading.

B. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight conditions.

PART 2 PRODUCT

2.01 PRODUCT DESCRIPTION

A. Flush seamed, hidden rib, vented, pre-finished metal panels fastened to furring channels.

B. Pan spacing of 14". Rib height shall be ⅜".

C. Panels shall be directly fastened to the substrate.

D. The fasteners shall be hidden when adjacent panels are installed.

E. The panel shall have an overlapping sidelap feature that hides the fasteners.

2.02 MATERIALS AND FINISHES

A. Panel materials

1. 24 gauge, Grade 40 (40 ksi yield strength) structural steel with AZ50 (0.50 oz./ft.2) aluminum-zinc alloy coating, both conforming to ASTM A 792.
2. 0.032", 3105 H14 or equivalent (20 ksi yield strength) aluminum alloy conforming to ASTM B 209.

B. Texture: panels shall be smooth.

C. Finish: Refer to manufacturer's standard color card to determine appropriate finish and color. All panels shall receive a factory-applied Kynar® 500/Hylar® 5000* coating conforming to the following:

1. Metal preparation: all metal shall have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with an acid rinse, and thorough drying.
2. Prime coating: a base coat of epoxy paint, specifically formulated to interact with the top-coat, shall be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 ± 0.05 mils. This prime coat shall be oven cured prior to application of finish coat.

3. Exterior coating: a Kynar® 500/Hylar® 5000 coating shall be applied over the primer by roll coating to a dry film thickness of 0.80 ± 0.05 mils for a total dry film thickness of 1.00 ± 0.10. This finish coating shall be oven-cured.
4. Interior coating: a washcoat shall be applied on the reverse side over the primer by roll coating to a dry film thickness of 0.30 ± 0.05 mils for a total dry film thickness of 0.50 ± 0.10 mils. The washcoat shall be oven-cured.
5. Color: the color of the exterior finish shall be per A2 drawing series as chosen from the manufacturer's standard color chart.
6. Physical properties: the coating shall conform to the manufacturer's standard performance criteria as listed by certified test reports for fade, chalk, abrasion, humidity, adhesion, pollution resistance, and others as required and standard within the industry.

2.03 ACCESSORIES

A. Flashing and Trim
   1. All flashing and trim shall be of the same material, gauge, finish, and color as the soffit panels and fabricated in accordance with standard SMACNA procedure and details.

B. Fasteners
   1. All screws shall be aluminum, plated steel, or stainless steel. They shall have a combination steel and EPDM washer.
   2. Screws for panel to structurals shall be of the type and size and of sufficient length to penetrate the supporting member by 1".
   3. Screws for flashings and sidelaps shall be #14 HHA x ¾" sheet metal stitch screws. All accessories, flashings, and sidelaps shall be fastened 12" o.c.

C. Caulking shall be a polyurethane where it is exposed and there is no thermal movement. All caulking or sealing shall be done in a neat manner with excess caulking or sealant removed from exposed surfaces.

D. Caulking shall be non-skinning, non-hardening gun grade butyl sealant or butyl sealant tape with a minimum thickness of ⅛" where it is concealed and where thermal movement must be accommodated. All caulking or sealing shall be done in a neat manner with excess caulking or sealant removed from exposed surfaces.

2.04 FABRICATION

A. Panels are not lappable.

B. Panels shall be roll formed on a stationary industrial type rolling mill to gradually shape the sheet metal. Portable rollformers, rented or owned by the installer, are not acceptable.

C. Fabricate flashings from the same material as the roof system.

2.05 SOURCE QUALITY

A. Source Quality: obtain metal panels and accessories from a single manufacturer.

B. Fabrication tolerances
   1. Rib height: ⅜" ± ⅛".
   2. Panel shearing length: ± ¼" maximum.
   3. Follow tolerances in MCA's Preformed Metal Wall Guidelines.

C. Tests and inspections

D. Verification of performance

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product cartons for installation.

3.02 EXAMINATION

A. Installer shall:
   1. Inspect substrate to verify deck layout complies with shop drawing layout and is smooth, even, sound, and free of depressions.
   2. Report variations and potential problems in writing to the architect.

3.03 INSTALLATION

A. Conform to the standard set forth in the SMACNA architectural sheet metal manuals and the approved shop drawings detailed for the project.
B. Install panels plumb, level, and straight with the ribs parallel, conforming to the design as indicated.
C. Install panel system so it is watertight, without waves, warps, buckles or distortions, and allow for thermal movement considerations.
D. Abrasive devices shall not be used to cut on or near roof or wall panel system.
E. Apply sealant tape or caulking as necessary at flashing and panel joints to prevent water penetration.
F. Remove any strippable film immediately upon exposure to direct sunlight.
G. Vapor retarder: The joints, perimeter, and all openings shall be sealed per the manufacturer's instructions to provide a continuous vapor retarder.

3.04 CLEANING

A. Dispose of excess materials and debris from jobsite.
B. Remove filings, grease, stains, marks, or excess sealants from roof panel system to prevent staining.
C. Protect work from damage from other trades until final acceptance.

END OF SECTION

SECTION 07 52 10

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. SBS-modified bituminous membrane roofing – Johns Mansfield is basis of design. Other manufacturers listed below.

B. APPROVED MANUFACTURES OF ROOFING MEMBRANE SYSTEMS

1. John Mansville
2. Soprema Inc. Roofing System
3. Or Pre-Bid Approval Equal. Other manufacturers are allowed to bid but must submit the FM Global Assembly proposed prior to bid. No product substitutions are approved or considered after Bid.

C. Basis of Design:

3 Ply Modified Bitumen over a 3/4" coverboard, 4.2” of insulation, and metal decking.

Roofing membrane shall be a component of a complete roofing system that is a FM Global RoofNav Assembly.

D. Coordinate work with Sections 06 10 00, 07 21 00, 07 62 00, and 07 72 00.

1.01 SUBMITTALS

A. Roofing Insulation shall be submitted to FM Global (as part of the FM Global Checklist – Section 07 68 80 - and in conjunction with other roofing system components) for review and approval prior to submittal to Design/Owner team. Complete manufacturer’s specifications shall be submitted for approval to Design/Owner team once FM Global has approved the proposed RoofNav Assembly.

1.02 REFERENCES

A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:

1. ASTM D 1079 “Terminology Relating to Roofing and Waterproofing.”
2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual.”
3. Roof Consultants Institute “Glossary of Roofing Terms” for definition of terms related to roofing work in this Section.

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

C. Hot Roofing Asphalt: Roofing asphalt heated to temperature recommended by roofing manufacturer to flux modified roofing membrane, measured at the mop cart or mechanical spreader immediately before application.

1.03 DESIGN CRITERIA

A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure. Prior to ordering materials and commencing work, there shall be a Pre-Construction Roofing Conference which shall include the following persons:

1. Licensed Roofing Contractor
2. Roofing Manufacturer's Representative
3. MSCAA Project Manager
4. Property Maintenance Representatives
5. Design Consultant/Architect

B. The purpose of this meeting shall be to answer any questions, discuss issues, and resolve potential problems associated with the project. At the conclusion of this meeting and prior to submitting a bid, the Contractor shall inspect all existing roof surfaces and notify the Owner in writing (through the Consultant) of any conditions or defects that will prevent the installation of his proposed roofing system.

C. The roofing material manufacturer shall furnish a written warranty for twenty (20) years from date of Substantial Completion. This warranty shall cover all labor and material necessary to keep the roofing membrane watertight for the period of the warranty and is to have an unlimited penal sum. Warranty shall include the entire roofing system inclusive of installed products from this Section and roofing products installed as specified in Sections 06 10 00, 07 21 00, 07 62 00, and 07 72 00**.**

D. The Contractor shall furnish a written warranty for five (5) years from date of substantial completion. This warranty is to cover all labor and material and is to have an unlimited penal sum. Warranty shall include a maximum (48 hr) response time.

E. All installed and completed roofs shall be tested prior to acceptance by the MSCAA.

F. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

H. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE-7.

I. FMG Listing: Roofing membrane, base flashings, and component materials shall comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

Roofing system shall comply with

a. Fire/Windstorm Classification: Class 1A-90 minimum (Field 1-60),(Perimeter 1-90),(Corners 1-120)

b. Hail Resistance: SH.

J. Contractor shall submit the FM Global Checklist to FM Global for proposed roofing assembly for approval. No materials shall be ordered, and no work shall begin until Contractor has received FM Global's approval of the proposed assembly.

1.04 SUBMITTALS

A. Submittals shall include complete technical data, shop drawings, samples and manufacturer's certification of installer experience with the specified materials. Product Data: Manufacturer's data sheets for each product to be provided.

B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details attachment to other Work, including:

1. Base flashings, cants, and membrane terminations.

2. Tapered insulation, including slopes.

3. Crickets, saddles, and tapered edge strips, including slopes.

4. Insulation fastening patterns.

C. Verification Samples: Provide for each product specified.

D. Maintenance Data: Refer to Johns Manville's latest published documents on www.specJM.com.

E. Guarantees: Special guarantees specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Test Reports:

1. Roof drain and leader test or submit plumber's verification.

2. Roof deck fastener pullout test.

E. Source Limitations: Obtain all components from the single source roofing system manufacturer guaranteeing the roofing system. All products used in the system shall be labeled by the single source roofing manufacturer issuing the guarantee.

F. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having

jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.07 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

PART 2 PRODUCTS

2.01 ROOFING MEMBRANE PLIES

A. Glass-Fiber Base-Ply Sheet: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt. Basis of Design: GlasPly IV

2.02 SBS-MODIFIED ASPHALT-SHEET MATERIALS

A. Roofing Membrane Cap Sheet: ASTM D 6163, Grade G, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified. Basis of Design: DynaGlas FR

2.03 BASE FLASHING SHEET MATERIALS - SBS

A. Flashing Sheet ASTM D 6221, glass-fiber and polyester reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified. Basis of Design: DynaFlex

2.04 AUXILIARY ROOFING MEMBRANE - BITUMINOUS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.

B. Roofing Asphalt: ASTM D 312, Type IV.

C. Asphalt Primer: ASTM D 41. Basis of Design: Asphalt Primer

D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application. Basis of Design: MBR Utility Cement

E. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, trowel-grade, cold-applied adhesive specially formulated for compatibility and use with flashing applications. Basis of Design: MBR Flashing Cement

F. Mastic Sealant: As required by Johns Manville.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer. Basis of Design: All Purpose Fasteners and Plates

H. Roofing Granules: Ceramic-coated roofing granules matching specified cap sheet, provided by roofing system manufacturer.

I. Walkway Pads: Shall be 36” x 48” x 3/8” min. Reinforced, Asphaltic Composition with slip resistant mineral granule surface.

J. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.05 AUXILIARY ROOFING SYSTEM COMPONENTS

A. Metal Flashing Sheet: specified in Division 07 Section

2.06 COVER BOARD

A. Cover Board: specified in Division 07 Section

2.07 ROOF INSULATION

A. Roof Insulation: specified in Division 07 Section

2.08 TAPERED INSULATION

A. Tapered Insulation: specified in Division 07 Section

2.09 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer. Basis of Design: UltraFast Fasteners and Plates

C. Insulation Cant Strips: ASTM C 728, perlite insulation board. Basis of Design: FesCant Plus

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements affecting performance of roofing system:

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 INSULATION INSTALLATION

A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes greater than 45 degrees per manufacturer’s instruction.

D. Install tapered insulation under area of roofing to conform to slopes indicated.

E. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with like material.

F. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall thickness is 1.5 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

G. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

H. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

I. Loose Laid Insulation with Top Insulation Layer Mechanically Fastened: Loose lay insulation with staggered joints and secure top layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type to deck type.

1. Fasten top layer according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.

2. Fasten top layer to resist uplift pressure at corners, perimeter, and field of roof.

J. Proceed with installation only after unsatisfactory conditions have been corrected.

3.05 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with cover board.

1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Preliminarily Fastened Insulation for Mechanically Fastened Systems: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.

F. Adhered Cover Board: Adhere cover board to substrate as follows:

1. Install in a solid mopping of hot roofing asphalt according to roofing system manufacturer’s instruction.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Asphalt Heating: Heat roofing asphalt to temperature recommended by roofing manufacturer to flux modified membrane. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.

G. Substrate-Joint Penetrations: Utilize 15# roofing felt over metal deck to prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.07 ROOFING MEMBRANE INSTALLATION

A. Install two ply sheets and one modified bituminous cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Adhere to substrate in a solid mopping of hot roofing asphalt applied at temperatures recommended by roofing system manufacturer.

2. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.

2. Apply roofing granules to cover exuded bead at laps while bead is hot.

C. Install roofing membrane sheets so side and end laps shed water.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.08 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.

2. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at EVT. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing with a strip of glass-fiber fabric set in MBR Flashing cement.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.

C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

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

3.10 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 DESCRIPTION

A. Sheet metal for all gutters, copings, downspouts, leader-heads, fascia, flashing, trim.

B. Work under this section shall be by the Roofing and Siding installer for a complete installation.

C. Roofing copings, flashings and trim shall be a component of a complete roofing system that is a FM Global RoofNav Assembly.

D. Coordinate work with Sections 06 10 00, 07 21 10, 07 52 10, and 07 72 00.

1.02 SUBMITTALS

A. Roofing copings flashings and trim shall be submitted to FM Global (as part of the FM Global Checklist – Section 07 68 80 - and in conjunction with other roofing system components) for review and approval prior to submittal to Design/Owner team. Complete manufacturer's specifications shall be submitted for approval to Design/Owner team once FM Global has approved the proposed RoofNav Assembly.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, shop pre-coated with PVDF coating.
   1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: per A2 drawing series.

2.02 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Slip Sheet: Rosin sized building paper.

C. Primer: Zinc chromate type.

D. Plastic Cement: ASTM D4586, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

D. SMACNA Architectural Sheet Metal Manual.

PART 3 EXECUTION

3.01 INSTALLATION

A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 68 80
FM GLOBAL CHECKLIST

PART 1 GENERAL

N/A

PART 2 PRODUCTS

N/A

PART 3 EXECUTION

3.01 PROCEDURE

A. The attached checklist shall be completed and submitted to FM Global for review, comment, re-submittal, and approval prior to submitting insulation, roofing, sheet metal, and flashing products to the Designer/Owner for their review and approval.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

CHECKLIST FOR ROOFING SYSTEM

CONTACT INFORMATION: **INDEX NUMBER:**

ROOFING CONTRACTOR (NAME & ADDRESS)	TELEPHONE NO.:	**FAX:**
	E-MAIL ADDRESS:	**CONTACT:**
CLIENT (NAME & ADDRESS)	TELEPHONE NO.:	**FAX:**
	E-MAIL ADDRESS:	**CONTACT:**

OVERVIEW OF WORK: *(Submit 1 form per roof area)*

Building Name & Number:		
Building Dimensions: Length: *ft/m;*	Width: *ft/m.;*	Height *ft/m.*
Roof Slope:		
Parapet Height ,max *(in./m)*:	Parapet Height ,min *(in /m):*	
Type of Work: ☒ New Construction ☐ Recover (New roof over existing Roofing System) ☐ Reroof (New cover/remove existing roofing system to deck) ☐ Other		
FM Approved RoofNav Assembly Numbers:		

ROOF SURFACING:

☐ None	
☐ Coating	*(Trade Name/Application Rate)*
☐ Granules	*(Application Rate)*
☐ Gravel/Slag 400 lb/100sf	*(Application Rate)*
☐ Ballast: ☐ Stone Size ☐ Pavers *(Beveled or square edge)*; ☐ Other:	
Ballast Weight (psf): Field: Perimeter: Corners:	

ROOF COVER/MEMBRANE:
(Please provide ALL applicable details including trade name, type, number of plies, thickness, reinforced, adhesive)

☐ Panel: ☐ Through Fastened Metal ☐ Standing Seam metal ☐ Fiber Reinforced Plastic (FRP) ☐ Other:			
☐ Built Up Roofing (BUR)			
☒ Modified Bitumen			
☐ Single Ply:	☐ Adhered	☐ Fastened	☐Ballasted
☐ Spray Applied			
☐ Other:			

BASE SHEET:
(Please include Trade Name, Type, and Width)

☐ None		
Trade Name:		Width: ☐ 36 In. ☐ 1 meter (39 In.)
☐ Fastened		☐ Adhered
☐ Secured per RoofNav	**OR**	☐ Per FM Global Loss Prevention Data Sheet 1-29
Comments:		
☐ Air Retarder		
☐ Vapor Retarder		

INSULATION

Layer	Trade Name	Thickness (In.)	Fastened	Adhered	Tapered
1. Top			☐	☐	☐
2. Next			☐	☐	☐
3. Next			☐	☐	☐
4. Next			☐	☐	☐

☐ Glass Fiber/Mineral Wool/Batt	☐ Facer Type/Vapor Barrier
☐ Thermal Barrier	

CHECKLIST FOR ROOFING SYSTEM

☐ Other:
☐ None

DECK:
(Please include manufacturer, type, yield strength, thickness/gage, etc.)

☒ Steel: intermed rib 22 ga	
☐ LWIC (Form Deck):	☐ Cementitious Wood Fiber:
☐ Concrete: ☐ Pre-cast panels or ☐ Cast in Place	
☐ Wood	
☐ Fiber Reinforced Cement	☐ Fiber Reinforced Plastic
☐ Gypsum: ☐ Plank	☐ Poured
☐ Other:	
Comments:	

ROOF STRUCTURE (Include Size, Gage, Etc.):

☐ Purlins ☐ "C" OR ☐ "Z"		
☒ Joists ☐ Wood OR ☒ Steel		
☐ Beams ☐ Wood OR ☐ Steel		
☐ Other:		
Spacing: Field:	Perimeter:	Corners:
Comments:		

FASTENERS USED IN ROOF ASSEMBLY:

Roof Cover Fasteners: Trade Name: TO BE COMPLETED BY CONTRTR		Length:	Diameter:
Stress Plate/Batten:			
Spacing: Field: X	Perimeter: X	Corners: X	
Insulation Fasteners: Trade Name:	Type:		
Size:	Stress Plate:		
Spacing: Field:	Perimeter:	Corners:	
Deck Or Roof Panels Fasteners: Trade Name:	Type:		
Length:	Size Washer:		
If Weld: Size:	Weld:	Washer:	
Deck Side Lap Fasteners: Field: X	Perimeter: X	Corners: X	
Spacing: Field: X	Perimeter: X	Corners: X	
Base Sheet Fasteners Trade Name:	Type:		
Head Diameter:	Length:		
Spacing: (Attached Sketches as necessary) Spacing Along Laps: Field:	Perimeter:	Corners:	
No. Intermediate Rows: Field:	Perimeter:	Corners:	
Spacing Along Intermediate Rows: Field:	Perimeter:	Corners:	

PERIMETER FLASHING:
(Attach a detailed sketch of metal fascia, gravel stop, nailer, coping, etc.)

☒ FM Approved Flashing	☐ Per FM Global Loss Prevention Data Sheet 1-49
☐ Other:	Comments:

DRAINAGE:

For new construction: Has roof drainage been designed by a Qualified Engineer per FM Global Loss Prevention Data Sheet 1-54 and the local building code? ☒ Yes ☐ No (Attach details)
For re-roofing and recovering: will the roof drainage be changed from the original design (for example: drain inserts, drains covered or removed, new expansion joints, blocked or reduced scupper size? ☐ Yes ☐ No If yes, were the changes reviewed by a Qualified Engineer? ☐ Yes ☐ No (Attach details)
Is secondary (emergency) roof drainage provided per FM Global Data Sheet 1-54? ☒ Yes ☐ No (Attach details)

CHECKLIST FOR ROOFING SYSTEM

FM Global OFFICE REVIEW
(Please leave blank for FM Global Office Review)

WIND:

Design Wind Speed: *(mph)*	Ground Terrain: ☐ B ☐ C ☐ D
Uplift Pressure in field: *(psf)*	Uplift Rating Required:
Adequate Uplift Rating Provided:	Adequate? ☐ Yes ☐ No

FIRE:

Internal Assembly Rating:	☐ Class 1	☐ Class 2	☐ Non-Combustible	
External Fire Rating:	☐ Class A	☐ Class B	☐ Class C	☐ None
Concealed Spaces?	☐ Yes	☐ No	Sprinklers below Roof?	☐ Yes ☐ No
Adequate?	☐ Yes	☐ No		

HAIL:

Hail Rating Needed?	☐ SH	☐ MH	☐ None	Hail Rating Provided?	☐ SH	☐ MH ☐ None
Adequate?	☐ Yes	☐ No				

COLLAPSE:

If standing seam, has collapse been reviewed? ☐ Yes ☐ No

COMMENTS:

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Submit manufacturer's technical data.

PART 2 PRODUCTS

2.01 ROOF HATCHES, MANUAL AND AUTOMATIC OPERATION

A. Roof Hatches: Factory-assembled steel frame and cover, complete with operating and release hardware.

B. Frames/Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
   1. Material: Galvanized steel, 14 gage, 0.0747 inch thick.
   2. Finish: Factory pre-finished baked-on enamel – dark bronze color.
   3. Insulation: 1 inch rigid glass fiber, located on outside face of curb.

C. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.
   4. Latch: Upon closing, engage latch automatically and reset manual release.
   5. Locking: Padlock hasp on interior.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing weather integrity.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 07 72 33

ROOF HATCH RAIL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Work Included: Provide factory-fabricated fixed hatch railing system.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data.

B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.03 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years' experience manufacturing similar products.

B. Installer: A minimum of 2 years' experience installing similar products.

C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.05 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. ACUDOR

B. Basis-of-Design

C. Approved equal

2.02 HATCH RAIL SYSTEM

A. The hatch rail system shall be field assembled and installed per the manufacturer's instructions.

B. Performance characteristics:

1. High visibility safety yellow powder coat paint finish.

2. Hatch rail system shall attach to the cap flashing of the roof hatch and shall not penetrate any roofing material.
3. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.29 and shall meet OSHA strength requirements with a factor of safety of two.
4. Corrosion resistant construction with a five-year warranty.
5. Hinged gate shall ensure continuous barrier around the roof hatch.
6. Self-closing gate hinge and positive latching system provided with hatch rail system.

C. Posts and Rails: 1-1/4" pipe

D. Hardware: Mounting brackets shall be 3/8" (9mm) thick extruded aluminum. Pivoting post guides with compression fittings and latching mechanism shall be cast aluminum. Self-closing hinges and all fasteners shall be type 316 stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.03 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

ISSUED FOR BID

SECTION 07 90 05
JOINT SEALERS

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Provide data indicating sealant chemical characteristics.

PART 2 PRODUCTS

2.01 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Color: Match adjacent finished surfaces.

C. Exterior Expansion Joint Sealer: Precompressed foam sealer; urethane with water-repellent;
   1. Color: Black.
   2. Size as required to provide weathertight seal when installed.

D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
   1. Color: Match adjacent finished surfaces.

E. Polyurea Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Color: Dark Bronze

2.02 ACCESSORIES

A. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

B. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Tool joints concave.

D. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

E. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

F. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.

B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

PART 2 PRODUCTS

2.01 DOORS AND FRAMES

A. Requirements for All Doors and Frames: Acceptable Manufacturers.

1. Ceco
2. Steelcraft
3. Approved equal.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 STEEL DOORS

A. Exterior and Interior Doors - Steelcraft
   1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.
   2. Core: Polyurethane foam.
   3. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
   4. Texture: Smooth faces.
   5. Insulating Value: U-value of 0.40, when tested in accordance with ASTM C1363.
   6. Finish: Factory primed, for field finishing.
   7. Materials: 16 ga galvanized steel, insulated exterior doors.

2.03 STEEL FRAMES

A. General:
   1. Comply with the requirements of grade specified for corresponding door.
      a. ANSI A250.8 Level 3 Doors: 14 gage frames.

B. Door Frames: Face welded, seamless with joints filled.
   1. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
   2. Weatherstripping: Separate, see Section 08 71 00.
   3. Interior frames all floors: 14 ga steel fully reinforced

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.

B. In addition, install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 08 30 50
ACCESS DOORS

PART 1 GENERAL

1.01 SUBMITTALS

A. Submit manufacturer's technical data.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ceiling Access Doors shall be 22" x 36" APWB Series flush non-fire-rated ceiling access panel manufactured by Nystrom, Inc. or approved equal. Frame and door panels shall be 16 and 14 gauge galvanized steel, respectively, with 1" wide exposed flange. All exposed joints shall be welded, filled, and ground smooth. Factory finish shall be phosphate dipped with baked-on rust-inhibitive gray prime finish. Provide flush key cylinder lock.

2.02 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store materials in a locked, weather-tight area. Remove from the locked area only those items to be immediately installed. Products shall be shipped and stored in manufacturer's original, unopened cartons.

PART 3 EXECUTION

3.01 INSTALLATION

A. Contractor shall field-verify existing conditions for proper installation of access doors.

B. Contractor shall install ceiling access door in accordance with manufacturer's recommendations.

C. Access doors may be supported and braced by a metal stud framework suspended from metal deck above. Door may be suspended from deck above by ¼" mounting holes in frame.

D. Replace or rehang doors which are hinge-bound and do not swing or operate freely.

3.02 CLEANUP

A. Upon completion of work, remove from the job site all excess materials, debris, and tools, and leave access door ready to receive specified paint finish.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Electric operated overhead insulated rolling doors and control station. Also included is one non-electric door.

1.02 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Air Infiltration to Comply With: IECC® (International Energy Conservation Code) 2015
   2. Wind Loading: Supply doors to withstand up to 20 psf design wind load
   3. Cycle Life: design doors of standard construction for normal use of up to 20 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the door
   4. Insulated Door Slat Material Requirements: Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.Sound Transmission Class (STC) rating up to 30 for the curtain and up to 22 for the entire assembly. All configurations are evaluated per ASTM E90 and based on testing a complete, operable assembly. Minimum R-value of 8.0 (U-value of 0.125) as calculated using the ASHRAE Handbook of Fundamentals. Insulation to be CFC Free with an Ozone Depletion Potential (ODP) rating of zero.

1.03 SUBMITTALS

A. Submit the following items: Product Data, Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work. Quality Assurance/Control Submittals:
   a. Provide manufacturer ISO 9001:2008 registration
   b. Provide manufacturer and installer qualifications - see below
   c. Provide manufacturer's installation instruction
   d. Manufacturer must provide independent testing lab results proving .3 CFM/FT2 or less air infiltration

1.04 QUALITY ASSURANCE

A. Qualifications: Manufacturer Qualifications: ISO 9001:2008 registered and a minimum of five years' experience in producing doors of the type specified.

1.05 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship

PART 2 PRODUCTS

2.01 MANUFACTURER

1. Cornell
2. Cookson
3. Clopay Building Products

2.02 PRODUCT INFORMATON

A. Model: ESD30 Cornell – Basis of Design

2.03 MATERIALS

A. Curtain: Air infiltration rate of less than .3 CFM/FT2, as tested per ASTM E283 validated by an independent testing agency. Test report required.
   1. Fabrication:
      a. Slat Material: No. 6F, (Listed Exterior/Interior):
         1) Galvanized Steel/Galvanized Steel: Manufacturer recommended gauge based on performance requirements. Minimum 22/22 gauge, Grade 40, ASTM A 653 galvanized steel zinc coating
      b. Insulation: 7/8 inch (22 mm) foamed-in-place, closed cell urethane
      c. Total Slat Thickness: 15/16 inch (24 mm)
      d. Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84
      e. R-value: 8.0
      f. STC Rating: Sound Transmission Class (STC) rating up to 30 for the curtain and up to 22 for the entire assembly.
   2. Exterior Slat Finish:
      a. SpectraShield® Coating System (Color Bronze):
         1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
         2) Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from manufacturer's standard color range, over 180 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better
   3. Interior Slat Finish:
      a. SpectraShield® Coating System (Color Bronze):
         1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
         2) Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from manufacturer's standard color range, over 180 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

B. Endlocks: Fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two ¼” (6.35 mm) rivets. Provide windlocks as required to meet specified wind load.

C. Bottom Bar
   1. Insulated Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge. Minimum 4” tall x 1-1/16” thickness.
   2. Finish:
      a. Powder coat to match slats
   3. Air Infiltration Certification Label: Must be affixed to bottom bar

D. Guides:
   1. Fabrication:
      a. Thermal break required. Minimum 3/16 inch (4.76 mm) structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.
         Top 16 ½" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service
   2. Finish:
      a. SpectraShield® Coating System (Color Bronze): Zirconium treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, over 180 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

E. Counterbalance Shaft Assembly:
   1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
   2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

F. Brackets:
   Fabricate from minimum 3/16 inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures
   1. Finish:SpectraShield® Coating System (Color Bronze): Zirconium treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, over 180 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

G. Hood:Minimum 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
   1. Finish: SpectraShield® Coating System (Color Bronze): ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
      2) Zirconium treatment followed by baked-on polyester powder coat, with color as selected by Architect from manufacturer's standard color range, over 180 colors; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better

H. Weatherstripping:
   1. Bottom Bar: Sensing/weather edge with neoprene astragal extending full width of door bottom bar
   2. Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain
   3. Lintel Seal: Double brush seal with EPDM sandwiched between the two brush seals at door header to impede air flow.

2.04 OPERATION

A. Motor - Continuous Use - Model SG (Super Duty Gear Head) Operator: The operator must not extend above or below the door coil when mounted front-of-coil. UL listed (to comply with UL requirements in The United States and Canada). Totally Enclosed Fan Cooled gear head operator rated 2 hp as recommended by door manufacture for size and type of door, 480 Volts, 3 Phase. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist provided up to 2 hp and control stations). Motor shall be high starting torque, industrial type, with overload protection. Primary speed reduction shall be heavy-duty gears running in grease or oil bath with mechanical braking to hold the door in any position. When equipped, the emergency manual chain hoist assembly is automatically disengaged when motor is energized. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with minimum #50 roller chain. Operator shall be capable of driving the door at a speed of 24 inches per second (20 to 23 cm/sec). Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The motor shall be removable without affecting the limit switch settings. The electrical contractor shall mount the control stations and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

B. Control Station:
   1. Surface mounted: "Open/Close/Stop" push buttons; NEMA 4; Interior Qty (1)
   2. Surface mounted: "Open/Close/Stop," push buttons with keyed lockout, masterkeyable; NEMA 4; Exterior Qty (1)

C. Control Operation:
   1. Momentary Contact to Close:
      Fail-safe, UL325-2010 Compliant Entrapment Protection for Motor Operation
      a. 2-wire, E.L.R. electric sensing/weather edge seal extending full width of door bottom bar. Provide a retracting safety cord and reel connection to control circuit.

PART 3 EXECUTION

3.01 EXAMINATION Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates. Commencement of work by installer is acceptance of substrate

3.02 INSTALLATION General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports. Follow manufacturer's installation instructions.

3.03 ADJUSTING Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.04 CLEANING Clean surfaces soiled by work as recommended by manufacturer. Remove surplus materials and debris from the site

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 08 42 20
CAB WINDOWS

PART 1 GENERAL

1.01 SYSTEM PROFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading and impact loading (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and or other defects in construction.

B. Glass Minimum thickness indicated is for detailing only. Confirm glass thickness by analyzing Project loads and in-service conditions. Glass shall comply with the requirements of ASTM Standard E1300 "Standard Specification for Determining the Minimum Thickness of Annealed Glass Required to Resist a Specific Load", based on straight line wind graphs as well as manufacturer's wind load charts and information obtainable from the local U.S. Weather Bureau.

C. Contractor shall determine the wind loading of glass in its position within the structure and provide glazing suitable to the wind pressure at each level, as recommended by the manufacturer. Furnish design data for the Owner's Representative for approval prior to the fabrication of any glazing unit.

D. Maximum deflection of framing member shall be limited to 1/175 of span. Contractor shall coordinate this requirement with the supplier of aluminum framing members.

E. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 F deg, ambient; 180 F deg, material surfaces.

F. Fixed Glazing Systems, including aluminum framing systems, glazing units, and joints and seals, shall meet or exceed the following:

1. Air infiltration (ASTM E 283) – 0.60 CFM/624 PSF of Pressure Water Penetration (ASTM E331) – none at 15 psf of pressure Uniform load structural per ATSM E330

G. ATCT Cab glazing, in addition to requirements above, shall be capable of resisting wind pressure as stated on the structural construction drawings, or higher values as determined by local wind charts obtained from NOAA or the National Weather Service. Glazed window openings shall experience no leakage during wind driven rains as determined during actual storm conditions.

1.03 SUBMITTALS

A. All product data shall for each glass product and glazing material shall be submitted as one package.

1. Glass wind load calculations derived from ASCE 7 or from actual wind load test whichever is greater. This will determine the thickness of glass using ASTM E 1300 with allowable glass stress based on probability of 8/100 glass breakage. The glazing shall withstand site condition loads without failure.

2. Maximum panel deflection certified by glass manufacturer to me requirements.

3. Manufacturers of glass accessories attesting that all units and parts meet luminous and solar radiant transmission requirements for heat absorbing glass.

4. Manufacturers of sealant and all systems parts attesting the products are compatible with glazing.
5. Maintenance manual
6. Warranties.
7. Sample of Insulated glass unit bearing manufactures label and general information

1.04 QUALITY INSURANCE

A. Glazing shall be free of defects and damages that will affect performance and or visibility.
B. Handling and temporary storage of material shall be as manufacturer prescribes to prevent broken, chipped, cracked, or damaged products.
C. Protect glass from damage after insulation. Replacement of all damage all during construction shall be handled by contractor.

1.05 WARRANTY

A. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by the manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate, f.o.b. point of manufacture, freight allowed Project site, within the specified warranty period indicated below. Capillary tubes and installation on an airport shall not be excluded. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
B. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of Delivery On-Site Acceptance by the Owner.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Design window mullions in the control tower cab to comply with wind load requirements while at the same time reducing visual obstructions to the maximum extent possible. In addition, the structural mullions shall be designed to be utilized for antenna cable access as an option.

B. Insulated glass units

1. Acceptable Manufacturers:
   a. PPG CLEAR GLASS
   b. Other approved equal
2. Glass thickness show on drawings or specified here in are the minimums. Manufacturer to certify that glass can withstand all force loads exposed to system.

C. Setting Material shall be approved by Manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examination of glazing system shall be done to determine the installers compliance of:
   1. Tolerances of installation per manufactures requirements
   2. Tested for acceptable visibility and clarity with no double imaging.
   3. Effective sealing of joints

3.02 INSTALLATION

A. Installer shall have 5 years of experience with similar system.
B. Installation shall be as manufacture prescribes.
C. Do not proceed with installation of glazing if ambient and substrate temperature are outside the limits permitted to do such.
D. Glass supplier shall identify site specific problems related to installation and provided advise on installation.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

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SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details, etc.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

1.02 WARRANTY

A. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.02 STOREFRONT FRAMING FOR ALL WINDOWS

A. 2” x 4 ½” aluminum framing, bronze color (anodized), thermal break construction, for 1” insulating glazing. Provide subsills and brake metal.

2.03 STOREFRONT DOORS

A. Medium Stile, Insulating Glazing, Thermally Broken:
   2. Thickness: 2 inches.

2.04 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage, and attachment devices.
   1. Finish: Class I color anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Glazing stops: Flush.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221.

B. Fasteners: Stainless steel.

2.07 FINISHES

A. Class I bronze Anodized Finish: AAMA 611 AA-M12C22A41

2.08 HARDWARE

A. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

B. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

C. Flush panic bar.

D. Offset hinges.

E. Closer

PART 3 EXECUTION

3.01 INSTALLATION

A. Install window system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following: Commercial mechanical door hardware for swinging doors.

1.02 SUBMITTALS

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

B. Warranty: 5 year warranty specified in this Section.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's (Door Hardware Institute) "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

   a. Organize door hardware sets in same order as in the Door Hardware Sets on the A6 Sheet Series of the drawings.

3. Content: Include the following information:

   a. Identification number, location, hand, fire rating, size and material of each door and frame.

   b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to Door and Frame Schedule.

   c. Complete designations, including name and manufacturer, type, style, function, size, label, hand, and finish of each door hardware item.

   d. Fastenings and other pertinent information.

   e. Explanation of abbreviations, symbols, and codes contained in schedule.

   f. Mounting locations for door hardware.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule.

D. Keying Schedule: Provide in accordance with MSCAA standards and to be prepared under the supervision of the Owner’s Representative, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. MSCAA’s

Representative to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. Maintenance Data: Provide for each type of door hardware, which will also be included in Owners final maintenance manual at the close of the project – owner occupancy. Include final hardware keying schedule.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who has completed both standard and electrified builders hardware and integrated access control installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Pre-Installation Conference: Conduct conference at Project site attended by representatives of MSCAA, Architect, Supplier, Installer, and Contractor to review proper hardware installation methods and the procedures for receiving and handling hardware. At completion of installation, provide written certification that hardware items were applied according to conference recommendations and to finish hardware specifications.

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.

2. Review sequence of operation for each type of electrified door hardware.

3. Review and finalize construction schedule and verify availability of materials.

4. Review required testing, inspecting, and certifying procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Pre-Installation Conference" listed in 1.3B above.

1.05 COORDINATION

A. Installation Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard, electrified and access control hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

1.06 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of standard, electrified hardware and access control hardware that fails in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period: Five years from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods: Five years for mortise and bored latches and locksets, five years for exit devices, ten years for manual door closers, and five years for electromechanical door hardware.

1.07 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and the Door Hardware Schedule on the drawings.

1. Threshold: Aluminum to fit door frame
2. Drip Caps: 16 ad if outside door
3. Closers:
    a. Standard Doors: LCN model 4041, arm RW/ PA, finish to match existing areas adjustment size 1-6 PC 23
    b. Jet Bridge Doors: Dorma 1816HT Series with smoke detector
4. Hinges:
    a. New doors shall have reinforcement on the hinge side and hinges shall be continuous geared hinges by National Guard Products, Stanley, or PBB. Minimum 0.120-inch thick hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame. Fabricate hinges non-handed and to template

screw locations. Continuous hinges guaranteed for the life of the opening.

1. At electrified hardware locations provide electric transfer continuous hinges with a 12" removable hinge modification accessible without de-mounting door from the frame and Molex standardized plug connectors to accommodate up to 12 wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Preferred hardware is Von Duprin EPT10.

5. Lock Prep: Yale 6-pin lockset-PB5407LN 694X497 Finish – US 10B
6. Keyways: 6-pin LFIC Cores with SA keyway
7. Panic Hardware: Dorma 9000 Series or Von Duprin RX QEL 98NL-F
8. Flush Bolts: Trimco, Burns, or Ives. Provide manual flush bolts with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be 8" in length and U.L. listed for labeled fire doors.
9. Low voltage door operators: Dorma ED900 Series or LCN 9000 Series

2.02 HINGES

A. Continuous Geared Hinges

B. Standards: BHMA Certified products complying with BHMA A156.26

C. Sizes:

1. Provide continuous geared hinges that are not smaller than 1" less than nominal door height; ie 7'0" door requires 83" hinge.

2.03 LOCKS AND LATCHES

A. Mechanical Mortise Locks and Latches:

1. Lock easily re-handed in the field without removing parts or opening the lock case.

2. Multi-functional lock body easily changeable lock functions in the field.

B. Standards: Comply with the following:

1. Mortise Locks and Latches: BHMA A156.13.

Best – 45H7 14M – Match Building Standard.

C. Mortise Locks: BHMA Certified Grade 1, Series 1000.

ASTM F1577-95b Paragraph 6.2 Impact Level 1 for Deadbolt Functions, Level 3 for Latchbolt only Functions.

D. Lock Trim:

1. Pull with exterior cylinder – N/L Function.

a. All trim through bolted

2. Tactile Warning Surfaces for all Doors to Hazardous Areas.

a. Knurling or Roughing required on entire gripping surface per Local and State Code.

E. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Mortise Locks: BHMA A156.13.

F. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.

G. Backset: 2-3/4 inches unless otherwise indicated.

2.04 CYLINDERS AND KEYING

A. Provide cylinders utilizing a unique factory code pattern that is both geographically and time zone protected to match Owners Existing System.

B. Manufacturers: Provide products by:

C. Cylinders:

1. Standards: BHMA A156.5.

D. Cylinder Grade: BHMA Certified Grade 1.

E. Permanent Cores:

1. Removable Cores: Small Format Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

F. Construction Keying:

1. Construction Master keying: Provide temporary construction keyed cores that are replaceable by permanent cores. Construction Cores must be Brass. Plastic Thumb Turn Cores are not allowed. Provide construction master keys in quantity as required by project Contractor.

G. Keying System: Provide for keying to comply with the Existing MSCAA Access System.

1. Grand Master Keyed: Cylinders are factory keyed operated by a change key, master key, and a grand master key. Conduct keying meeting with End User to define and document keying system instructions and requirements.

H. Keys: Provide keys per the Owners direction and per the Keying meeting:

1. Stamping: No Marking on Keys or Cores as directed by Owner.

2. Quantity: Provide the following:

a. Cylinder Change Keys (Per Core): Two.

b. Master Keys (Per Level): As directed by Owner.

c. Grand Master Keys: As directed by Owner.

d. Construction Control Keys: Minimum of Two and as required by General Contractor.

e. Permanent Control Keys: As directed by Owner.

f. Extra Keyed Permanent Small Format Cores: Ten.

I. Key Registration List: Provide keying transcript list to Owner's Representative for lock cylinders.

2.05 STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolt, as recommended by manufacturer.

2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Electric Strikes are not allowed.

2.06 EXIT DEVICES

A. Manufacturers: Von Duprin, Stanley and Sargent subject to compliance with requirements as follows:

1. Rim Exit Devices, BHMA Certified Grade 1

B. Devices tested & labeled for “panic protection” according to UL305.

C. Thru bolt application at center case to trim (4) and push rail mounting bracket (2).

2.07 CLOSERS

A. Subject to compliance with requirements:

1. Surface-Mounted Closers Heavy Duty Grade I

a. Heavy Duty Parallel Arms.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.

C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide non-handed, factory-sized closers adjustable to meet field conditions and requirements for opening force.

D. Closer Options/ Accessories: As indicated in hardware sets, provide door closer options including: extra duty parallel arms, spring compression stop/hold open arms, special mounting brackets, spacers and drop plates. Through bolt type mounting is required.

2.08 OPERATING and PROTECTIVE TRIM UNITS

A. Subject to compliance with requirements:

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:

1. Stainless Steel: .050 inches thick, beveled four sides (B4E) with countersunk screw holes.

D. Furnish protection plates sized two inches less than door width (LDW) on push side of door.

E. Kickplates to be 20” in Height.

2.09 STOPS AND HOLDERS

A. Subject to compliance with requirements:

1. Stops and Holders:

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.

2. Electromagnetic Door Holders: BHMA A156.15.

3. Combination Overhead Holders and Stops: BHMA A156.8.

4. Door Silencers: BHMA A156.16

C. Stops and Bumpers: BHMA Certified Grade 1

1. Hager – 236W-32D

D. Where floor or wall stops are not appropriate, provide overhead stops.

E. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame. Provide (3) per single door and (2) per paired door frame

2.10 DOOR THRESHOLDS, WEATHERSTRIPPING AND GASKETING

A. Subject to compliance with requirements:

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weatherstrip seal on exterior doors and smoke, light, or sound gasketing on interior doors where specified. Provide non-corrosive fasteners for exterior applications.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. Install header seal before mounting door closer arms.

2. Meeting Stile Astragals: Fasten to meeting stiles, forming seal when doors are closed.

3. Door Sweep: Apply to bottom of door, forming seal with threshold when door is closed.

2.11 FINISHES

A. Standard: Comply with BHMA A156.18.

1. BHMA 630, stainless steel.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Notify Designer of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

A. Steel Doors and Frames: Comply with ANSI/BHMA A115 series.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Thresholds: Set thresholds for exterior in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.04 FIELD QUALITY CONTROL

A. The Contractor shall comply with AIA A201 1997 section 3.3.1 which reads as follows: “The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the contract Documents give other specific instructions concerning these matters.”

B. Field Inspection: Secure the services of the Manufacturer’s Authorized Product Supplier to perform a final inspection of installed door hardware. Provide a report to state whether work complies with or deviates from the specifications and requirements, including whether door hardware is properly installed, operating and adjusted.

3.05 ADJUSTING

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

1. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

2. Consult with and instruct Owner's personnel on recommended maintenance procedures.

3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.06 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper finish. And provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

C. Secure the services of a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

1.02 WARRANTY

A. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, inter-pane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 AVAILABLE MANUFACTURERS

A. Provide
   1. PPG Industries, Inc.
   2. Dow Corning
   3 Libby Owens Ford.

2.01 GLAZING TYPES

A. Exterior Glazing – Sealed 1" Insulating Glass Units, Grey-tint, low-E.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Basis of Design: PPG Industries, Inc.: www.ppgideascapes.com.
   3. Outboard Lite: Tempered glass, 1/4 inch thick, 3/8" if glass pane size requires
      a. Coating: PPG Solarban 60 on surface (or approved equal)
   4. Inboard Lite: Tempered float glass, 1/4-inch-thick, 3/8" if glass pane size requires
   5. Total Thickness: 1 inch.
   6. U-value between .2 and.3.

B. Interior Glazing – ¼" clear tempered glazing.

2.02 EXTERIOR GLAZING ASSEMBLIES

A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with International Building Code.
   1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Thicknesses listed are minimum.

2.03 GLASS MATERIALS

A. Float Glass: All glazing is to be float glass unless otherwise indicated.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: grey tinted for exterior glazing, clear for interior.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

2.04 SEALED INSULATING GLASS UNITS

A. Sealed Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.

2. Edge Spacers: Aluminum, bent and soldered corners.
3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
4. Purge interpane space with dry hermetic air.

2.05 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3-inch-long x one half the height of the glazing stop x thickness to suit application, self-adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; bronze color.

PART 3 EXECUTION

3.01 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF THIS SECTION.

SECTION 08 83 00
MIRRORS

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data on Mirror Types: Provide structural, physical and environmental characteristics, size limitations, handling or installation requirements.

1.02 WARRANTY

A. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of the same.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mirror Glass - General: Select materials and/or provide supports as required to limit mirrored glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

B. Mirror Glass Single unit with Aluminum frame (wood trim frame to be added by others): Clear float type with copper and silver coating, organic overcoating, arrised edges, 60 mm thick minimum.

1. Size as shown on drawings

2.02 GLAZING ACCESSORIES

A. Glazing Clips: Manufacturer's standard type.

B. Mirror Attachment Accessories: Stainless steel clips.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Install mirrors in accordance with GANA recommendations.

B. Set mirrors plumb and level, free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF THIS SECTION.

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:

B. Adhesive Bond and Compatibility Test Report.

1.02 QUALITY ASSURANCE

A. Contractor may perform adhesive and bond test with his own personnel or hire a testing agency.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of pH found, and suitable for adhesion of flooring without further treatment.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:

1. Preliminary cleaning.
2. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
3. Specified remediation, if required.
4. Patching, smoothing, and leveling, as required.
5. Other preparation specified.
6. Adhesive bond and compatibility test.
7. Protection.

B. Remediations:

1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating over entire suspect floor area.
3. Excessive pH: If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 INTERNAL RELATIVE HUMIDITY TESTING

A. Test in accordance with ASTM F2170 Procedure A and as follows.

B. If test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

3.03 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF THIS SECTION.

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES with METAL STUD FRAMING

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. All Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM.

C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

2.02 METAL FRAMING MATERIALS

A. Non-Loadbearing Interior and Exterior Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing 16”oc, with maximum deflection of wall framing per 2015 IBC and Local Amendments.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Gage: 20 (or equal) minimum.

B. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

C. Door and Window Frames: Install Double Studs at jambs.

2.03 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   3. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.

B. Backing Board For Wet Areas: Cement Board
   1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

C. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.

1. Application: Exterior sheathing, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Glass-Mat-Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177.
4. Core Type: Regular.
5. Regular Board Thickness: 5/8 inch.
6. Edges: Square, for vertical application with all joints taped per manufacturer's minimum standards.
7. Window and exterior openings: all joints taped per manufacturer's minimum standards.

2.04 ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless otherwise indicated.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.

B. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

C. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

D. Screws for Attachment to Steel Members From 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

E. Sound Attenuation Blankets shall be Kraft-faced Thermafiber sound Attenuation Blankets as manufactured by United States Gypsum of Chicago, Illinois. Blankets shall be 3-1/2" thick, 16" wide, 48" long with a density of 3 pcf.

PART 3 EXECUTION

3.01 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

3.02 ACOUSTIC INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

3.03 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

3.04 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, and all partitions not visible above ceilings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF THIS SECTION.

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SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work included: this section specifies furnishing materials and installation of Ceramic Tile and accessories as indicated on drawings. Crack Suppression shall be provided per the latest Edition of The Handbook for Ceramic Tile Installation by the Tile Council of North America.

1.02 SUBMITTALS

A. Furnish Master Grade Certificate bearing certification mark of the Tile Council of North America, signed by both the tile manufacturer and tile sub-contractor.

B. Furnish Manufacturer's Certification of Compliance to required standard.

C. Submit one sample of each type and color of tile intended to be used.

D. Submit one sample of each color and type of threshold intended to be used.

E. Obtain approval of sample submittals before delivering any products to the job site.

1.03 QUALITY ASSURANCE

A. Publications: A copy of the following standards shall be kept on the job by the Contractor at all times: USAS 137.1, American National Standards Institute Standard Specifications; Latest Edition of The Handbook for Ceramic Tile Installation by the Tile Council of North America. These Standards shall be referred to for the tile installation.

1.04 DELIVERY

A. Deliver all products to job site in manufacturer's unopened, original, standard containers with grade seals unbroken and labels intact. Keep tile cartons dry.

1.05 EXTRA MATERIALS

A. Supply extra 15% of total quantity of each tile used. Place in clean marked cartons for Owner's use.

1.06 ENVIRONMENTAL REQUIREMENTS

A. The product specified herein for concrete cleaning contains acidic ingredients. Vapors given off by cleaner can cause damage to light fixtures, door hardware and other metallic items. Such items shall be protected from damage by these vapors.

B. Always maintain complete ventilation during cleaning of slab areas scheduled to receive Ceramic Tile until all surfaces are dry.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: Products and colors as listed on construction documents or approved equal from the following manufacturers:

1. Marazzi
2. American Olean
3. Crossville

B. Accessories: Special shapes shall be provided as required. All external corners shall be protected using Schluter Systems finishing and edge protection profile Schluter-RONDEC. All internal corners shall be square.

C. Setting Materials for Thin-set installation:

1. Mortar for wall tile: use organic adhesive, ANSI A136.1-1967, Type One for prolonged water resistance
2. Mortar for thin set floor tile: use factory prepared mix conforming to ANSI A118.4

D. Thresholds per drawings.

E. Transition support - Schluter Systems Schiene per drawings.

2.02 GROUTS

A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Where indicated on Construction Documents
2. Color: per Construction Documents

B. Sealant and Control Joints: fungicidal one-part silicone rubber sealant comparable to Dow Corning782 or 784. Color to match grout.

2.03 CRACK SUPRESSION

A. Use Crack Suppression System per the latest Edition of The Handbook for Ceramic Tile Installation by the Tile Council of North America.
1. Laticrete Hydroban for cracks 1/8" or less.
a. Install per manufacturer's instructions

PART 3 EXECUTION

3.01 INSPECTION

A. All concrete substrates must be fully cured and free of any hydrostatic and/or moisture problems. Moisture Vapor emission from concrete slab must not exceed 3 pounds per 1000 square feet per 24 hours as measured by the anhydrous calcium chloride test kit based on method ASTM F1869-03.

B. Do not install where moisture problem is expected. A moisture barrier with permeance less than 0.2 metric perms as measured according to ASTM-96 standard must be present under concrete slabs that are below grade. This barrier must be resistant to deterioration as well as to puncture during construction and must remain intact and continuous.

3.02 PREPARATION

A. All surfaces receiving tile shall be dry, clean free from oily or waxy films, paint, tar, curing compound, sealers, form release agents, primers, free alkali, or any substance that may prevent or reduce adhesion. Do not start work until all grounds anchors, hangers, buck, electrical or mechanical work in or behind the tile have been installed.

3.03 INSTALLATION - GENERAL

A. Install crack suppression, tile, and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and The Tile Council of North America Handbook recommendations.

B. Lay tile to pattern indicated. Tiling shall terminate under doorways at thresholds as indicated.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF THIS SECTION

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work included: This section specifies furnishing materials and installation of the acoustical ceiling tile systems indicated on drawings.

1.02 SUBMITTALS

A. Prior to delivery of any ceiling materials to the job site, copies of Shop Drawings and technical data and two (2) physical samples shall be submitted to the architect for approval. No materials shall be delivered until submittals have been approved in writing by the Architect.

B. Product Data: Provide data on suspension system components.

1.02 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Armstrong – Basis of Design

B. USG – pre-bid approved equal

C. Other pre-bid approved equal

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels shall be material and color as scheduled on drawings – Sheets A8's.

2.03 SUSPENSION SYSTEM

A. Suspension Systems - General: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Suspension Systems details and installation must meet seismic design category 'D'/risk category IV requirements per 2015 IBC and per manufacturer's standard details for these criteria.

C. Grid color – white, except Control Cab (third floor) to be black.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.

PART 3 EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636, ASTM E580, and manufacturer's instructions and as supplemented in this section.

B. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

3.02 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Provide 20% extra stock material for grid and ceiling panels of each type and color.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF THIS SECTION.

SECTION 09 65 80
VCT & LVT, RESILIENT BASE AND TRANSITION ACCESSORIES

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's printed data sheets for products specified in drawings.

B. Verification Samples: Actual product and color specified.

1.02 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient base and transition accessories within range of 70-95 degrees F for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F or to go above 100 degrees F.

PART 2 PRODUCTS

2.01 VCT

A. Acceptable manufacturers:

1. Armstrong VCT flooring as specified in A7 drawing series.
2. Pre-bid approved equal.
3. All products by the same manufacturer.

2.02 LVT

A. Acceptable manufacturers:

1. Armstrong LVT planks as specified in A7 drawing series.
2. Pre-bid approved equal.
3. All products by the same manufacturer.

2.03 RESILIENT BASE

A. Acceptable manufacturers:

1. Armstrong
2. Flexco
3. Roppe
4. All products by the same manufacturer.

B. Color Integrated Rubber Wall Base

1. ASTM F1861, Type TS rubber, vulcanized thermoset: top set style B, Cove
   a. Thickness: 1/8 in.
   b. Height: 4”.
   c. Finish: Satin.
   d. Length: roll.
   e. Provide coved external corners
2. Color: as specified in A.7 series.

2.04 ACCESSORIES

A. Moldings, Transitions and Edge Strips as shown in drawings by same manufacturer.

B. Adhesive: S-725 as recommended by manufacturer for project conditions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's recommendations and approved shop drawings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF THIS SECTION.

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide and install all modular carpet and installation work as required on drawings. See drawings for color and location of carpet tile.

1.02 QUALITY ASSURANCE

A. MANUFACTURER

1. The carpet manufacturer shall have no less than fifteen years of production experience with modular carpet similar to type specified. Published product literature of carpet manufacturer shall clearly indicate compliance of products with requirements of this section.
2. Commitment to quality - carpet manufacturer shall provide verification of its registration to the ISO 9001/9002 Quality Management System.
3. Commitment to Environmental sustainability - carpet manufacturer shall demonstrate environmental responsibility through programs of source reduction, recycling, reuse, water conservation and conservation of raw material usage; and registration in the ISO 14001 Environmental Management System.
4. All products offered by the manufacturer meeting environmental standards provided in this specification shall be "standard running line" products and shall be available with no minimum order (single box availability). Manufacturer shall guarantee availability of post-consumer content product.

B. INSTALLATION PROVIDER

1. The installation provider shall be directly responsible for the quality of the completed floorcovering installation, including the quality of both the materials and labor used in the installation. The installation provider shall directly warrant to owner that all products, materials and services related to the floorcovering installation (including any floorcovering(s), or other products or materials used in the installation) meeting specifications set forth herein. The product warranty required herein shall be provided directly by the carpet manufacturer.
2. The installation provider shall have successful carpet installation experience on work similar to the work of this Section.

1.03 SUBMITTALS

A. Please submit each of the following with your bid (unless otherwise noted):

1. Manufacturer's Data - Two (2) copies of carpet manufacturer's construction specifications, performance specification, environmental performance and installation instructions for carpet and related items specified.
2. Fiber Verification – Certification from the fiber producer verifying use of the premium branded, type 6,6 with post-consumer content for the submitted carpet product. Premium branded fibers are identified as Universal. Fibers extruded by carpet mills will be considered "non-premium" for purposes of this specification.
3. All applicable product warranties provided by manufacturer.
4. Installation provider's proof of insurance, copy of contractor's license, and worker's compensation certificate.
5. Samples – Customary (standard) size carpet samples of each type of carpet, in each specified pattern, color, and construction.
6. Maintenance Instructions - Two (2) copies of the manufacturer's carpet maintenance instructions.
7.

1.04 WARRANTY

A. Provide the following written warranties by carpet manufacturer for a period of not less than 15 years:

1. Wear - Surface fiber wear shall not be more than 10% by weight in 15 years. (Note: Wear warranty shall not require use of chair pads)
2. Static - Static generation shall be less than 3.0 kV at 70º F, and 20% R.H.
3. No delamination
4. No edge ravel
5. No dimensional instability (i.e., shrinkage, curling and doming) which adversely affect the ability of the tile to lie flat
6. Mergeability* – Carpet that is of the same style and colorway, but from different dyelots and/or manufacturing dates, shall be mergeable and interchangeable, both at initial installation and at later selective replacement, to create a continuous carpeted surface with no tile appearing out of place
7. Submit manufacturer's National Voluntary Laboratory Accreditation Program (NVLAP) certified test results to show that carpet meets or exceeds product performance specification criteria for carpet testing requirements under Section 2.1 hereof.
8. Installation provider shall warrant all installation services will be free from defects in workmanship for a period of at least one (1) year following their completion, and that in the event of defective services, the installation provider will re-perform the affected services and, as necessary, supply new products of the same or similar grade sufficient to repair or replace products adversely affected.

PART 2 PRODUCTS

2.01 CARPET TILES

A. Modular Carpet Tile Performance Standards. Modular carpet tile shall meet the following performance standards:

0.1	Carpet Flammability	
	.1 Pill Test (ASTM D2859 or CPSC FF-1-70)	Passes
	.2 Radiant Panel Test (ASTM E648)	$\geq$ 0.45 watts/cm^2, Class 1
0.2	Smoke Density (ASTM E662)	$\leq$ 450 Flaming Mode
0.3	Dimensional Stability (Aachen Method Din 54318)	$\leq$ 0.1% change
0.4	Static Generation at 70º F (AATCC 134 w/ neolite)	$\leq$ 2.5 kV at 20% R.H.
0.5	Lightfastness (AATCC 16E)	$\geq$ 4.0 after 60 hours
0.6	Gas Fade (AATCC 23)	4
0.7	Ozone Fade (AATCC 109)	4
0.8.1	Antimicrobial (ASTM E2471-05)	The carpet **primary backing** should display a minimum performance rating of "CI" (complete inhibition) or "PI" high (partial inhibition high < 10% coverage) against the three challenge microorganisms
or 0.8.2	Antimicrobial (AATCC 174, Part II)	$\geq$ 90.0% reduction
0.9	Fungicidal (AATCC 174, Part III)	No growth
0.10	Soil/Stain Protection (AATCC 175-1991)	$\geq$ 8.0 on the Red 40 Stain Scale

0.11	Sustainable Carpet Assessment Standard – NSF/ANSI 140	Platinum, as certified by 3rd party
0.12	Carpet & Rug Institute Green Label Plus	Any and all products shall pass Carpet & Rug Institute Green Label Plus. Certification number of the specified product category shall accompany submittal.

B. Product Construction Specification. Modular carpet tile shall meet the following construction specifications:

1. Yarn System: 100% Universal Type 6,6 Nylon with post consumer content. Fiber shall have a cross-section modification ratio no greater than 2.5.
2. Dye Method: 100% Solution Dyed
3. Mergeability*: Carpet that is of the same style and colorway, but from different dyelots and/or manufacturing dates, shall be mergeable and interchangeable, both at initial installation and at later selective replacement, to create a continuous carpeted surface with no tile appearing out of place
4. Construction: Tufted tip-sheared
5. Patterning:: Integrated (topical application or wet printed patterning not allowed)
6. Gauge: 1/12
7. Pile Height: Minimum 0.15
8. Pile Thickness: .094
9. Stitches: 9
10. Density: 6511
11. Total Thickness: .280 in
12. Pile Weight: Maximum 18 oz per yard: Primary Backing: Non-woven polyester. Woven primary backings not allowed.
13. Secondary Backing: Fiberglass Reinforced Thermoplastic Composite (polyolefin-free) Glasbac. Secondary backing shall be 100% recyclable at the end of its useful life. Claims of 'recyclable' shall meet the Federal Trade Commission Part 260 -- Guides for the Use of Environmental Marketing Claims 260.7(d).
14. Soil/Stain Resistance: Application by fiber producer and manufacturer required.
15. Antimicrobial: Antifungal and Antibacterial ASTM E 2471-05 Standard Test Method for Use of Seeded Agar for Screening Assessment of Antimicrobial Activity in Carpet. Minimum allowable growth ratings on washed and unwashed carpet samples after 72 hours incubation are complete to partial inhibition (<10% sample coverage) on shaven primary and unshaven fiber layers. Or, if AATCC 174 Parts II & III (AATCC 171 Washed) is used, shall pass both Part II and Part III of AATCC 174 with a minimum of 90% reduction both gram negative and gram positive bacteria and no visible growth against the fungi.
16. Non-directional Installation Method: All product shall be designed for random installation, meaning that each and every tile can be installed in any of the four possible directions without regard to pile direction, pattern or orientation of any adjacent tiles while still creating a finished carpet tile assembly that appears to be a visually continuous carpeted surface with no tile appearing out of place or improperly positioned. Trim waste should be held to an absolute minimum.

C. Environmental Specifications

1. Recycled Content by total product weight: minimum of 60% total recycled content
2. Recycled versus Recyclable – Primary consideration will be given to carpet products in the following order of priority: (A) use of post consumer recycled content in both fiber and backing, (B) post consumer recycled content in the backing, (C) 100% recyclable product. Claims shall meet the Federal Trade Commission Part 260 -- Guides for the Use of Environmental Marketing Claims.

3. Product platform shall have a 3rd party verified Environmental Product Declaration following ISO 14025 guidelines and a 3rd party verified Life Cycle Assessment following ISO 14040 guidelines.
4. Carbon footprint of the Product – Submission shall state the average quantity of greenhouse gas emissions associated with the entire life cycle of the product from raw material extraction through end-of-life, a description of the emission reduction credits used to offset the global warming footprint, and the name of the 3rd party verifying these claims.

D. Minimum Antimicrobial Construction Standards in Addition to Product Specifications
   1. Antimicrobial preservative, registered by the EPA for use in carpeting, with broad spectrum efficacy against the growth of bacteria and fungi for a minimum of 15 years, assuming proper maintenance. The antimicrobial ingredient shall meet standards set by the U.S. General Services Administration (GSA) for Antimicrobial Carpet as supported by independent lab testing less than six months old.
      a. Manufacturer shall provide a stamped EPA technical data sheet for carpet. Antimicrobial preservative shall contain no arsenic, formaldehyde or heavy metals (tin, lead, mercury, silver, copper or zinc), be non-halogenated (no fluorine, chlorine, bromine or iodine) and non-phenolic. Blends of amine neutralized phosphated esters are preferable. Antimicrobial shall have low water solubility (30ppm), a vapor pressure of 12mm Hg at 27º C, and an oral LD_{50} toxicity rate less than 2.4 grams/kg.
      b. The Antimicrobial preservative shall be incorporated into the primary backing of the product during the manufacturing process, not topically applied to the carpet fibers.
      c. The antimicrobial treated carpet when new shall pass GSA parameters for treated carpets via AATCC method 174 parts II and III. Initial performance shall be 90% reduction of the microorganisms (Staphylococcus aureus 6538 and Klebsiella pneumoniae 4352) and no fungal growth on either the primary backing or fibers both on washed (AATCC method 174) and non-washed samples. The Standard Test Method for Use of Seeded Agar for Screening Assessment of Antimicrobial Activity in Carpet (ASTM E 2471-05) may be used in lieu of AATCC method 174 parts II and III.
      d. The antimicrobial treated carpet shall maintain, for the warranted life of the carpet, a minimum of 90% reduction of the microorganisms (Staphylococcus aureus 6538 and Klebsiella pneumoniae 4352) listed in AATCC method 174 part II, provided the carpet is maintained as specified. Additionally, the antimicrobial treated carpet shall maintain a "no macroscopic growth" rating against Aspergillus niger 6275 at the primary backing in accordance with AATCC 174 part III.
      e. The preservative shall be biodegradable and not toxic to non-target species.
      f. Efficacy of the preservative should be documented in professional peer reviewed scientific publications.

2.02 ACCAPTABLE MANUFACTURERS

A. InterfaceFlor
B. Milliken
C. Atlas
D. Pre-bid approved equal

2.03 RELATED CARPET MATERIALS

E. Leveling compound - Latex type as recommended by carpet manufacturer. Shall be compatible with carpet and curing/sealing compound on concrete.
F. Glue - Installation shall be free of glue (sprayed or spread) Carpet tiles shall be installed with glueless system.
G. Installation connectors - Compounded acrylic adhesive, applied to PET polyester backing with PET polyester release liner (clear 3” x 3” polyester squares with small quantity of a pressure sensitive

adhesive applied on one side of the polyester film). The squares connect the carpet modules together to form a stable surface over almost any hard surface. The connectors shall contain no liquid components, have "zero" calculated VOC's and help to minimize floor prep in all future installations.

H. Carpet edge guard, non-metallic - Extruded or molded heavy duty vinyl or rubber carpet edge guard of size and profile indicated on drawings, and with minimum two inch wide anchorage flange; colors selected by architect/designer from among standard colors available within the industry.

I. Ancillary materials - To be selected by installation provider to meet specifications and project requirements.

PART 3 EXECUTION

3.01 PRE-INSTALLATION REQUIREMENTS

A. All existing carpet and existing carpet waste shall be reused or recycled. A reclamation plan shall be submitted that will provide directions for the reclamation of all carpet at the job site. Carpet recycling options consist of:

1. REPURPOSING - reusing the product in another application such as facilitating the donation of used carpeting to charities and other nonprofit organizations.
2. CLOSED LOOP RECYCLING - turning waste materials into new materials of the same value, such as vinyl backing into vinyl backing and nylon yarn into nylon carpet yarn.
3. OPEN LOOP RECYCLING – creating other product types from reclaimed carpet. For example, turning nylon face fiber into automotive parts or carpet padding, including nylon face fiber in recycled backings.
4. WASTE-TO-ENERGY - using carpet for waste-to-energy. In the case of waste-to-energy, manufacturer shall justify why carpet cannot be recycled.
5. LANDFILL OR INCINERATION – are not approved disposal methods.

B. Description of Reclamation Services **-** Carpet shall be removed from the existing installation and prepared for pickup based on the type of material and reclamation option selected. Specifications for removal from the jobsite include:

1. Removal of carpet tile for recycling
   a. Carpet tile shall be palletized and secured for shipping, (i.e., shrink wrap, banding, strapping).
   b. Carpet tile shall be kept dry and free of any moisture damage.
   c. Carpet tile shall be clean of any non-carpet debris.

2 Removal of performance broadloom for recycling.
   a. Performance broadloom shall be rolled, palletized and secured for shipping. Cut pieces of performance broadloom shall also be acceptable, provided they are secured for shipping.
   b. Performance broadloom shall be kept dry and free from moisture damage.
   c. Rolls shall be clean of any non-carpet debris, front and back, other than ordinary soiling in normal use.

3 Removal of broadloom carpet for recycling.
   a. Rolled carpet shall not exceed six (6) feet in length x one (1) foot diameter. Width may vary from 2 feet to 12 feet.
   b. Carpet shall be accumulated and kept dry for shipping and processing.
   c. Rolls shall be clean of any non-carpet debris, front and back, other than ordinary soiling in normal use.

4 Repurposing of carpet material.
   a. Approval of old carpet for possible donation shall be determined at the jobsite.

5 All possible recycling options shall be clearly presented and submitted in writing prior to job start. A written description of the used carpet disposal process is required.
a. Description shall contain information as to complete process of diversion from landfill.
b. A certificate shall be furnished upon request verifying the reclamation of the carpet and the pounds of material diverted from the landfill.

3.02 INSTALLATION

A. General
1. Comply with manufacturer's instructions and recommendations. A "no-glue" waterless method of installation is preferred using materials described in 2.4.2 above. In the event a releasable glue method of installation is required, the following adhesive description applies. Adhesive shall be water-based and allow for removal of carpet tile at any time without damage to carpet or substrate. Adhesive shall contain antimicrobial preservative and have "zero" calculated VOC's.
2. Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
3. Provide cut outs where required. Conceal cut edges with protective edge guards or overlapping flanges.
4. Run carpet under open bottom items such as heating convectors, and install tight against walls, columns and cabinets so the entire floor area is covered with carpet. Cover over all floor type door closures.
5. Install edging guard at all openings and doors wherever carpet terminates, unless indicated otherwise.
6. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed.
7. Use leveling compound where necessary. Any floor filling or leveling shall have a minimum of 4'0" of feather.
8. Expansion joints - Do not bridge building expansion joints with continuous carpeting.

B. Installation
1. Install carpet according to carpet manufacturer's printed instructions and in accordance with the Carpet and Rug Institute's Installation Standard.
2. Chair Pads shall not be recommended or required within installation instructions

3.03 CLEANING AND PROTECTION

A. On completion of the installation in each area, all dirt, carpet scraps, etc. shall be removed from the surface of the carpet.
B. Remove debris, and sort pieces to be saved from scraps to be repurposed or recycled.
C. Construction manager shall protect carpeting against damage during construction.
D. At the completion of the work and when directed by the construction manager, vacuum carpet using commercial dual motor vacuum of type recommended by carpet manufacturer. Remove spots and replace carpet where spots cannot be removed. Remove rejected carpeting and replace with new carpeting. Remove any protruding yarns with shears or sharp scissors.

3.04 INSPECTION

A. Upon completion of the installation, manufacturer and installer shall verify and certify that work is complete, properly installed and meets all specification herein.
B. Preliminary Acceptance - Upon completion of the carpet installation of each floor, such installation shall be inspected by owner, the construction manager and installation provider.

3.05 ENVIRONMENTAL IMPACT AND MEASUREMENTS. The manufacture of all modular carpet tile shall meet the

A. Greenhouse gas emissions from purchased electricity and on-site combustion attributable to the manufacturing process shall average 0.57 kg of carbon dioxide or less per square meter (1.06 lbs per square yard).

B. Non-renewable energy per unit of production during the manufacturing process shall average 6,200 k or less per square meter (4,900 BTU per square yard).

C. Solid waste generated at the manufacturing process regardless of disposal method shall average 0.14 kg or less per square meter (0.25 lbs per square yard).

D. Water intake for manufacturing purposes during the manufacturing process shall average 2.3 liters or less per square meter (0.5 gallons per square yard).

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

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SECTION 09 69 00
ACCESS FLOOR SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This section includes:

1. Access flooring panels and understructure
2. Various accessories, including, but not limited to ramps, steps and electrical boxes.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide access flooring system capable of supporting the following loads and stresses within limits and under conditions indicated, as demonstrated by testing manufacturer's current standard products according to referenced procedures in latest revised edition of Ceilings and Interior Systems Construction Associates (CISCA) "Recommended Test Procedures for Access Floors" referenced elsewhere in this section as CISCA/AF or, if not specified, manufacturers standard method.

1. Concentrated Design Loads: Provide floor panels capable of withstanding a concentrated design load of 1,250 lbf. (5560 N) applied on a one square inch area at any location on the panel with a permanent set not to exceed 0.010 inch (0.25 mm) as defined by CISCA. The loading method used to determine the concentrated design load shall be in conformance with CISCA/AF, Section 1, "Concentrated Load".

2. Ultimate Load: Provide access flooring system capable of withstanding a minimum ultimate load of two times the Concentrated Design Load without failing, according to CISCA/AF, Section 2, "Ultimate Loading".

3. Rolling Loads: Provide access flooring system capable of withstanding rolling loads of the following magnitude, with a combination of local and overall deformation not to exceed 0.040 inch (1.02) mm after exposure to rolling over CISCA/FA Path A or B, whichever path produced the greatest top surface deformation, according to CISCA/AF, Section 3, "Rolling Loads".

   a. CISCA/AF Wheel A, Rolling Load: 1,125 lbf. (5000 N) - 10 Passes

   b. CISCA/AF Wheel B, Rolling Load: 875 lbf. (3890 N) - 10,000 Passes

4. Stringer Load Testing: Provide stringers, without panels in place, capable of withstanding a concentrated load of 450 lbf (2002 N) at center span with a permanent set not to exceed 0.010 inch (0.25 mm), as determined per CISCA/AF Section 4, Stringer Load Testing".

5. Pedestal Axial Load Test: Provide pedestal assemblies, without panels in place, capable of withstanding a 6,000 lbf (44,448 N) axial load per pedestal, according to CISCA/AF Section 5, "Pedestal Axial Load Test", without any permanent deformation.

6. Pedestal Overturning Moment Test: Provide pedestal assemblies, without panels in place, capable of withstanding an overturning moment of 1,000 inch-pounds (113 NM) per pedestal, according to CISCA/AF Section 6, "Pedestal Overturning Moment Test", when glued to a clean, sound, uncoated concrete surface.

7. Drop Impact Load Test: Provide access flooring system capable of withstanding a drop impact load of 150 lb. (68 kg) dropped from a height of 36 inches (914 mm) without a failure of the system, according to CISCA/AF Section 8, “Drop Impact Load Test”.

8. Panel Drop Test: Provide access flooring system with panels capable of meeting all structural performance requirements specified, after the panel is dropped from a height of 36 inches onto a concrete surface.

9. Panel Cutout: Panel with an 8.625” diameter interior cutout shall be capable of withstanding a minimum ultimate load of two times the concentrated load without failure without the use of additional supports, according to CISCA/AF, Section 2, “Ultimate Loading”.

B. Seismic Performance: Provide access flooring system capable of withstanding the effects of seismic motions as calculated for the area of installation according to 2015 IBC – local code.

C. Flammability: System shall meet Class A Flame Spread requirements for flame spread and smoke development. Tests shall be performed in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics for Building Materials.

D. Combustibility: All components of the access floor system shall qualify as non-combustible by demonstrating compliance with requirements of ASTM E 136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg. C.

1.03 SUBMITTALS

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

1. Shop Drawings: Include complete layout of access flooring system based of field verified dimensions.

a. Details and sections with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, and understructure.

b. Detail Cut Sheets for each type of product indicated, including accessories, to show the information necessary to make a full evaluation of the entire flooring system.

c. For installed products indicated to comply with seismic design loads, include calculated structural analysis data signed by the qualified engineer responsible for their preparation.

B Product Certificates: For each type of access flooring system indicated, to certify that the flooring system meets the requirements of these written specifications and signed by a qualified employee of the manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or performed by access flooring manufacturer and witnessed by a qualified testing agency, for each type of flooring material and exposed finish.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is approved by the access flooring manufacturer for installations of the type of access flooring indicated for this project.

B. Source Limitations: Obtain access flooring system through one source from a single manufacturer.

C. Regulatory Requirements: Fabricate and install access flooring system to comply with NFPA 75 requirements for raised flooring.

D. Provide floor panels that are clearly and permanently marked with manufacturer's name and panel type. Removable product identification stickers are not acceptable.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver access flooring components in original, unopened packages, clearly labeled with manufacturer's name and item description.

B. Handle and store packages containing access flooring in a manner which avoids overloading building structure.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install access flooring until installation area is enclosed and has an ambient temperature of between 50 degrees Fahrenheit and 90 degrees Fahrenheit (100 C to 320 C) and a relative humidity of not less than 20 percent and not more than 80 percent.

1.07 COORDINATION

A. Coordinate locations of mechanical and electrical work in under-floor cavity to prevent interferences with access flooring pedestals

B. Do not proceed with installation of access flooring until after substantial completion of other performable construction within affected spaces.

1.08 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage and identified with labels clearly describing contents.

1. Standard field panels – 20%
2. Pedestals – 20%
3. Stringers – 20%

PART 2 PRODUCTS

2.01 FLOOR PANELS AND UNDERSTRUCTURE

A. Manufacturers: provide access flooring by ASM Modular Systems, Inc., consisting of FS200D access floor panels supported on a bolted stringer understructure.

B. Floor Panels General: Provide modular panels complying with the following requirements, that are interchangeable with other standard field panels, and can be easily relocated by one person, using a lifting device, without disturbing adjacent panels or understructure. Installed panels with floor covering in place are to be free of exposed metal edges.

1. Nominal Panel Size: 24" x 24" (610 mm x 610 mm)
2. Fabrication Tolerances: Fabricate panels to the following tolerances with squareness tolerances expressed as the difference between diagonal measurements from corner to corner.

a. Size and Squareness: Plus or minus 0.010" (0.12 mm) of required size, with squareness tolerance of plus or minus 0.015" (0.38 mm).

b. Flatness: Plus or minus 0.035” (0.89 mm) measured on a diagonal on top of the panel. Plus or minus 0.025” (0.64 mm) measured along edges.

3. Panel Attachment to Understructure: By Bolting to pedestal head. Provide panels with holes in corners to align precisely with threaded holes in pedestal heads and to accept countersunk screws with heads flush with top of panel.

C. Cementitious–Filled, Formed-Steel Panels: Fabricate panels with a die formed all-steel bottom pan fully welded to a die-cut full-hard steel top sheet to form a structural unitized construction. Completed panels to be filled with light-weight cementitious fill. Panels to be cleaned with 3-part wash and rinse system, prior to applying a protective electro-deposited epoxy paint finish.

1. Solid Panels: Flat, solid top surface

D. Pedestals: Provide manufactures standard pedestal assembly including base, column with provisions for height adjustments, and head (Cap), made of steel.

1. Base: Square base plate with not less than 16 square inches (103 sq. mm) of bearing area.

2. Column: Welded to base plate and of height required to bring finished floor to elevations indicated.

3. Provide vibration-proof leveling mechanism for making and holding fine adjustments in height over a range of not less than 2 inches (50 mm) and for locking at a selected height, so deliberate action is required to change height setting and prevents vibratory displacement.

4. Construct pedestal adjusting rod of minimum 3/4” (19 mm) diameter solid steel, and vertical column of minimum 7/8” (22 mm) square steel tubing. All steel components to have manufacturer’s standard galvanized finish.

5. Head: Pedestal head to accept bolted stringers as specified below.

E. Stringer System: Manufacturer’s modular steel stringer system designed and fabricated to interlock with pedestal head and to form a grid pattern with a stringer under each edge of each floor panel and a pedestal under each corner of each floor panel. Protect steel component against corrosion with manufacturer's standard galvanized finish.

1. Bolted Stringers: System of main and cross stringers of sizes shown below, attached to pedestal heads with 1/4-20 fasteners accessible from top of stinger.

2. Provide stringers that support each edge of each panel where required to meet design load criteria.

2.02 FLOOR PANEL COVERINGS

A. General: Provide bare panels without wear-surface covering.

2.03 ACCESSORIES

A. Service Cutouts: Fabricate cutouts in floor panels to accommodate cable penetrations and service outlets. Comply with requirements indicated for size, shape, number, and location. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with standard performance requirements.

1. Fit cutouts with manufacturer’s standard grommets in size indicated or, where size of cutouts exceeds maximum grommet size available, trim edge of cutouts with

manufacture's standard plastic molding having tapered top flange. Furnish removable covers for grommets.

2. Provide foam-rubber pads for sealing annular space formed in cutouts by cables. Trim edge of cutout with molding having a double-flanged internal edge for containing and supporting foam pads.

B. Vertical Closures (Fascia): Where under floor cavity is not enclosed by abutting walls or other construction, provide manufacturer's standard metal closure plates with manufacturer's standard finish.

C. Steps: Provide steps of size and arrangement indicated with floor covering to match access flooring. Apply non-slip aluminum nosing to treads, unless otherwise indicated.

D. Panel Lifting Device: Manufacture's standard portable lifting device of type and number required for lifting panels.

1. Provide the following quantity: one lifting device per room

PART 3 EXECUTION

3.01 PREPARATION

A. Examine sub-floor for any problems that would prevent a satisfactory installation of access floor, such as moisture an unevenness of top surface. Do not proceed with installation until sub-floor is clean, dry and level as completed by other trades.

B. Verify field dimensions to contract drawings for size of area of installation, height and level of recessed slabs, door openings, ledges, etc.

C. Floor Sealers: Verify that any concrete sealer that has been used is compatible with pedestal adhesive.

D. Access to Installation Area: General Contractor shall provide clear access to installation area throughout entire duration of installation of access floor that is free of construction debris and other trades.

E. Storage of Materials: Area to receive and store access floor materials shall be enclosed and dry. Storage area shall be maintained at a temperature of not less than 350 F and not more than 950 F (20 C to 350 C), with a relative humidity level between 20% min. to 80% max.

F. Area of Installation: Shall be maintained throughout entire duration of installation of access floor at a temperature of 500 F min. to 900 F max. (100 C to 320 C) and at 20% min. to 80 % max. relative humidity.

Prior to installation, all floor panels shall be stored for at least 24 hours in a dry enclosed area at no less than 500 F and no more than 900 F (100 C to 320 C).

3.02 INSTALLATION

A. Install access floor system and accessories under supervision of the access flooring manufactures authorized representative to ensure rigid, firm installation that complies with performance requirements and is free of vibration, rocking, rattles and squeaks.

B. Layout floor panel installation to keep the number of cut panels at the floor perimeter to a minimum.

C. Set pedestal in adhesive as recommended by the access flooring manufacturer to provide full bearing of the pedestal base on the sub floor.

1. Pedestal locations shall be established from approved shop drawings to allow mechanical and electrical work to be installed without interfering with pedestal installation.
2. Pedestals shall be attached to sub-floor using manufacturer's approved method.

D. Secure grid member to pedestal heads in accordance with access floor manufacturer's instructions.

E. Install floor panels securely in place and properly seated with panel edges flush. Do not force panels into place.

F. Scribe panels at perimeter to provide a close fit with adjoining construction with no voids greater than 1/8" (3 mm) where panels abut vertical surfaces.

G. Install accessories according to Manufacturer's instructions.

H. Clean up dust, dirt and construction debris caused by floor installation, and vacuum the sub-floor area, as installation of floor panel proceeds. Extend cleaning under installed panels as far as possible.

I. Level installed access floor to within 0.10" (2.5 mm) over the entire access flooring area and within 0.060" (1.5 mm) of true level in any 10 ft. (3 M) distance.

3.03 ADJUSTING, CLEANING AND PROTECTION

A. During installation, all traffic on access floor shall be directed by access floor installer.
1. No traffic, other than access floor installer, shall be allowed on the floor area for 24 hours after installation to allow the pedestal adhesive to set.
2. No access floor panels shall be removed by other trades for 72 hours after installation.

B. After completing installation, vacuum clean access flooring.

C. Replace any flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

D. General contractor and/or owner shall provide and maintain suitable protection to prevent damage to completed access floor throughout entire duration of installation.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 09 90 00
PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

B. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 SUBMITTALS

A. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Material List: An inclusive list if required coating materials. Indicate each material and cross-reference specific coating, finish system and application. Identify each material by manufacturer's catalog number and general classification.
   2. Preparation instructions and recommendations.
   3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing and applying each coating material.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in manufacture's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F (7 degrees C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1.04 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gallon (3.8l) or one case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paint selected from one of the following manufacturers:

1. PPG/Porter Paints
2. Benjamin Moore
3. Sherwin Williams
4. Farrell-Calhoun

C. Products and Paint Systems as listed in this specification.

D. Refer to Construction Documents for paint color and location.

E. Accent Walls will be dark tint paint

F. Exposed Structure shall not be painted white.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
1. Supply each coating material in quantity required to complete entire project's work from a single production run.
2. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.03 PAINT SYSTEMS – INTERIOR

A. Masonry - Concrete Block: One Acrylic Latex Filler Coat and Two Acrylic Latex Finish Coats**(Zero VOC System)**

1. Filler:

Moore 285 Moorecraft Super Craft Acrylic Latex Block Filler (45 g/L)
PPG 6-7 Speedhide Acrylic Latex Masonry Block Filler (14 g/L)

S/W B25W25 PrepRite Interior / Exterior Latex Block Filler (42 g/L)
FC 470 Interior/Exterior Latex Masonry Block Filler (0 g/L)

2. Finish

Moore N376 Eco Spec WB Acrylic Latex Zero VOC **Semi-Gloss** Enamel (0 g/L)

PPG 6-4510 Speedhide Zero VOC Interior Latex Semi-Gloss (0 g/L)
FC 680G Line Interior Semi-Gloss Latex Enamel (0 g/L)

B. Ferrous Metals: Low VOC System: One Primer Coat & Two Finish Coats

1. Primer:

Moore P04 Super Spec HP Acrylic Metal Primer (54 g/L)
PPG 90-712 Pitt-Tech Waterborne Acrylic DTM Primer (123 g/L)
S/W B66W1 Direct to Metal (DTM) Acrylic Primer (138 g/L)
FC 5-56 Waterborne 100% Acrylic DTM Primer (45 g/L)

2. Finish:

Moore P29 Super Spec HP Acrylic DTM **Semi-Gloss** Enamel (206 g/L)
PPG 7-374 PPG Interior Exterior Acrylic Semi Gloss Enamel (81 g/L)
S/W B66-200 Direct To Metal (DTM) Acrylic Semi Gloss Enamel (208 g/l)
FC FC 8000 Line Waterborne 100% Acrylic DTM Semi-Gloss Enamel (95 g/L)

C. Direct To Galvanized Metal (No Primer Required) Two Finish Coats of DTM Dryfog

1. Finish

Moore 153 Super Spec Sweep Up Spray Acrylic Latex Flat Dry Fall (46 g/L)
PPG 6-725XI Speedhide Super Tech WB Acrylic Flat Dry Fog (29 g/L)
S/W B42W1 Waterborne Flat DTM Dry Fog (B42W2 Eggshell Finish (58 g/L)
FC 999 Tuff-Boy Water-Base Dry Fog Flat (34 g/L)

D. Gypsum Drywall Low VOC System: One Primer Coat and Two Finish Coats.

1. Primer

Moore N372 Eco Spec WB Acrylic Latex Zero VOC Primer Sealer (0 g/L)
PPG 6-4900, Speedhide Zero VOC Interior Latex Wall Primer (0 g/L)
S/W B28W2600 ProMar 200 Zero VOC Interior Latex Primer (0 g/l)
FC 380 Perfik-Seal Interior Latex Primer/Sealer (0 g/L)

2. Finish

Moore N376 Eco Spec WB Acrylic Latex Zero VOC Semi-Gloss Enamel (0 g/L)
PPG 6-4510 Speedhide Zero VOC Interior Latex Semi-Gloss (0 g/L)
S/W ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31-2600 (0 g/l voc)
B34W200 ProMar 200 Alkyd Semi-Gloss Enamel (442 g/L)
B54 Alkyd Gloss Industrial Enamel (440 g/L)
FC 680G Line Interior Semi-Gloss Latex Enamel (0 g/L)

2.03 PAINT SYSTEMS – EXTERIOR

A. Galvanized Metal: Low VOC: One Waterborne Acrylic Primer Coat & Two Waterborne Acrylic Finish Coats

1. Primer

Moore P04 Super Spec HP Acrylic Metal Primer (54 g/L)
PPG 90-712 Pitt-Tech Waterborne Acrylic DTM Primer (123 g/L) 90-708 Red
S/W B66W1 Direct to Metal (DTM) Acrylic Primer (138 g/L)
B66-310 ProCryl WB Universal Metal Primer (110 g/L)
FC 5-56 Waterborne 100% Acrylic DTM Primer (45 g/L)

2. Finish:

Moore P29 Super Spec HP Acrylic DTM Semi-Gloss Enamel (206 g/L)
P28 Super Spec HP DTM Acrylic Gloss Enamel (147 g/L)
PPG 7-374 PPG Interior Exterior Acrylic Semi Gloss Enamel (81 g/L)
90-374 Pitt-Tech Waterborne Acrylic Gloss Industrial Enamel (192 g/L)

S/W B66-200 Direct To Metal (DTM) Acrylic Semi Gloss Enamel (208 g/L)
B66W100 Direct To Metal (DTM) Acrylic Gloss Enamel (208 g/L)
FC 8000 Line Waterborne 100% Acrylic DTM Semi-Gloss Enamel (95 g/L)

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.02 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 09 97 24
CONCRETE SEALER

PART 1 GENERAL

1.01 SUBMITTALS

A. Prior to delivery of materials to job site, submit manufacturer's current technical data sheets.

B. Color samples.

C. Prepare a field sample of 30 square feet prior to execution of work to evaluate physical and chemical effects of sealer. Locate sample at direction of Architect.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers

1. Tex-Cote
2. L.M. Scofield
3. Other manufacturer as pre-bid approved.

B. Products:

1. Semi-transparent water based concrete sealant.
   a. Tex-Cote RS400 Rainstopper
   b. Approved Equal
   c. Increte Systems- Ultragrip Slip Resistant Additive

C. Equipment: Low pressure airless spray equipment, fitted with fan spray nozzles. Keep equipment clean and free of contaminants including water.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect concrete for suitability to receive sealer. Concrete shall have cured minimum of 28 days and shall be free of large cracks, holes, voids and surface stains. Do not begin installation until unsatisfactory conditions have been remedied.

B. Prepare substrate according to manufacturer's written instructions, which may include sandblasting, sweeping, power washing, and/or non-residual chemical cleaning. Surface contaminants, including dust, mold/mildew, oil, dirt and loose materials must be entirely removed before installation may begin.

C. As necessary, install joint sealants and allow them to cure before applying concrete sealer.

D. Do not install sealer if temperature is below 40 degrees F or above 100 degrees F

3.02 INSTALLATION

A. Clean and dry area to be treated. Apply two coats of sealer according to manufacturer's instructions. Do not exceed coverage rates. Excess sealer remaining on surface after 15 minutes shall be removed using a clean mop or cloth.

B. Sealer must remain moisture free for 12 hours after installation, and shall be allowed to cure for 72 hours before any work may be done in treated areas. Limit traffic on uncured sealant.

C. Provide adequate ventilation during application and curing. Protective gear should be worn at all times during installation; including eye protection. Comply with all applicable safety requirements.

D. Sweep spilled product into a closed container.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

C. Selection Samples: submit two sets of color selection charts or chips.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADA Standards for Accessible Design and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Signage – provide APCO I.M. System
   5. Office Doors: Identify with room numbers to be determined later; in addition, provide "window" section for replaceable occupant name.
   6. Meeting Rooms: Identify with room numbers to be determined later; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
   7. Service Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings.
   8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", Handicap symbol, and braille.

2.02 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica
   2. Character Case: Upper case only.
   3. Background Color: tbd
   4. Character Color: tbd

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 10 21 15
STAINLESS STEEL TOILET COMPARTMENTS

PART 1-GENERAL

1.01 SUBMITTALS

A. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
B. Provide data on panel construction, hardware, and accessories.

PART 2 PRODUCTS

2.01 MOUNTING STYLE

A. The toilet partitions shall be stainless steel with floor anchored/overhead braced mounting style as manufactured by ASI Accurate Partitions, Burr Ridge, Illinois.
B. Furnish all labor and materials necessary for completion of work in this section as shown in the approved drawings and specified herein.
C. The toilet partitions shall be stainless steel with floor anchored/overhead braced mounting style as manufactured by **ASI Accurate Partitions**, Burr Ridge, Illinois – Basis of Design. Other manufacturers shall be pre-bid approved equal.
D. Furnish all labor and materials necessary for completion of work in this section as shown in the approved drawings and specified herein.

   Related Work – Specified elsewhere shall include accessories and anchorage/blocking for attachment of partition.

2.02 PRODUCT

A. **Door, Panels, and Urinal Screens** – Shall be 1" thick and fabricated from tension leveled 22 gauge, type 304 stainless steel with a #4 finish bonded to sound deadening honeycomb core.
B. **Pilasters** – Shall be 1-¼" thick, 82" high, and fabricated from tension leveled 22 gauge, type 304 stainless steel with a #4 finish bonded to sound deadening honeycomb core.
C. **Material** - Doors, panels, pilasters, and urinal screens shall be manufactured with a resin impregnated honeycomb core that is bonded under pressure to the stainless steel with a non-toxic adhesive to ensure solid construction and sound attenuation. All the stainless steel components shall be assembled with a continuous roll-formed interlocking, 22-gauge stainless steel crown molding welded and ground smooth at the corners.
D. **Finish** – All components shall be type 304 stainless steel with a #4 finish and include a PVC film for protection during shipment and installation.
E. **Door Hardware** – Shall be gravity actuated, cam-action hinges that permit door to remain at desired position when not in use. Hinges, one-piece strike and keeper and coat hook shall be chromium plated Zamac to resist corrosion. Hinges, strike and keeper shall be attached with tamper resistant barrel nuts and shoulder screws. Concealed latch assembly will allow for emergency access. Doors for handicapped compartments shall be supplied with **e** ADA paddle handles.

F. **Mounting Hardware** – Chrome plated Zamac stirrup brackets shall be used to mount panels and pilasters. Mounting hardware shall be secured with tamper resistant screws.
G. **Construction Design** - Partitions shall be floor anchored with L-shaped mounting forks and include an integral leveling bolt to provide proper height adjustment. Floor anchoring system shall be concealed by a type 304 stainless steel trim shoe with a #4 finish. Aluminum headrail with anti-grip profile shall provide overhead bracing and span all compartments and brace the end pilaster to the back wall.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 inches high, concealing floor fastenings.
B. Head Rails: Hollow chrome plated steel tube, 1 x 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.
C. Wall and Pilaster Brackets: Polished stainless steel.
D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
E. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Nylon bearings.
   3. Thumb turn door latch with exterior emergency access feature.
   4. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   5. Coat hook with rubber bumper; one per compartment, mounted on door.
   6. Provide door pull for out-swinging doors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Shall be installed in accordance to the Accurate installation instructions with partitions rigid, straight and plumb. Doors and panels shall be mounted 12” above the finished floor.

3.02 WARRANTY

A. ASI Accurate Partitions guarantees its stainless steel partitions, properly maintained, against corrosion or discoloration for 5 YEARS from the date of receipt by the customer. If material is found defective during that period, the material shall be replaced free of charge. No credits or allowances shall be issued for any labor or expenses relating to the replacement of components covered under the warranty plan.

3.03 TOLERANCES

A. Maximum variation from true position: 1/4 inch.
B. Maximum variation from plumb: 1/8 inch.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 10 28 00
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all products manufactured by one manufacturer of the following:

1. Bobrick
2. Pre-bid approved equal

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269, Type 304 or 316.

2.03 FINISHES

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

2.04 TOILET ROOM ACCESSORIES

A. Toilet Accessories: Bobrick

i. Recessed towel dispenser and waste receptacle: B-3961
ii. Surface mounted toilet tissue dispenser B-2888
iii. Sanitary napkin disposal B-270
iv. Heavy duty robe hook: B-2116
v. Handicap tilt mirror B-293 (24” x 36”)

B. Toilet Accessories: Non-Bobrick

i. Foam Dispenser – Spartan Chemical Company 975700
ii. Toilet paper dispenser: Shoreline 830 from Memphis Chemical (not for public restroom)
iii. Toilet Seat Cover Cabinet : Franklin Brass #1988 (Stainless Steel)
vi. C. Grab Bars: Stainless steel, nonslip grasping surface finish with Snap Flange

1. Standard Duty Grab Bars:
   a. Push/Pull Point Load: 250 pound-force, minimum.
   b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
   c. Length and Configuration: As indicated on drawings.

2.06 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: 3 spring-loaded rubber cam holders.
   2. Length: 36 inches.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings. Install plumb and level, securely and rigidly anchored to substrate.

B. Mounting Heights: As required by accessibility regulations, refer to AC series sheets unless otherwise indicated on drawings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 11 13 30
MEZZANINE FALL PROTECTION

PART 1 GENERAL

1.01 SUMMARY

Section includes permanent, free-standing loading dock guardrail systems and swing gates.

A. Manual-closing pivot gates.

1.02 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Installation methods.

B. Certification: Provide manufacturer's certifications that the ultimate strength of the fall protection system is equal to or greater than those specified.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: minimum of 15 years' experience manufacturing portable railing systems.

B. Installer Qualifications: 1–2-person crew capable of positioning mounting plates and installing portable railing systems according to manufacturer's instructions.

1.04 WARRANTY

A. Manufacturer 10 year non pro-rated Warranty

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mezzanine Safeti-Gates INC.

B. Approved Equal.

2.02 DESIGN REQUIREMENTS

A. Structural Performance: Comply with requirements of applicable local, state, and federal codes including:

1. OSHA: 29 CFR 1926 – Safety and Health Regulations for Construction, Subpart M-Fall Protection.

2. OSHA: 29 CFR 1910.23 – Occupational Health and Safety Standards for General Industry.

2.03 EQUIPMENT

A. Manual-Closing Pivot Gate System shall meet OSHA 1910.23(a)(2).

1. Rails: 1-5/8 inch O.D. by 0.120 inch wall HREW tubing.
2. Length: per drawings – 2 REQUIRED, TWO SIZES
3. Overall Height: 90 inches
4. Clearance Height: 88 inches
5. Clearance of Drop area Depth: 60 inches
6. Mid-rail: weld to posts at 21 inches (533 mm) below top rail.
7. Finish: Epoxy powder coated safety yellow

PART 3 EXECUTION

3.01 PREPARATION

1. Clean surfaces thoroughly prior to installation.
2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.02 INSTALLATION

3. Install in accordance with manufacturer's instructions.
4. Before installation, inspect all parts to ensure no damaged parts are used.
5. Railing must be secured to base with securing pins.
6. Install base mounts spaced to receive rail sections.
7. Anchor base mounts to concrete substrate with expansion bolts or to steel edge angles with appropriate threaded anchors.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

ISSUED FOR BID

SECTION 11 24 00
ROOF FALL PROTECTION EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended maintenance and fall protection equipment including delegated design.

1.02 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including: Preparation instructions and recommendations, Storage and handling requirements and recommendations and Installation methods.

B. Shop Drawings:

1. Provide project specific, scaled, engineered stamped shop drawings and calculations including layout, dimensions, loading and structural requirements.

C. Certifications:

1. Include a letter certified by an engineer registered in the project's state noting that the primary structural system has adequate capacity to support the transient equipment loading when combined with the applicable dead and live loads.

2. Manufacturer Insurance Certificate(s): Include product liability specifically for suspended maintenance and fall protection equipment.

3. Installer Insurance Certificate(s): Include workmen's compensation, comprehensive general liability, and comprehensive automobile liability.

D. Closeout Submittals:

1. Log Book including record shop drawings indicating the constructed condition with a completed initial testing log, bi-annually inspection log to be filled out by others, a 10-year retest log to be filled out by others, and an appendix containing the Preconstruction Submittals.

   a. Log book shall include the statement: Systems users to inspect all equipment prior to each use, including all visible attachment points, locks, and pins to ensure all equipment is in safe working order. All users shall be trained on proper use of the equipment, as well as knowing and complying with OSHA, ANSI, and other pertinent life safety regulations. All equipment shall be annually inspected by a qualified person and also re-certified within 10 years under direct supervision of a licensed engineer.

2. Laminated placards noting the log book location and showing the system layout for each permanent roof access location.

3. Operations and Maintenance Data.

1.03 QUALITY ASSURANCE

A. Products shall meet or exceed OSHA and ASME A120.1 standards and be tested and certified by professional engineers.

B. Installer Qualifications: Approved by the manufacturer and with minimum three similar completed projects.

C. Welder Qualifications:

1. AWS D1.1 for structural steel.
2. AWS D1.2 for aluminum.
3. AWS D1.6 for stainless steel.

1.04 PROJECT CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's recommended temperature limits.

1.05 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty for parts for a term of 1 year on finish and structural capacity.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:

1. Engineered Supply LLC

2.02 SYSTEM DESIGN REQUIREMENTS

A. Design and anchorage layout to comply with OSHA, ANSI, IWCA, applicable state regulatory requirements, and other project requirements as necessary.

B. Provide graphical design indicating areas of the building to be serviced. Provide complete coverage for the type of service required and service methods.

C. Fall Protection Anchorages:

1. Capable of sustaining a minimum ultimate load of 5,000 pound force in any direction the load may be applied for fall arrest.

D. Horizontal Lifelines:

1. Capable of sustaining a 1,800 pound force impact service load in any direction the load may be applied when two users are attached to the system with shock absorbing lanyards limiting the force applied to the system to 900 pounds force for each user.
2. Maintain a minimum factor of safety from service loads to elastic material limits of 2:1.
3. Capable of sustaining a minimum ultimate load of 5,000 pound force in any direction the load may be applied under the plastic limits of the materials.
4. All components of the system shall be directly specified and supplied including manufacturer, make, and model in the design. No replacement components or equals are allowed.

2.03 PRODUCT REQUIREMENTS

A. Anchors shall be completely free of sharp edges or abrasive surfaces.

B. Specifically deburr hoops after hot dip galvanizing process.

C. All exposed portions of carbon steel anchors shall be hot dipped galvanized or aluminum thermal sprayed.

D. Vent holes to accommodate the hot dip galvanizing process shall be permanently sealed.

1. Provide a minimum of 3/4" diameter attachment hoop. Attachment hoop shall be capable of sustaining 5,000 pound force in any direction the load may be applied under the plastic limits of the materials.

2. Inside radius shall be a minimum of 1.625 inches.

2.04 FINISHES

A. Galvanized steel, no applied finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrates match the recommendations of the manufacturer and the project specific shop drawings.

B. Verify bearing surfaces are even, plumb, and true. Uneven bearing surfaces may lead to loosening of anchorages during load testing and rejection of anchorage.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Sequence and coordinate with other ongoing work, allowing appropriate notice to other trades and inspectors.

B. Install anchors and fasteners in strict accordance to manufacturer requirements.

C. Torque fasteners with a calibrated torque wrench in strict accordance to manufacturer requirements.

D. Fasteners shall be vibration proof through the use of permanent thread locking compound, deformed thread nuts, or damaged threads. Split ring lock washers are not acceptable without additional retention as noted.

E. Coordinate installation with the Roofing Contractor and General Contractor to verify installation will result in a warrantable building envelope.

3.03 FIELD QUALITY CONTROL

A. Equipment shall be initially load tested under the direct supervision of a licensed engineer in accordance with ANSI, OSHA, and IWCA requirements.

B. Each anchor shall be inspected for conformance to manufacturer requirements, building envelope, looseness, and signs of permanent deflection during load testing.

3.04 DEMONSTRATION AND TRAINING

A. Provide on-site instruction by manufacturer technician for Owner's representative in proper use, maintenance, and inspection requirements of the system.

B. Repair or replace non-conforming and damaged products and inspect as necessary to supply a complete, useable system.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 12 24 13

WINDOW ROLLER SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roller shades, manual operation, and accessories.
B. Shade fabric.

1.02 REFERNCES

A. ASTM International (ASTM):

1. ASTM G21_ Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. National Fire Protection Association (NFPA):

2. NFPA 70- National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
3. NFPA 701- Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

C. Underwriters Laboratories (UL):
1. UL (GGG) – GREENGUARD Gold Certified Products; Current Edition.
D. Window Covering Manufacturers Association (WCMA):
1. WCMA A100.1- Safety of Window Covering Products; 2018.

1.03 SUBMITTALS

A. Shop drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams, and relationship to adjacent work.
B. Verification samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements.
1. Shadecloth Sample: Mark face of material to indicate interior faces.
a. Test reports indicating compliance with specified fabric properties.
b. Verification Samples: 6 inches (150 mm) square, representing actual materials, color, and pattern.
C. Maintenance Data: Bill of materials for all components with part numbers. Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

1.05 WARRANTY

A. Roller Shade Hardware and Chain Warranty: Manufacturer’s standard non-depreciating warranty for interior shading.

1. Shade Hardware: 10 years unless otherwise indicated.
    a. Mecho, Soho shade fabric: 25 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mecho, Rep is Cherie Simmons. Email: cherie.simmons@mechoshade.com. Phone: 770-519-0570.
B. Or prebid approved equal.

2.02 ROLLER SHADES, MANUAL OPERATION, AND ACCESSORIES

A. Shade System; General:
    1. Components capable of being removed or adjusted without removing mounted shade brackets, or cassette support channel.
    2. Smoothly operation raising or lowering shades.
    3. Cradle-to-Cradle certified and listed in C2C (DIR).
B. Basis of Design: Mecho Soho System as manufactured by MechoShade Systems LLC.
    1. Description: Manually operated fabric window shades.
        a. Shade Type: Single Roller.
        b. Drop Position: Regular roll.
        c. Mounting: Window Jamb Mounting.
        d. Size: As indicated on drawings (see F series).
        e. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    2. Accessories:
        a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
            1) Finish: Baked enamel.
                a) Color: Bronze.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
C. Coordinate with window installation and placement of concealed blocking to support shades.

3.02 INSTALLATION

A. Install shades level, plumb, square, and true per manufacturer's instructions and approved shop drawings. Locate so shade band is at least 2 inches (51mm) from interior face of glass. Allow proper clearances for window operation hardware. Use mounting devices as indicated.
B. Replace shades exceeding specified tolerances at no extra cost to Owner.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric.
D. Clean roller shade surfaces after installation, per manufacturer's written instructions.
E. Demonstrate operation and maintenance of window shade system to Owner's personnel.
F. Manufacturer's authorized personnel are to train Owner's personnel on operation and maintenance of system.
    1. Use operation and maintenance manual as a reference, supplemented with additional training materials as required.

3.03 PROTECTION AND CLEANING

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.
    1. Clean soiled shades and exposed components as recommended by manufacturer.
    2. Replace shades that cannot be cleaned to "like new" condition.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 12 52 40
SEATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chairs.

1.02 SUBMITTALS

A. Samples: Submit manufacturer's samples of materials, finishes, and colors.

B. Warranty: Manufacturer's standard warranty.

1.03 WARRANTY

A. Warranty information: Products will be free from defects in material and/or workmanship for a period of five years from the date of invoice. The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.

PART 2 PRODUCTS

2.01 SEATING

A. Hon Motivate 4-Leg Stacked Chair: Provide all pieces as specified on drawings (see F series) or pre bid approved equal.

B. Hon Endorse Work Mid Upholstered Back Big & Tall: Provide all pieces as specified on drawings (see F series) or pre bid approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive chairs.

B. Notify Architect of conditions that would adversely affect placement or subsequent use.

C. Do not begin placement until unacceptable conditions are corrected.

3.02 PLACEMENT

A. Place chairs as specified in drawings.

3.03 CLEANING

A. Clean chairs promptly after placement in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.04 PROTECTION

A. Protect placed chairs to ensure that, except for normal weathering, chairs will be without damage or deterioration at time of Substantial Completion.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 12 59 10
DESK SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Desk system

B. Tile and Frame System.

1.02 SUBMITTALS

A. Samples: Submit manufacturer’s samples of materials, finishes, and colors.

B. Warranty: Manufacturer’s standard warranty.

1.03 WARRANTY

A. Warranty information: Products will be free from defects in material and/or workmanship for a period of five years from the date of invoice. The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.

PART 2 PRODUCTS

2.01 PRODUCT

A. Hon Abound Tile and Frame System: Provide all pieces as specified on drawings (see F series) or pre bid approved equal.

B. Hon Abound Desk System: Provide all pieces as specified on drawings (see F series) or pre bid approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained.

3.04 PROTECTION

A. Protect installed products until substantial completion of project.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 12 59 20
TABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tables.

1.02 SUBMITTALS

A. Samples: Submit manufacturer's samples of materials, finishes, and colors.

B. Warranty: Manufacturer's standard warranty.

1.03 WARRANTY

A. Warranty information: Products will be free from defects in material and/or workmanship for a period of five years from the date of invoice. The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.

PART 2 PRODUCTS

2.01 TABLE

A. Hon Birk Table: Provide all pieces as specified on drawings (see F series) or pre bid approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive tables.

B. Notify Architect of conditions that would adversely affect placement or subsequent use.

C. Do not begin placement until unacceptable conditions are corrected.

3.02 PLACEMENT

A. Place tables as specified in drawings (see F series).

3.03 CLEANING

A. Clean tables promptly after placement in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.04 PROTECTION

A. Protect placed tables to ensure that, except for normal weathering, tables will be without damage or deterioration at time of Substantial Completion.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 12 59 30
LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Storage lockers.

1.02 SUBMITTALS

A. Samples: Submit manufacturer’s samples of materials, finishes, and colors.

B. Warranty: Manufacturer’s standard warranty.

1.03 WARRANTY

A. Warranty information: Products will be free from defects in material and/or workmanship for a period of five years from the date of invoice. The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.

PART 2 PRODUCTS

2.01 LOCKERS

A. Allsteel Align Storage Lockers: Provide all pieces as specified on drawings (see F series) or pre bid approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

3.02 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.

3.03 INSTALLATION

A. A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 21 05 17
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.02 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.

3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
    a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeve>.
    b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel wall sleeves.
2. Exterior Concrete Walls below Grade:
    a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
    b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
    a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
        1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
    a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
5. Interior Partitions:
    a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 21 05 18
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Escutcheons.
   2. Floor plates.

1.02 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening. Install in accordance to ASTM E580.
   1. Escutcheons for New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, 2-inch, cast-brass type with polished, chrome-plated finish.
      f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.

g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 21 05 48

VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restraining braces.

1.02 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.03 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Risk Category as Defined in the IBC: IV.
   a. Component Importance Factor: 1.5.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.660g (site specific)
4. Design Spectral Response Acceleration at 1-Second Period: 0.3162 (site specific)

1.04 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations, drawings including plans showing locations of all bracing and equipment anchorage and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Manufacturers Seismic qualification/certification data for “active” equipment with Ip = 1.5 as noted in the individual equipment specifications.

1.05 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.

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

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATORS

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:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

2.02 SEISMIC BRACING AND RESTRAINT DEVICES

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:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Gripple, Inc.
5. Hilti, Inc.
6. Kinetics Noise Control.
7. Loos & Co.; Cableware Division.
8. Mason Industries.
9. TOLCO Incorporated; a brand of NIBCO INC.
10. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

G. Mechanical Anchor Bolts: Drilled-in and stud-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ACI 335.2 per ASCE 7-10. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.01 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127 and NFPA 13.
2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c., unless a shorter span is determined by calculation.
3. Brace a change of direction longer than 12 feet (3.7 m).

C. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

E. Attachment to Structure: Anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members based on the design calculations and details.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.02 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. See structural drawings for expected differential displacements at the building separation/expansion joints for use in designing the flexible connections. Comply with requirements in Division 21 Section "Wet Fire-Suppression Systems" for piping flexible connections.

3.03 SEISMIC INSTALLAION VERIFICATION

A. The Owner will hire a 3rd Party Inspector/Professional Engineer who has at least 5-yrs experience in the seismic design and inspection of nonstructural components, equipment and systems to inspect the seismic installations of nonstructural components for compliance with the approved delegated seismic design submittal. Periodic inspection reports and a final certification report stating that the nonstructural components, equipment and systems have been installed in accordance with the approved delegated seismic design submittal shall be

submitted to the Owner, Architect and Fire Protection Engineer of Record. The final report shall be stamped by the inspecting Professional Engineer licensed in the state of the job location.

B. The Contractor shall correct any and all deficiencies identified by the 3rd Party Inspector deviating from the approved delegated seismic design submittal at the Contractor's expense to the satisfaction of the Inspector.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Excess-pressure pumps.
6. Alarm devices.
7. Pressure gages.

B. Related Sections:

1. Division 21 Section “Vibration and Seismic Controls for Fire Suppression Piping.

1.02 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.03 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Available fire-hydrant flow test records indicate the following conditions:
    a. Date: 2/11/15
    b. Time: 11:30 p.m.
    c. Performed by: M.L.G&W
    d. Location of Residual Fire Hydrant R: 4141 Louis Carruthers Dr.
    e. Location of Flow Fire Hydrant F: 4079 Louis Carruthers Dr.
    f. Static Pressure at Residual Fire Hydrant R: 64 psig.
    g. Measured Flow at Flow Fire Hydrant F: 1,145 gpm.
    h. Residual Pressure at Residual Fire Hydrant R: 59 psig.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Automobile Parking Areas: HC-2 Occupancy.
b. Building Service Areas: HC-2 Occupancy.
c. Electrical Equipment Rooms: HC-2 Occupancy.
d. General Storage Areas: HC-2 Occupancy.
e. Mechanical Equipment Rooms: HC-2 Occupancy.
f. Office and Public Areas: HC-1 Occupancy.
g. Repair Garages: HC-2 Occupancy.

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. HC-1 Occupancy (ceiling height up to 30 ft): 0.10 gpm over 1500-sq. ft. area.
   b. HC-2 Occupancy (ceiling height up to 30 ft): 0.20 gpm over 2500-sq. ft. area.
   c. HC-2 Occupancy (ceiling height 30 to 45 ft): 0.20 gpm over 2500-sq. ft. area.
   d. Special Occupancy Hazard: As determined by authorities having jurisdiction.
4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:
   a. Office Spaces: 225 sq. ft. (20.9 sq. m).
   b. Storage Areas: 130 sq. ft. (12.1 sq. m).
   c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
   d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m).
   e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
   a. HC-1 Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
   b. HC-2 Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
   c. HC-3 Occupancies: 500 gpm (31.5 L/s) for 90 to 120 minutes.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13, ASCE/SEI 7 and specification section 210548.

1.04 SUBMITTALS

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

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, seismic bracing locations and details and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Qualification Data: For qualified Installer and professional engineer.

E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

F. Welding certificates.

G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

H. Field quality-control reports.

I. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.02 STEEL PIPE AND FITTINGS

2.03 Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

A. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

B. Uncoated, Steel Couplings: ASTM A 865, threaded.

C. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable- or Ductile-Iron Unions: UL 860.

E. Cast-Iron Flanges: ASME 16.1, Class 125.

F. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

G. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

H. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.

b. Corcoran Piping System Co.

c. National Fittings, Inc.

d. Shurjoint Piping Products.

e. Tyco Fire & Building Products LP.

f. Victaulic Company.

2. Pressure Rating: 175 psig (1200 kPa) minimum.

3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.

4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

I. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig (1200-kPa) pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the followin]:

a. Victaulic Company.

2.04 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick.

1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.05 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.

2. Minimum Pressure Rating: 175 psig (1200 kPa).

B. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFAC Inc.

b. American Cast Iron Pipe Company; Waterous Company Subsidiary.

c. Anvil International, Inc.

d. Clow Valve Company; a division of McWane, Inc.

e. Crane Co.; Crane Valve Group; Crane Valves.

f. Crane Co.; Crane Valve Group; Jenkins Valves.

g. Crane Co.; Crane Valve Group; Stockham Division.

h. Fire-End & Croker Corporation.

i. Fire Protection Products, Inc.

j. Fivalco Inc.

k. Globe Fire Sprinkler Corporation.
l. Groeniger & Company.
m. Kennedy Valve; a division of McWane, Inc.
n. Matco-Norca.
o. Metraflex, Inc.
p. Milwaukee Valve Company.
q. Mueller Co.; Water Products Division.
r. NIBCO INC.
s. Potter Roemer.
t. Reliable Automatic Sprinkler Co., Inc.
u. Tyco Fire & Building Products LP.
v. United Brass Works, Inc.
w. Venus Fire Protection Ltd.
x. Victaulic Company.
y. Viking Corporation.
z. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Pressure Rating: 250 psig (1725 kPa) minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

C. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, **a**vailable manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. United Brass Works, Inc.
2. Standard: UL 262.
3. Pressure Rating: 175 psig (1200 kPa).
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
   b. American Valve, Inc.

c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. Hammond Valve.
h. Milwaukee Valve Company.
i. Mueller Co.; Water Products Division.
j. NIBCO INC.
k. Shurjoint Piping Products.
l. Tyco Fire & Building Products LP.
m. United Brass Works, Inc.
n. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Pressure Rating: 250 psig (1725 kPa) minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

E. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International, Inc.
   b. Fivalco Inc.
   c. Global Safety Products, Inc.
   d. Kennedy Valve; a division of McWane, Inc.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Shurjoint Piping Products.
   h. Tyco Fire & Building Products LP.
   i. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Valves NPS 2 (DN 50) and Smaller:
   a. Valve Type: Ball or butterfly.
   b. Body Material: Bronze.
   c. End Connections: Threaded.
5. Valves NPS 2-1/2 (DN 65) and Larger:
   a. Valve Type: Butterfly.
   b. Body Material: Cast or ductile iron.
   c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

2.06 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Fire-End & Croker Corporation.
   d. Fire Protection Products, Inc.
   e. Flowserve.
   f. Jomar International, Ltd.
   g. Kennedy Valve; a division of McWane, Inc.
   h. Kitz Corporation.
   i. Legend Valve.
   j. Milwaukee Valve Company.
   k. NIBCO INC.
   l. Potter Roemer.
   m. Red-White Valve Corporation.
   n. Southern Manufacturing Group.
   o. Stewart, M. A. and Sons Ltd.
   p. Tyco Fire & Building Products LP.
   q. Victaulic Company.
   r. Watts Water Technologies, Inc.

2.07 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig (1200 kPa).
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AFAC Inc.

b. Globe Fire Sprinkler Corporation.

c. Reliable Automatic Sprinkler Co., Inc.

d. Tyco Fire & Building Products LP.

e. Venus Fire Protection Ltd.

f. Victaulic Company.

g. Viking Corporation.

2. Standard: UL 193.

3. Design: For horizontal or vertical installation.

4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AFAC Inc.

b. Reliable Automatic Sprinkler Co., Inc.

c. Tyco Fire & Building Products LP.

2. Standard: UL 1726.

3. Pressure Rating: 175 psig (1200 kPa) minimum.

4. Type: Automatic draining, ball check.

5. Size: NPS 3/4 (DN 20).

6. End Connections: Threaded.

2.08 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AFAC Inc.

b. Elkhart Brass Mfg. Company, Inc.

c. GMR International Equipment Corporation.

d. Guardian Fire Equipment, Inc.

e. Potter Roemer.

2. Standard: UL 405.

3. Type: Flush, for wall mounting.

4. Pressure Rating: 175 psig (1200 kPa) minimum.

5. Body Material: Corrosion-resistant metal.

6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: Two.
12. Outlet Location: Back.
13. Escutcheon Plate Marking: Similar to "AUTO SPKR."
14. Finish: Rough brass or bronze.
15. Outlet Size: NPS 6 (DN 150).

2.09 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International, Inc.
   b. National Fittings, Inc.
   c. Shurjoint Piping Products.
   d. Tyco Fire & Building Products LP.
   e. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:
   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.

4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkhart Brass Mfg. Company, Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer.
2. Standard: UL 199.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
   a. AGF Manufacturing Inc.
   b. Triple R Specialty.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.
   e. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CECA, LLC.
   b. Corcoran Piping System Co.
   c. Merit Manufacturing; a division of Anvil International, Inc.
2. Standard: UL 1474.
3. Pressure Rating: 250 psig (1725 kPa) minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.

5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fivalco Inc.
   b. FlexHead Industries, Inc.
   c. Gateway Tubing, Inc.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Size: Same as connected piping, for sprinkler.

2.10 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire & Building Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

E. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers. Install in accordance to ASTM E580.

1. Ceiling Mounting: Chrome-plated steel, 2-inch, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, 2-inch, one piece, flat.

G. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.11 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:
   a. Globe Fire Sprinkler Corporation.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.
2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch (250-mm) diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4 (DN 20).
8. Outlet: NPS 1 (DN 25) drain connection.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ADT Security Services, Inc.
   b. McDonnell & Miller; ITT Industries.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.
   e. Viking Corporation.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.

4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig (1725 kPa).
7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fire-Lite Alarms, Inc.; a Honeywell company.
   b. Kennedy Valve; a division of McWane, Inc.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.12 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
   1. AMETEK; U.S. Gauge Division.
   2. Ashcroft, Inc.
   3. Brecco Corporation.
   4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

D. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.01 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-Suppression Water-Service Piping."

B. Install shutoff valve, pressure gage, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.02 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 22 Section "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Division 22 Section "Domestic Water Piping Specialties."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.03 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic bracing restraints on piping. Comply with requirements for seismic-brace/restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

N. Fill sprinkler system piping with water.

O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 21 Section "Escutcheons for Fire-Suppression Piping."

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.05 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.06 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.07 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.08 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run excess-pressure pumps.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.11 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6 (DN 65 to DN 150), shall be one of the following:

1. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.

2. Rooms with Suspended Ceilings: Recessed sprinklers.

3. Wall Mounting: Sidewall sprinklers.

4. Spaces Subject to Freezing: Pendent, dry sprinklers or Sidewall, dry sprinklers. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

2. Flush Sprinklers: Bright chrome, with painted white escutcheon.

3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

4. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 05 16
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal-bellows packless expansion joints.
2. Pipe loops and swing connections.
3. Alignment guides and anchors.

1.02 SUBMITTALS

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

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Welding certificates.

D. Product certificates.

E. Maintenance data.

1.03 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.01 PACKLESS EXPANSION JOINTS

A. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Adsco Manufacturing LLC.
   b. American BOA, Inc.
   c. Badger Industries, Inc.
   d. Expansion Joint Systems, Inc.

e. Flex-Hose Co., Inc.

f. Flexicraft Industries.

g. Flex Pression Ltd.

h. Flex-Weld, Inc.

i. Flo Fab inc.

j. Hyspan Precision Products, Inc.

k. Metraflex, Inc.

l. Proco Products, Inc.

m. Senior Flexonics Pathway.

n. Tozen Corporation.

o. Unaflex.

p. Unisource Manufacturing, Inc.

q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.

r. U.S. Bellows, Inc.

s. WahlcoMetroflex.

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3. Type: Circular, corrugated bellows with external tie rods.

4. Minimum Pressure Rating: 150 psig (1035 kPa) unless otherwise indicated.

5. Configuration: Single joint class(es) unless otherwise indicated.

6. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

a. End Connections for Copper Tubing NPS 2 (DN 50) and Smaller: Solder joint.

b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Solder joint.

2.02 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.

2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.

3. Washers: ASTM F 844, steel, plain, flat washers.

4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Stud: Threaded, zinc-coated carbon steel.

b. Expansion Plug: Zinc-coated steel.

c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.

b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.

c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.01 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

3.02 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.03 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install **one** guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.

3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.

2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 05 17
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Sleeve-seal systems.
   3. Grout.

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, Inc.
   2. CALPICO, Inc.
   3. Metraflex Company (The).
   4. Pipeline Seal and Insulator, Inc.
   5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves.
2. Exterior Concrete Walls below Grade:
   a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
4. Interior Partitions:
   a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 05 18
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Escutcheons.
   2. Floor plates.

1.02 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. Escutcheons for New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
      e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
      f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
      g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.
   3. Dial-type pressure gages.
   4. Gage attachments.

1.2 SUBMITTALS

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

B. Product certificates.

C. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Flo Fab Inc.
      b. Miljoco Corporation.
      c. Palmer Wahl Instrumentation Group.
      d. Tel-Tru Manufacturing Company.
      e. Trerice, H. O. Co.
      f. Weiss Instruments, Inc.
      g. Winters Instruments - U.S.
   2. Standard: ASME B40.200.
   3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
   4. Case Form: Back angle unless otherwise indicated.
   5. Tube: Glass with magnifying lens and blue or red organic liquid.
   6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
   7. Window: Glass.
   8. Stem: Aluminum and of length to suit installation.
      a. Design for Thermowell Installation: Bare stem.
   9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
   10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:
   1. Standard: ASME B40.200.
   2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
   3. Material for Use with Copper Tubing: CNR or CUNI.

4. Material for Use with Steel Piping: CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   m. Weiss Instruments, Inc.
   n. WIKA Instrument Corporation - USA.
   o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated is psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Brass.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.

I. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

J. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

K. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
   1. Industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:
   1. Liquid-filled, direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi and 0 to 600 kPa.

B. Scale Range for Domestic Water Piping: 0 to 100 psi and 0 to 600 kPa.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.Z E

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.
   3. Bronze swing check valves.
   4. Bronze gate valves.
   5. Bronze globe valves.

B. Related Sections:
   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
   3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Handwheel: For valves other than quarter-turn types.
   2. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
   1. Gate Valves: With rising stem.
   2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:
   1. Flanged: With flanges according to ASME B16.1 for iron valves.
   2. Solder Joint: With sockets according to ASME B16.18.

3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
      d. Hammond Valve.
      e. Jomar International, LTD.
      f. Kitz Corporation.
      g. Legend Valve.
      h. Milwaukee Valve Company.
      i. NIBCO INC.
      j. Red-White Valve Corporation.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig (1035 kPa).
      c. CWP Rating: 600 psig (4140 kPa).
      d. Body Design: Two piece.
      e. Body Material: Forged brass.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.
      h. Stem: Brass.
      i. Ball: Chrome-plated brass.
      j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Conbraco Industries, Inc.; Apollo Valves.
      c. Crane Co.; Crane Valve Group; Crane Valves.
      d. Hammond Valve.
      e. Legend Valve.
      f. Milwaukee Valve Company.
      g. NIBCO INC.
      h. Red-White Valve Corporation.
      i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig (1035 kPa).
      c. CWP Rating: 600 psig (4140 kPa).
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.

h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.5 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Stockham Division.
      c. Hammond Valve.
      d. Kitz Corporation.
      e. Milwaukee Valve Company.
      f. NIBCO INC.
      g. Red-White Valve Corporation.
      h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-80, Type 1.
      b. CWP Rating: 200 psig (1380 kPa).
      c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
      d. Ends: Threaded or solder joint.
      e. Stem and Disc: Bronze.
      f. Packing: Asbestos free.
      g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball or gate valves.
   2. Throttling Service: Globe or ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
   1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2-1/2 (DN 65) and Smaller:
   1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Bronze Angle Valves: Class 125, bronze disc.
   3. Ball Valves: Two piece, full port, brass or bronze with brass trim.
   4. Bronze Swing Check Valves: Class 125, bronze disc.
   5. Bronze Gate Valves: Class 125, NRS.
   6. Bronze Globe Valves: Class 125, bronze disc.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.Z E

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.4 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
   1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
   2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
   3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
   4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
   5. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
   6. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb (340 kg).
   b. Medium (MSS Type 32): 1500 lb (680 kg).
   c. Heavy (MSS Type 33): 3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel rivets or self-tapping screws.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:
   1. Domestic Water Piping:
      a. Background Color: White.
      b. Letter Color: Green.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic hot-water piping.
   2. Sanitary waste piping exposed to freezing conditions.
   3. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:
   1. Division 22 Section "Plumbing Equipment Insulation."

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail insulation application at pipe expansion joints for each type of insulation.
   3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   4. Detail removable insulation at piping specialties, equipment connections, and access panels.
   5. Detail application at linkages of control devices.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule" article for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Pittsburgh Corning Corporation; Foamglas.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
4. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Armacell LLC; Tubolit.
b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
   2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Use adhesive that complies 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," including 2004 Addenda.

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Aeroflex USA, Inc.; Aeroseal.
      b. Armacell LLC; Armaflex 520 Adhesive.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
      d. K-Flex USA; R-373 Contact Adhesive.
   2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Use adhesive that complies 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," including 2004 Addenda.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
      b. Eagle Bridges - Marathon Industries; 225.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
      d. Mon-Eco Industries, Inc.; 22-25.
   2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Use adhesive that complies 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," including 2004 Addenda.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:
1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
      b. Vimasco Corporation; Elastafab 894.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. ABI, Ideal Tape Division; 428 AWF ASJ.
      b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
      c. Compac Corporation; 104 and 105.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches (75 mm).
   3. Thickness: 11.5 mils (0.29 mm).
   4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. ITW Insulation Systems; Gerrard Strapping and Seals.
      b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, galvanized steel.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. C & F Wire.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, L-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. McGuire Manufacturing.
   b. Plumberex.
   c. Truebro; a brand of IPS Corporation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at **2 inches (50 mm)** o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
1. Flat Acrylic Finish: **Two** finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot Water: Insulation shall be one of the following:
   1. Flexible Elastomeric: 3/4 inch (19 mm) thick.
   2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
   3. Polyolefin: 3/4 inch (19 mm) thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:
   1. Protective Shield Guards.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
   2. Specialty valves.
   3. Flexible connectors.
   4. Water meters furnished by utility company for installation by Contractor.

B. Related Section:
   1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 SUBMITTALS

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

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
   1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
   2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
   3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
   4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
   5. Copper Pressure-Seal-Joint Fittings:
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) Elkhart Products Corporation; Industrial Division.
         2) NIBCO INC.
         3) Viega; Plumbing and Heating Systems.
      b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

c. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) and ASTM B 88, Type L (ASTM B 88M, Type B) water tube, annealed temper.
1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Copper Pressure-Seal-Joint Fittings:
a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1) Elkhart Products Corporation; Industrial Division.
2) NIBCO INC.
3) Viega; Plumbing and Heating Systems.
b. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 CPVC PIPING

A. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

E. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

C. CPVC Union Ball Valves:
1. Description:
a. Standard: MSS SP-122.
b. Pressure Rating: 125 psig (860 kPa) at 73 deg F (23 deg C).

c. Body Material: CPVC.
d. Body Design: Union type.
e. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
f. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged.
g. Ball: CPVC; full port.
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

D. CPVC Ball Check Valves:
1. Description:
a. Pressure Rating: 125 psig (860 kPa) at 73 deg F (23 deg C).
b. Body Material: CPVC.
c. Body Design: Union-type ball check.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Detachable, socket.
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged.
f. Ball: CPVC.
g. Seals: EPDM- or FKM-rubber O-rings.

E. CPVC Gate Valves:
1. Description:
a. Pressure Rating: 125 psig (860 kPa) at 73 deg F (23 deg C).
b. Body Material: CPVC.
c. Body Design: Nonrising stem.
d. End Connections for Valves NPS 2 (DN 50) and Smaller: Socket.
e. End Connections for Valves NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Socket.
f. Gate and Stem: Plastic.
g. Seals: EPDM rubber.
h. Handle: Wheel.

2.6 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Sleeve-Type Transition Coupling: AWWA C219.

C. Plastic-to-Metal Transition Fittings:
1. Description: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket end.

D. Plastic-to-Metal Transition Unions:
1. Description: CPVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
1. Description:
a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig (1035 kPa).
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
1. Description:
a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig (1035 kPa).
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Description:
a. Electroplated steel nipple.
b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.8 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum [200 psig (1380 kPa)] [250 psig (1725 kPa)].
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install domestic water piping level without pitch and plumb.

F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping adjacent to equipment and specialties to allow service and maintenance.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   3. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.

F. Install supports for vertical copper tubing every 10 feet (3 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
   4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1 (DN 25) and Smaller: 36 inches (900 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/4 to NPS 2 (DN 32 to DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.

J. Install supports for vertical CPVC piping every 60 inches (1500 mm) for NPS 1 (DN 25) and smaller, and every 72 inches (1800 mm) for NPS 1-1/4 (DN 32) and larger.

K. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.13 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building service piping, NPS 3 (DN 80) and smaller, shall be one of the following:
   1. Soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal fittings; and pressure-sealed joints.
   2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

D. Aboveground, domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
   2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper solder-joint fittings; and soldered joints.
   3. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.

3.14 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
   2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
   3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
   4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

D. CPVC valves matching piping materials may be used.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Strainers.
   4. Hose bibbs.
   5. Wall hydrants.
   6. Drain valves.
   7. Water hammer arresters.

B. See Division 22 Section "Domestic Water Piping" for water meters.

C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:
   1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
   2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Co.
      b. Cash Acme.
      c. Conbraco Industries, Inc.
      d. FEBCO; SPX Valves & Controls.
      e. Rain Bird Corporation.
      f. Toro Company (The); Irrigation Div.
      g. Watts Industries, Inc.; Water Products Div.
      h. Zurn Plumbing Products Group; Wilkins Div.
   2. Standard: ASSE 1001.

3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Arrowhead Brass Products, Inc.
   b. Cash Acme.
   c. Conbraco Industries, Inc.
   d. Legend Valve.
   e. MIFAB, Inc.
   f. Prier Products, Inc.
   g. Watts Industries, Inc.; Water Products Div.
   h. Woodford Manufacturing Company.
   i. Zurn Plumbing Products Group; Light Commercial Operation.
   j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1001.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Rough bronze.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers <BFP-1>:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Ames Co.
   b. Conbraco Industries, Inc.
   c. FEBCO; SPX Valves & Controls.
   d. Flomatic Corporation.
   e. Watts Industries, Inc.; Water Products Div.
   f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
7. Configuration: Designed for horizontal, straight through flow.
8. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Backflow-Preventer Test Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Conbraco Industries, Inc.
   b. FEBCO; SPX Valves & Controls.

c. Flomatic Corporation.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm).
6. Drain: Factory-installed, hose-end drain valve.

2.4 HOSE BIBBS

A. Hose Bibbs <HB-1>:
1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.

2.5 WALL HYDRANTS

A. Nonfreeze Wall Hydrants <WH-1>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Prier Products, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products Inc.
   g. Woodford Manufacturing Company.
   h. Zurn Plumbing Products Group; Light Commercial Operation.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig (860 kPa).
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Rough bronze.
12. Operating Keys(s): Two with each wall hydrant.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.7 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. PPP Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products Inc.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
   3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, solenoid valve, and pump.

G. Install water hammer arrestors in water piping according to PDI-WH 201.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Reduced-pressure-principle backflow preventers.
   2. Primary, thermostatic, water mixing valves.
   3. Supply-type, trap-seal primer valves.

K. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.

B. Related Section:
   1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 SUBMITTALS

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

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ANACO-Husky.
      b. Dallas Specialty & Mfg. Co.
      c. Fernco Inc.
      d. Matco-Norca, Inc.
      e. MIFAB, Inc.
      f. Mission Rubber Company; a division of MCP Industries, Inc.
      g. Stant.
      h. Tyler Pipe.
   2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Clamp-All Corp.
   c. Dallas Specialty & Mfg. Co.
   d. MIFAB, Inc.
   e. Mission Rubber Company; a division of MCP Industries, Inc.
   f. Stant.
   g. Tyler Pipe.
2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.
1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.
1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement 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."

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company; a division of MCP Industries, Inc.
        4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    b. Standard: ASTM C 1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. Sleeve Materials:
        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        1) Cascade Waterworks Mfg. Co.
        2) Mission Rubber Company; a division of MCP Industries, Inc.
    b. Standard: ASTM C 1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends

G. Install fittings for changes in direction and branch connections.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
   2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

M. Install aboveground PVC piping according to ASTM D 2665

N. Install underground PVC piping according to ASTM D 2321.

O. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
   2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
   4. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
   4. NPS 3 and NPS 5 (DN 80 and DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.

I. Install supports for vertical copper tubing every 10 feet (3 m).

J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.

K. Install supports for vertical PVC piping every 48 inches (1200 mm).

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into

piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty cast-iron hubless-piping couplings; and coupled joints.
2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty cast-iron hubless-piping couplings; coupled joints.
2. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.Z E

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Roof flashing assemblies.
   4. Miscellaneous sanitary drainage piping specialties.
   5. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for oil interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
   3. Size: Same as connected drainage piping
   4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
   5. Closure: Countersunk, brass plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
      a. Josam Company; Josam Div.
      b. Oatey.
      c. Sioux Chief Manufacturing Company, Inc.
      d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      e. Tyler Pipe; Wade Div.
      f. Watts Drainage Products Inc.
      g. Zurn Plumbing Products Group; Light Commercial Operation.

h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Spigot.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Rough bronze.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Extra Heavy Duty.
13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor and Hub Drains:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
a. Commercial Enameling Co.
b. Josam Company; Josam Div.
c. MIFAB, Inc.
d. Prier Products, Inc.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Tyler Pipe; Wade Div.
g. Watts Drainage Products Inc.
h. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.

9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Bronze.
13. Top of Body and Strainer Finish: Rough bronze.
14. Top Shape: Round.
15. Top Loading Classification: Extra Heavy-Duty.
16. Funnel: Required for hub drain.
17. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
18. Trap Material: Cast iron.
19. Trap Pattern: Deep-seal P-trap.
20. Trap Features: Not required.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Acorn Engineering Company; Elmdor/Stoneman Div.
   b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
   a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
   b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

B. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:
1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch (25 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.
C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
D. Solder: ASTM B 32, lead-free alloy.
E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
H. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.
I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.
K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
M. Install vent caps on each vent pipe passing through roof.
N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
C. Set flashing on floors and roofs in solid coating of bituminous cement.
D. Secure flashing into sleeve and specialty clamping ring or device.
E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 13 23
SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Oil interceptors.

1.02 SUBMITTALS

A. Product Data: For each type of metal interceptor indicated.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

PART 2 - PRODUCTS

2.01 OIL INTERCEPTORS

A. Oil Interceptors: Factory-fabricated, cast-iron or steel body; with removable sediment bucket or strainer, baffles, vents, and flow-control fitting on inlet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Josam Company.

b. MIFAB, Inc.

c. Parkson Corporation.

d. Rockford Sanitary Systems, Inc.

e. Schier Products Company.

f. Smith, Jay R. Mfg. Co.

g. Tyler Pipe, Inc.

h. Watts Water Technologies, Inc.

i. Zurn Plumbing Products Group; Zurn Specification Drainage Products.

2. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.

3. Extension: Cast-iron or steel shroud, full size of interceptor, extending from top of interceptor to grade.

4. Cover: Cast iron or steel, with steel reinforcement to provide ASTM C 890, H-20**,** traffic load.

5. Comply with requirements in Division 23 Section "Facility Fuel-Oil Piping" for waste-oil storage tank and piping

B. Capacities and Characteristics:

1. Capacity: 150 gal.

2. Inlet and Outlet Pipe Size: 6 NPS.

3. Waste-Oil-Outlet Pipe Size: 6 NPS.

4. Trapped Outlet Required: Integral.
5. Vent Pipe Size: 3 NPS.
6. Installation Position: Underground with manhole riser to grade.

2.02 PRECAST-CONCRETE MANHOLE RISERS

A. Precast-Concrete Manhole Risers: ASTM C 478 (ASTM C 478M), with rubber-gasket joints.

1. Structural Design Loads:
   a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
2. Length: From top of underground concrete structure to grade.
3. Riser Sections: 3-inch (75-mm) minimum thickness and 36-inch (915-mm) diameter.
4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
5. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
6. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals.

B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover.

1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
2. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
3. Include indented top design with lettering cast into cover, using wording equivalent to the following:

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.02 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements.

D. Set metal interceptors level and plumb.

E. Set tops of metal interceptor covers flush with finished surface in pavements.

F. Install piping and oil storage tanks according to Division 23 Section "Facility Fuel-Oil Piping."

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.04 IDENTIFICATION

A. Identification materials and installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 33 00
ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Commercial, electric, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters 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.

1.3 SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

B. Shop Drawings:
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and maintenance data.

H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Warranty Periods: From date of Substantial Completion.
      a. Commercial, Electric, Storage, Domestic-Water Heaters:
         1) Storage Tank: Five years.
         2) Controls and Other Components: Five years.

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. American Water Heaters.
   b. Bradford White Corporation.
   c. HESco Industries, Inc.
   d. Lochinvar Corporation.
   e. Rheem Manufacturing Company.
   f. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   g. State Industries.
2. Standard: UL 1453.
3. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
   a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
      1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
   b. Pressure Rating: 150 psig (1035 kPa).
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
5. Special Requirements: NSF 5 construction.

B. Capacity and Characteristics:
1. Capacity: 30 gal. (L).
2. Recovery: 34 gph at 70 deg F temperature rise.
3. Temperature Setting: 125 deg F (52 deg C).
4. Power Demand: 6 kilowatts.
5. Heating Elements:

a. Number of Elements: Two.
b. Kilowatts Each Element: 6 kilowatts>.
c. Number of Stages: One.

6. Electrical Characteristics:
a. Volts: 240.
b. Phases: Single.
c. Hertz: 60.
d. Full-Load Amperes: 25 Amps.
e. Minimum Circuit Ampacity: 30 Amps.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AMTROL Inc.
b. Flexcon Industries.
c. Honeywell International Inc.
d. Pentair Pump Group (The); Myers.
e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
f. State Industries.
g. Taco, Inc.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:
a. Working-Pressure Rating: 100 psig (690 kPa).
b. Capacity Acceptable: 2 gal. (7.6 L) minimum.
c. Air Precharge Pressure: 45 psi.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- (172.5-kPa-) maximum outlet pressure unless otherwise indicated.

F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-

water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03 Section "Cast-in-Place Concrete.

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill electric, domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 34 00

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.02 PERFORMANCE REQUIREMENTS

B. Seismic Performance: Commercial domestic-water heaters 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."

1.03 SUBMITTALS

C. Product Data: For each type and size of domestic-water heater indicated.

D. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

E. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

F. Product certificates.

G. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

H. Source quality-control reports.

I. Field quality-control reports.

J. Operation and maintenance data.

K. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

L. 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.

M. ASHRAE/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

N. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

O. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.05 WARRANTY

P. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Five year(s).

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.01 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
a. HESco Industries, Inc.
b. PVI Industries, LLC.
c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
d. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.

3. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) working-pressure rating.

    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

        1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

    b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

4. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and natural-gas fuel.
    g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.
6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

B. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL Inc.
    b. Honeywell International Inc.
    c. Pentair Pump Group (The); Myers.

d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
e. State Industries.

f. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: **100 psig (690 kPa)**.
b. Capacity Acceptable: 4 gal. (15.1 L) minimum.
c. Air Precharge Pressure: 45 psi.

C. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

D. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

E. Heat-Trap Fittings: ASHRAE 90.2.

F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig (3.5-kPa) pressure rating as required to match gas supply.

H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

J. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

2.03 SOURCE QUALITY CONTROL

M. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

N. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

O. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

P. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23 Section "Facility Natural-Gas Piping."

D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill domestic-water heaters with water.

K. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

L. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."

M. Comply with requirements for fuel-oil piping specified in Division 23 Section "Facility Fuel-Oil Piping."

N. Comply with requirements for gas piping specified in Division 23 Section "Facility Natural-Gas Piping."

O. Drawings indicate general arrangement of piping, fittings, and specialties.

P. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

Q. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

R. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

S. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

T. Prepare test and inspection reports.

3.05 DEMONSTRATION

U. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Flushometers.
   2. Toilet seats.
   3. Protective shielding guards.
   4. Fixture supports.
   5. Water closets.
   6. Lavatories.
   7. Service sinks.

B. Related Sections include the following:
   1. Division 22 Section "Emergency Plumbing Fixtures."
   2. Division 22 Section "Drinking Fountains and Water Coolers."

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. FRP: Fiberglass-reinforced plastic.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. PVC: Polyvinyl chloride plastic.

F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
   1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
   2. Plastic Sinks: ANSI Z124.6.
   3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
   4. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
   5. Stainless-Steel Residential Sinks: ASME A112.19.3.
   6. Vitreous-China Fixtures: ASME A112.19.2M.

G. Comply with the following applicable standards and other requirements specified for lavatory faucets:
   1. Faucets: ASME A112.18.1.
   2. Hose-Coupling Threads: ASME B1.20.7.
   3. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
   4. NSF Potable-Water Materials: NSF 61.
   5. Pipe Threads: ASME B1.20.1.
   6. Supply Fittings: ASME A112.18.1.
   7. Brass Waste Fittings: ASME A112.18.2.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
   1. Atmospheric Vacuum Breakers: ASSE 1001.
   2. Brass and Copper Supplies: ASME A112.18.1.
   3. Manual-Operation Flushometers: ASSE 1037.
   4. Plastic Tubular Fittings: ASTM F 409.
   5. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Flexible Water Connectors: ASME A112.18.6.
   2. Grab Bars: ASTM F 446.
   3. Hose-Coupling Threads: ASME B1.20.7.
   4. Off-Floor Fixture Supports: ASME A112.6.1M.
   5. Pipe Threads: ASME B1.20.1.
   6. Plastic Toilet Seats: ANSI Z124.5.
   7. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets, <**L-1**>:

   1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

      a. American Standard Companies, Inc.
      b. Bradley Corporation.
      c. Chicago Faucets.
      d. Delta Faucet Company.
      e. Eljer.
      f. Zurn Plumbing Products Group; Commercial Brass Operation.

2. Description: Single-control mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
    a. Body Material: Commercial, solid brass.
    b. Finish: Polished chrome plate.
    c. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
    d. Maximum Flow: N/A.
    e. Centers: 4 inches (102 mm).
    f. Mounting: Deck, exposed.
    g. Valve Handle(s): Lever.
    h. Inlet(s): NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor.
    i. Spout: Rigid type.
    j. Spout Outlet: Aerator.
    k. Operation: Noncompression, manual.
    l. Drain: Grid.
    m. Tempering Device: Not required.

2.2 FLUSHOMETERS

A. Flushometers, WC-1:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    a. Coyne & Delany Co.
    b. Delta Faucet Company.
    c. Sloan Valve Company.
    d. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
    a. Internal Design: Diaphragm operation.
    b. Style: Exposed.
    c. Inlet Size: NPS 1 (DN 25).
    d. Trip Mechanism: Hard-wired, electric-sensor actuator.
    e. Consumption: 1.28 gal./flush.
    f. Tailpiece Size: NPS 1-1/4 (DN 32) and standard length to top of bowl.

2.3 TOILET SEATS

A. Toilet Seats, WC-1:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    a. American Standard Companies, Inc.
    b. Bemis Manufacturing Company.
    c. Centoco Manufacturing Corp.
    d. Church Seats.
    e. Eljer.
    f. Kohler Co.
    g. Olsonite Corp.
    h. Sanderson Plumbing Products, Inc.; Beneke Div.
    i. Sperzel.
2. Description: Toilet seat for water-closet-type fixture.

a. Material: Molded, solid plastic.
b. Configuration: Open front without cover.
c. Size: Elongated.
d. Hinge Type: CK, check.
e. Class: Heavy-duty commercial.
f. Color: White.

2.4 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Lavatory Supports, <L-1>:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.5 WATER CLOSETS

A. Water Closets, WC-1:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Acorn Engineering
2. Description: Floor-mounting, floor-outlet, stainless steel fixture designed for flushometer valve operation.
3. Style: One piece.
   a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
   b. Height: Standard.
   c. Design Consumption: Dual flush 1.28 gal./flush.
   d. Color: Stainless steel.

2.6 LAVATORIES

A. Lavatories, <L-1>:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Acorn Engineering
2. Description: Accessible, wall-mounting, stainless steel fixture.
   a. Type: With back.
   b. Size: 20 by 14 inches rectangular.
   c. Faucet Hole Punching: Three holes, 2-inch (51-mm) centers.
   d. Faucet Hole Location: Top.

e. Pedestal: Not required.
f. Color: Stainless steel.
g. Faucet: Lavatory <L-1>.
h. Supplies: NPS 3/8 (DN 10) chrome-plated copper with stops.
i. Drain: See faucet.

1) Location: Near back of bowl.

j. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chrome-plated, cast-brass P-trap;, 0.032-inch- (0.8-mm-) thick tubular brass waste to wall; and wall escutcheon.

2.7 SERVICE SINKS

A. Service Sinks, SK-1:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
a. Commercial Enameling Company.
b. Eljer.
c. Just Manufacturing Company
2. Description: Single-bowl, floor-mounted, stainless-steel one-compartment sink.
a. Overall Dimensions: 24 inch by 24 inch
b. Metal Thickness: 14 gauge type 304, 18-8 stainless steel
c. Drain: Grid with NPS 1-1/2 (DN 40) outlet.
d. Sink Faucet: <SK-1.>
e. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
f. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch-(1.1-mm-) thick tubular brass waste to wall; continuous waste; and wall escutcheon(s).

g. Drain Piping: Schedule 40 PVC, NPS 1-1/2 (DN 40) P-trap; tubular waste to wall; continuous waste; and wall escutcheon(s).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports without waste fitting for fixtures with tubular waste piping.

C. Install fixtures level and plumb according to roughing-in drawings.

D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

E. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

F. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

G. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

H. Install toilet seats on water closets.

I. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

J. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

K. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

L. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 22 45 00
EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Combination units.
   2. Water-tempering equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Field quality-control test reports.
C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
B. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
C. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Standard, Plumbed Emergency Shower with Eyewash Combination Units, <**SS/EW-1**>:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:
      a. Bradley Corporation.
      b. Guardian Equipment Co.
      c. Haws Corporation.
   2. Piping:
      a. Material: **Galvanized steel**.
      b. Unit Supply: **NPS 1-1/4 (DN 32) minimum**.
      c. Unit Drain: Outlet at back or side near bottom.
   3. Shower:
      a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
      b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
      c. Control-Valve Actuator: **Pull rod**.
      d. Shower Head: 8-inch- (200-mm-) minimum diameter, **plastic**.
      e. Mounting: Pedestal.
   4. Eyewash Unit:
      a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.

b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Paddle.
d. Spray-Head Assembly: Two receptor-mounted spray heads.
e. Receptor: **Plastic** bowl.
f. Mounting: Attached shower pedestal.
g. Drench-Hose Option: May be provided instead of eyewash unit.

1) Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
2) Drench Hose: Hand-held spray head with squeeze-handle actuator and hose.
3) Mounting: Bracket on shower pedestal.

2.2 WATER-TEMPERING EQUIPMENT

A. Hot- and Cold-Water, Water-Tempering Equipment, <TMV-1>:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Acorn Safety; a division of Acorn Engineering Company.

b. Armstrong International, Inc.

c. Bradley Corporation.

d. Guardian Equipment Co.

e. Haws Corporation.

f. Lawler Manufacturing Co., Inc.

g. Leonard Valve Company.

h. Powers; a division of Watts Water Technologies, Inc.

i. Speakman Company.

2. Description: Factory-fabricated equipment with thermostatic mixing valve.

a. Thermostatic Mixing Valve: Designed to provide 85 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

b. Supply Connections: For hot and cold water.

2.3 SOURCE QUALITY CONTROL

A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.

2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping. Comply with requirements for steam and condensate piping specified in Division 23 Section "Steam and Condensate Heating Piping."

F. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Division 22 Section "Domestic Water Piping."

G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Division 22 Section "Sanitary Waste and Vent Piping."

H. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

I. Fill self-contained fixtures with flushing fluid.

3.2 CONNECTIONS

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Division 22 Section "Domestic Water Piping."

B. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Division 22 Section "Sanitary Waste and Vent Piping."

C. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.

D. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.3 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 22 47 00
DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.
2. Fixture supports.

B. Seismic design is not required for the components of the specification; however, they shall be positively anchored.

1.02 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.01 PRESSURE WATER COOLERS

A. Water Coolers, <EWC-1>:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Elkay Manufacturing Co.
   b. Halsey Taylor.
   c. Haws Corporation.
   d. Larco, Inc.

e. Oasis Corporation.

f. Sunroc Corp.

2. Description: ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult-mounting height.

a. Cabinet: Single, vinyl-covered steel with stainless-steel top.

b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.

c. Bottle-Filling Station:Sensor-operated

d. Control: Push bar.

e. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.

f. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

g. Drain(s): Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.1.

h. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

1) Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.

2) Electrical Characteristics: 1/2 hp; 120-V ac; single phase; 60 Hz.

i. Support: Type I, water cooler carrier. Refer to "Fixture Supports" Article.

B. Water Coolers, <EWC-2>:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Elkay Manufacturing Co.

b. Halsey Taylor.

c. Haws Corporation.

d. Larco, Inc.

e. Oasis Corporation.

f. Sunroc Corp.

2. Description: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult-mounting height.

a. Cabinet: Bilevel with two attached cabinets, vinyl-covered steel with stainless-steel top.

b. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.

c. Bottle-Filling Station:Sensor-operated

d. Control: Push bar.

e. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.

f. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.

g. Drain(s): Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.1.

h. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

1) Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.

2) Electrical Characteristics: 1/2 hp; 120-V ac; single phase; 60 Hz.

i. Support: Type II, water cooler carrier. Refer to "Fixture Supports" Article.

2.02 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Co.
2. MIFAB Manufacturing, Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Type I: Hanger-type carrier with two vertical uprights.
2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.

B. Set freestanding and pedestal drinking fountains on floor.

C. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.02 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.
2. Report test results in writing.

3.05 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

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SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer licensed in the state of Arkansas. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Welding certificates.

1.4 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

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SECTION 23 05 48
VIBRATION & SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding and restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I/II/III.
    a. Component Importance Factor: 1.0.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.869g.
4. Design Spectral Response Acceleration at 1-Second Period: 0.667g

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

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

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum

seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

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: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. Isolation Technology, Inc.
3. Kinetics Noise Control.
4. Mason Industries.
5. Vibration Eliminator Co., Inc.
6. Vibration Isolation.
7. Vibration Mountings & Controls, Inc.

C. Pads Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

D. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

F. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

G. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

H. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.

I. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

J. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

L. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

M. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- (13-mm-) thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

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: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. Cooper B-Line, Inc.; a division of Cooper Industries.
3. Hilti, Inc.
4. Kinetics Noise Control.
5. Mason Industries.
6. TOLCO Incorporated; a brand of NIBCO INC.
7. Unistrut; Tyco International, Ltd.

C. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building

structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of [40 feet (12 m)] o.c., and longitudinal supports a maximum of [80 feet (24 m)] o.c.
3. Brace a change of direction longer than 12 feet (3.7 m).

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least [four] of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 HVAC VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment:

1. Equipment Location: See drawings
2. Pads:
    a. Material: Neoprene
    b. Thickness: 1/2 inches (mm)
    c. Number of Pads: 2 thick
3. Isolator Type: Restraining braces and cables
4. Base Type: Spring Isolation Mounts
5. Minimum Deflection: 1 inches (mm)
6. Component Importance Factor: 1.5
7. Component Response Modification Factor: 2.5
8. Component Amplification Factor: 2.5

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel rivets or self-tapping screws.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Pre-coiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surface of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 25 feet (7.6 m).

B. Pipe Label Color Schedule:
   1. Refrigerant Piping:
      a. Background Color: White.
      b. Letter Color: Green.
   2. Natural Gas Piping:
      a. Background Color: Yellow.
      b. Letter Color: Black.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 23 07 13
DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

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

B. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.

b. Johns Manville; Microlite.

c. Knauf Insulation; Friendly Feel Duct Wrap.

d. Manson Insulation Inc.; Alley Wrap.

e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
d. Thermal Ceramics; FireMaster Duct Wrap.
e. 3M; Fire Barrier Wrap Products.
f. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.

d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Use adhesive that complies 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," including 2004 Addenda.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.

b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.

d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Use adhesive that complies 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," including 2004 Addenda.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    b. Eagle Bridges - Marathon Industries; 550.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    d. Mon-Eco Industries, Inc.; 55-50.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.

c. Compac Corporation; 110 and 111.

d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).

3. Thickness: 6.5 mils (0.16 mm).

4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 488 AWF.

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.

c. Compac Corporation; 120.

d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).

3. Thickness: 3.7 mils (0.093 mm).

4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.

5. Elongation: 5 percent.

6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.

b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in

position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.

2) GEMCO; Perforated Base.

3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) GEMCO; Nylon Hangers.

2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.

c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.

2) GEMCO; Peel & Press.

3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

d. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel or aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.

2) GEMCO; R-150.

3) Midwest Fasteners, Inc.; WA-150.

4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) GEMCO.

2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

   b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

   d. Do not overcompress insulation during installation.

   e. Impale insulation over pins and attach speed washers.

   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

   b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

   d. Do not overcompress insulation during installation.

   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.5 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.6 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.

B. Items Not Insulated:

1. Fibrous-glass ducts.

2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

C. Exposed, Supply-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

D. Exposed, Return-Air Duct and Plenum Insulation: Mineral-fiber board, 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 23 11 23
FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 2.0 psig to 0.25 psig (7” w.c.) or less.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

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

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

D. Welding certificates.

E. Field quality-control reports.

F. Operation and maintenance data.

1.4 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. OmegaFlex, Inc.
      b. Parker Hannifin Corporation; Parflex Division.
      c. Titeflex.
      d. Tru-Flex Metal Hose Corp.

      Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
   2. Coating: PE with flame retardant.
      a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
         1) Flame-Spread Index: 25 or less.
         2) Smoke-Developed Index: 50 or less.
   3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
   4. Striker Plates: Steel, designed to protect tubing from penetrations.
   5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
   6. Operating-Pressure Rating: 5 psig (34.5 kPa).

C. PE Pipe: ASTM D 2513, SDR 11.
   1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
   2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
      a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
      b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
      c. Aboveground Portion: PE transition fitting.
      d. Outlet shall be threaded or suitable for welded connection.
      e. Tracer wire connection.
      f. Ultraviolet shield.

g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
   b. Outlet shall be threaded or suitable for welded connection.
   c. Bridging sleeve over mechanical coupling.
   d. Factory-connected anode.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
   1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
   2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
   3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
   4. Corrugated stainless-steel tubing with polymer coating.
   5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
   6. End Fittings: Zinc-coated steel.
   7. Threaded Ends: Comply with ASME B1.20.1.
   8. Maximum Length: 72 inches (1830 mm).

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
   1. Copper-alloy convenience outlet and matching plug connector.
   2. Nitrile seals.
   3. Hand operated with automatic shutoff when disconnected.
   4. For indoor or outdoor applications.
   5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:
   1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
   2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller.
   3. Strainer Screen: [40] [60]-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
   4. CWP Rating: 125 psig (862 kPa).

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
   1. CWP Rating: 125 psig (862 kPa).
   2. Threaded Ends: Comply with ASME B1.20.1.
   3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
   4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
   5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
   6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. BrassCraft Manufacturing Company; a Masco company.
      b. Conbraco Industries, Inc.; Apollo Div.
      c. Lyall, R. W. & Company, Inc.
      d. McDonald, A. Y. Mfg. Co.
      e. Perfection Corporation; a subsidiary of American Meter Company.
   2. Body: Bronze, complying with ASTM B 584.
   3. Ball: Chrome-plated bronze.
   4. Stem: Bronze; blowout proof.
   5. Seats: Reinforced TFE; blowout proof.
   6. Packing: Threaded-body packnut design with adjustable-stem packing.
   7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
   8. CWP Rating: 600 psig (4140 kPa).
   9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
   10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. PE Ball Valves: Comply with ASME B16.40.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Kerotest Manufacturing Corp.
      b. Lyall, R. W. & Company, Inc.
      c. Perfection Corporation; a subsidiary of American Meter Company.
   2. Body: PE.
   3. Ball: PE.
   4. Stem: Acetal.
   5. Seats and Seals: Nitrile.
   6. Ends: Plain or fusible to match piping.
   7. CWP Rating: 80 psig (552 kPa).
   8. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
   9. Operator: Nut or flat head for key operation.
   10. Include plastic valve extension.
   11. Include tamperproof locking feature for valves where indicated on Drawings.

E. Valve Boxes:
1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:
a. Pacific Seismic Products, Inc.
2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 60 psig (414 kPa).
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 (DN 50) and smaller.

2.6 DIELECTRIC UNIONS

A. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International Ltd.
e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.
2. Description:
a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
   1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:
   1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
   3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:
   1. Apply joint cover kits over tubing to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gage downstream from each service regulator.

3.2 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install sleeves for piping penetrations of walls, ceilings, and floors.

V. Install sleeve seals for piping penetrations of concrete walls and slabs.

W. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

3.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:
1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be the following:
1. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:
1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:
1. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be the following:
1. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.11 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground: PE valves.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:
1. Two-piece, full port, bronze ball valves with bronze trim.

B. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:
1. Two-piece, full port, bronze ball valves with bronze trim.

C. Valves in branch piping for single appliance shall be the following:
   1. Two-piece, full port, bronze ball valves with bronze trim.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level D:

Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

C.

D.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.

4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

E. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Penetrations of smoke barriers and fire-rated construction.
5. Items penetrating finished ceiling including the following:
    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Sprinklers.

B. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Lindab Inc.
    b. McGill AirFlow LLC.
    c. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.

4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

D. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
   a. Pressure Class: Positive 1-inch wg.
   b. Minimum SMACNA Seal Class: C.
   c. SMACNA Leakage Class for Rectangular: 24.
   d. SMACNA Leakage Class for Round and Flat Oval: 24.
2. Ducts Connected to Variable-Volume Air-Handling Units:
   a. Pressure Class: Positive 4-inch wg.
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 12.
   d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Constant-Volume Air-Handling Units:
    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.
4. Ducts Connected to Equipment Not Listed Above:
    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.

C. Return Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    a. Pressure Class: Positive or negative 1-inch wg.
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.
2. Ducts Connected to Air-Handling Units:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.
3. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.

D. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    a. Pressure Class: Negative 1-inch wg.
    b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.
3. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
    a. Type 304, stainless-steel sheet.
        1) Exposed to View: No. 3 finish.
        2) Concealed: No. 2D finish.
    b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
    c. Pressure Class: Positive or negative 3-inch wg.
    d. Minimum SMACNA Seal Class: A.
    e. SMACNA Leakage Class: 3.
4. Ducts Connected to Equipment Not Listed Above:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    a. Pressure Class: Positive or negative 1-inch wg.
    b. Minimum SMACNA Seal Class: C.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.
2. Ducts Connected to Air-Handling Units:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 24.
    d. SMACNA Leakage Class for Round and Flat Oval: 24.
3. Ducts Connected to Equipment Not Listed Above:
    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.

c. SMACNA Leakage Class for Rectangular: 24.

d. SMACNA Leakage Class for Round and Flat Oval: 24.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Galvanized.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.

b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round and Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm: Conical tap.

c. Velocity or Higher: 45-degree lateral.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

ISSUED FOR BID

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Fire dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

1.2 SUBMITTALS

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

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.

b. Manual volume damper installations.

c. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.

d. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).

2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.
7. SEMCO Incorporated.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm (10 m/s).

D. Maximum System Pressure: 2-inch wg (0.5 kPa).

E. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Nonferrous metal or Galvanized steel.

2. Diameter: 0.20 inch (5 mm).

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.

2. Counterweights and spring-assist kits for vertical airflow installations.

3. Screen Mounting: Front mounted in sleeve.

a. Sleeve Thickness: 20-gage (1.0-mm) minimum.

b. Sleeve Length: 6 inches (152 mm) minimum.

4. Screen Mounting: Rear mounted.

5. Screen Material: Galvanized steel.

6. Screen Type: Bird.

7. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. McGill AirFlow LLC.
d. METALAIRE, Inc.
e. Pottorff; a division of PCI Industries, Inc.
f. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.

4. Frames:

a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.

b. Mitered and welded corners.

c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.

b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.

d. Galvanized-steel, 0.064 inch (1.62 mm) thick.

6. Blade Axles: Galvanized steel or Nonferrous metal.

7. Bearings:

a. Oil-impregnated bronze.

b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Air Balance Inc.; a division of Mestek, Inc.
    b. American Warming and Ventilating; a division of Mestek, Inc.
    c. McGill AirFlow LLC.
    d. METALAIRE, Inc.
    e. Pottorff; a division of PCI Industries, Inc.
    f. Ruskin Company.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- (2.5-mm-) thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
    e. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
6. Blade Axles: Galvanized steel or Nonferrous metal.
7. Bearings:
    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:
1. Size: 1-inch (25-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. METALAIRE, Inc.
7. Pottorff; a division of PCI Industries, Inc.
8. Ruskin Company.
9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades inside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick, as indicated, and of length to suit application.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

K. Heat-Responsive Device: Electric resettable link and switch package, factory installed, 165 deg F (74 deg C) and 212 deg F (100 deg C) rated.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.

2. Nexus PDQ; Division of Shilco Holdings Inc.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Pottorff; a division of PCI Industries, Inc.
7. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.

b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision panel.

d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.

b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.

c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.

d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.

2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.

3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.

4. Factory set at 10-inch wg (2500 Pa).

5. Doors close when pressures are within set-point range.

6. Hinge: Continuous piano.

7. Latches: Cam.

8. Seal: Neoprene or foam rubber.

9. Insulation Fill: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.8 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).

F. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.10 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Non-insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).

C. Non-insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).

D. Non-insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).

E. Non-insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).

F. Non-insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
2. Maximum Air Velocity: 5000 fpm (25 m/s).
3. Temperature Range: Minus 100 to plus 435 deg F (Minus 73 to plus 224 deg C).

G. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

H. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

I. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

J. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

K. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
2. Maximum Air Velocity: 5000 fpm (25 m/s).
3. Temperature Range: Minus 20 to plus 250 deg F (Minus 29 to plus 121 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

L. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Control devices requiring inspection.
3. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

K. Install flexible connectors to connect ducts to equipment.

L. Connect terminal units to supply ducts directly or with maximum 6-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

M. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with draw bands.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.
2. Ceiling-mounted ventilators.
3. In-line centrifugal fans.
4. Propeller fans.

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aerovent; a division of Twin City Fan Companies, Ltd.
2. Breidert Air Products.
3. Central Blower Company.
4. Greenheck Fan Corporation.
5. Hartzell Fan Incorporated.
6. Loren Cook Company.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 12 inches (300 mm).
3. Pitch Mounting: Manufacture curb for roof slope.

2.2 CEILING-MOUNTED VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Coolair Corporation.
2. Breidert Air Products.
3. Broan-NuTone LLC; NuTone Inc.
4. Greenheck Fan Corporation.
5. Loren Cook Company.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 IN-LINE CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. American Coolair Corporation.
3. Breidert Air Products.
4. Greenheck Fan Corporation.
5. Hartzell Fan Incorporated.
6. Loren Cook Company.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.4 PROPELLER FANS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acme Engineering & Manufacturing Corporation.
2. Aerovent; a division of Twin City Fan Companies, Ltd.
3. Airmaster Fan Company.
4. American Coolair Corporation.
5. Breidert Air Products.
6. Chicago Blower Corporation.
7. Cincinnati Fan.
8. Hartzell Fan Incorporated.
9. Loren Cook Company.
10. W.W. Grainger, Inc.; Dayton Products.

B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.

D. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

E. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

F. Fan Drive:

1. Resiliently mounted to housing.
2. Statically and dynamically balanced.
3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
4. Extend grease fitting to accessible location outside of unit.
5. Service Factor Based on Fan Motor Size: 1.4.
6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories:

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.

2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Weathershield Hood: Galvanized steel to match fan and accessory size.
5. Weathershield Front Guard: Galvanized steel with expanded metal screen.
6. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
7. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Section "Roof Accessories" for installation of roof curbs.

B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

C. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch (25 mm). Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

F.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 23 62 00
PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, air-cooled, refrigerant compressor and condenser units.

1.2 SUBMITTALS

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

B. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1-2010 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-20010, Section 6, "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Compressor failure.

b. Condenser coil leak.

2. Warranty Period: Five years from date of Substantial Completion.

3. Warranty Period (Compressor Only): Five years from date of Substantial Completion.

4. Warranty Period (Components Other Than Compressor): One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 1 TO 5 TONS (3.5 TO 17.6 kW)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carrier Corporation; Commercial HVAC Systems.
2. Lennox International Inc.
3. Trane; a business of American Standard Companies.
4. York; a Johnson Controls company.
5. Daikin

B. Description: Factory assembled and tested; consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.

C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.

1. Motor: Single speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

2. Accumulator: Suction tube.

D. Refrigerant: R-410A.

E. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid sub-cooler, with removable drain pan and brass service valves with service ports.

F. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection.

G. Accessories:

1. Crankcase heater.

2. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.

3. Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.

4. Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.

5. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.

6. Liquid-line solenoid.

7. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.

8. Pre-charged and insulated suction and liquid tubing.

9. Thermostatic expansion valve.

10. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.

H. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

2.2 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 6 TO 120 TONS (21 TO 422 kW)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Daikin (Basis of Design)
2. Lennox
3. Trane
4. York
5. Aaon
6. Greenheck (Valent)

B. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.

C. Compressor: Hermetic scroll compressor designed for service with crankcase sight glass, crankcase heater, and back-seating service access valves on suction and discharge ports.

1. Capacity Control: On-off compressor cycling.

D. Refrigerant: R-410A.

E. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and back-seating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.

F. Condenser Fan: Propeller-type vertical discharge; either directly or belt driven. Include the following:

1. Permanently lubricated, ball-bearing motors.

2. Separate motor for each fan.

3. Dynamically and statically balanced fan assemblies.

G. Operating and safety controls include the following:

1. Manual-reset, high-pressure cutout switches.

2. Automatic-reset, low-pressure cutout switches.

3. Low-oil-pressure cutout switch.

4. Three-leg, compressor-overload protection.

5. Control transformer.

6. Magnetic contactors for compressor and condenser fan motors.

7. Timer to prevent excessive compressor cycling.

H. Accessories:

1. Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.

2. Part-winding-start timing relay, circuit breakers, and contactors.

I. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:

1. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.

2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.

3. Gasketed control panel door.

4. Non-fused disconnect switch, factory mounted and wired, for single external electrical power connection.

5. Condenser coil grille.

2.3 SOURCE QUALITY CONTROL

A. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1-2010, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air-Conditioning."

B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Install compressor and condenser units on new or adapter curb.

C. Maintain manufacturer's recommended clearances for service and maintenance.

D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.2 CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 23 81 26
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Operation and maintenance data.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:
   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
   2. Applicable requirements in ASHRAE 62.1-2013.

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period:
      a. For Compressor: Five years from date of Substantial Completion.
      b. For Parts: One year from date of Substantial Completion.
      c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   1. Carrier.
   2. Lennox.
   3. Daikin.
   4. Friedrich.
   5. LG.

B. Wall-Mounted, Evaporator-Fan Components:
   1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
4. Fan: Direct drive, centrifugal.
5. Fan Motors:
    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
    f. Mount unit-mounted disconnect switches on interior of unit.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2013.
7. Condensate Drain Pans:
    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2013.
    b. Single-wall galvanized or stainless-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
    d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
8. Air Filtration Section:
    a. General Requirements for Air Filtration Section:
        1) Comply with NFPA 90A.
        2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
        3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
    b. Disposable Panel Filters:
        1) Factory-fabricated, viscous-coated, flat-panel type.
        2) Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
        3) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.
    c. Extended-Surface, Disposable Panel Filters:
        1) Factory-fabricated, dry, extended-surface type.

2.2 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    a. Compressor Type: Scroll.
    b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant Charge: R-410A.
    d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
7. Mounting Base: Polyethylene.

2.3 ACCESSORIES

A. Control equipment and sequence of operation are specified in Division 23 Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls."

B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

C. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

F. Drain Hose: For condensate.

G. Additional Monitoring:
1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base that is 4 inches (100 mm) larger, on each side, than unit. Concrete,

reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

D. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

E. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

F. Install seismic restraints.

G. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Provide a minimum of (2) two hours training with (2) two full copies of training materials.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

ISSUED FOR BID

SECTION 23 82 39
UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall heaters with propeller fans and electric-resistance heating coils.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Plans, elevations, sections, and details.
   2. Location and size of each field connection.
   3. Equipment schedules to include rated capacities, furnished specialties, and accessories.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2013 and ASHRAE 90.1-2013.

PART 2 - PRODUCTS

2.1 WALL HEATERS

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: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings a comparable product by one of the following:
   1. Marley Electric Heating; a division of Marley Engineered Products.
   2. QMark Electric Heating; a division of Marley Engineered Products.
   3. Trane.

D. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

E. Cabinet:
   1. Front Panel: Stamped-steel louver with removable panels fastened with tamperproof fasteners.
   2. Finish: Baked enamel over baked-on primer with manufacturer's **custom** color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2013.

F. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.

G. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection.

H. Fan: Aluminum propeller directly connected to motor.
1. Motor: Permanently lubricated.

I. Controls: Unit-mounted thermostat.

J. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

C. Comply with safety requirements in UL 1995.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables.
2. Sleeve seals.
3. Grout.
4. Common electrical installation requirements.

1.2 SUBMITTALS

A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Advance Products & Systems, Inc.
   b. Metraflex Co.
   c. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 26 05 23
CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. UTP cabling.
2. RS-232 cabling.
3. Low-voltage control cabling.
4. Control-circuit conductors.
5. Identification products.

1.2 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

B. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

1.3 SUBMITTALS

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

B. Field quality-control reports.

C. Maintenance data.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

B. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 48 inches (19 by 1220 by 1220 mm).

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Belden CDT Inc.; Electronics Division.
2. CommScope, Inc.
3. Draka USA.
4. Genesis Cable Products; Honeywell International, Inc.
5. KRONE Incorporated.
6. Mohawk; a division of Belden CDT.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope, Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, four-pair UTP.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    a. Communications, General Purpose: Type CM or Type CMG.
    b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    d. Communications, Limited Purpose: Type CMX.
    e. Multipurpose: Type MP or Type MPG.
    f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.6 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.7 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 44.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in racewaypower-limited cable, concealed in building finishes, complying with UL 44.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.8 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.

4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.

2. Install cable trays to route cables if conduits cannot be located in these positions.

3. Secure conduits to backboard if entering room from overhead.

4. Extend conduits 3 inches (75 mm) above finished floor.

5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

2. Install 110-style IDC termination hardware unless otherwise indicated.

3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (305 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:
1. Class 1 remote-control and signal circuits, No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For data communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Visually inspect UTP cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. 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.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.

2. Steel slotted channel systems. Include Product Data for components.

3. Equipment supports.

C. Welding certificates.

1.4 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

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:

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.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. 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.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. 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:

1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials 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:

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.

7. Hanger Rods: Threaded steel.

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.

PART 3 - EXECUTION

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 RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) 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, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. 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 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

ISSUED FOR BID

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel, compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

A. ENT: NEMA TC 13.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

C. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

D. LFNC and FNC

2.3 METAL WIREWAYS

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:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

C. Fittings and Accessories: Include 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: Screw-cover type or As indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

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:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Fittings and Accessories: Include 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.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Thomas & Betts Corporation.
    b. Walker Systems, Inc.; Wiremold Company (The).
    c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Butler Manufacturing Company; Walker Division.
    b. Enduro Systems, Inc.; Composite Products Division.
    c. Hubbell Incorporated; Wiring Device-Kellems Division.
    d. Lamson & Sessions; Carlon Electrical Products.
    e. Panduit Corp.
    f. Walker Systems, Inc.; Wiremold Company (The).
    g. Wiremold Company (The); Electrical Sales Division.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast metal, semi-adjustable, rectangular.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Plastic.

I. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: IMC.

2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.

3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.

2. Exposed and Subject to Severe Physical Damage: IMC. Includes raceways in the following locations:

a. Loading dock.

b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

c. Mechanical rooms.

d. Truck Bays.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

5. Damp or Wet Locations: IMC.

6. Raceways for Optical Fiber or Communications Cable: EMT.

7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) 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. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

K. Raceways for Optical Fiber and Communications Cable: Install as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    d. Attics: 135 deg F (75 deg C) temperature change.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
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 the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, 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.

O. 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.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
2. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
4. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 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 raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE, .
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.6 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

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 (915 MM)."

2.7 INSTRUCTION SIGNS

A. 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 (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 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. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 21-foot (7-m) maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.
4. Fire alarm

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.

2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

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.

J. 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.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor photoelectric switches.
3. Indoor occupancy sensors.
4. Outdoor motion sensors.
5. Lighting contactors.
6. Emergency shunt relay.

B. See Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.

C. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

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

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

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:

1. Intermatic, Inc.
2. Leviton Mfg. Company Inc.
3. Lightolier Controls; a Genlyte Company.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Paragon Electric Co.; Invensys Climate Controls.
6. Square D; Schneider Electric.
7. TORK.
8. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: SPST.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
5. Astronomic Time: All channels.
6. Battery Backup: For schedules and time clock.

C. Electromechanical-Dial Time Switches: Type complying with UL 917.

1. Contact Configuration: SPST.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
4. Astronomic time dial.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

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:

1. Intermatic, Inc.
2. Lithonia Lighting; Acuity Lighting Group, Inc.
3. Paragon Electric Co.; Invensys Climate Controls.
4. Square D; Schneider Electric.
5. TORK.
6. Watt Stopper (The).

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.

4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

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:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Sensor Switch, Inc.
5. TORK.
6. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of sound and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

2.4 OUTDOOR MOTION SENSORS (PIR)

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:

1. Hubbell Lighting.
2. Lithonia Lighting; Acuity Lighting Group, Inc.
3. Paragon Electric Co.; Invensys Climate Controls.
4. RAB Lighting, Inc.
5. TORK.

B. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as raintight according to UL 773A.

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
    b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
3. Bypass Switch: Override the on function in case of sensor failure.
4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc (11 to 215 lx); keep lighting off during daylight hours.

C. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).

D. Detection Coverage: Up to 35 feet (11 m), with a field of view of 180 degrees.

E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.

F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.5 LIGHTING CONTACTORS

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:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.

3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. GE Industrial Systems; Total Lighting Control.
5. Hubbell Lighting.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. MicroLite Lighting Control Systems.
8. Square D; Schneider Electric.
9. TORK.
10. Watt Stopper (The).

B. Description: Electrically operated and electrically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.

1. Monitoring: On-off status.
2. Control: On-off operation.

2.6 EMERGENCY SHUNT RELAY

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:

1. Lighting Control and Design, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual switching contacts; complying with UL 924.

1. Coil Rating: 120 V.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 26 09 43
NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes manually operated lighting controls with relays and control module.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for time clocks, photoelectric sensors, occupancy sensors, and multipole contactors.

1.2 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.

2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. Coordinate lighting control components specified in this Section with components specified in Division 26 Section "Panelboards."

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of software input/output to execute switching or dimming commands.
b. Failure of modular relays to operate under manual or software commands.
c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.
3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.
4. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acuity Brands Lighting, Inc.; Lithonia Lighting brand.
2. Leviton Mfg. Company Inc.
3. Lighting Control & Design, Inc.
4. Lightolier Controls; a division of Genlyte Group, LLC.
5. Lutron Electronics Co., Inc.
6. Musco Lighting.
7. Square D; a brand of Schneider Electric.
8. Watt Stopper/Legrand?.
9. Douglas Controls.

2.2 SYSTEM REQUIREMENTS

A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

B. Performance Requirements: Manual switch operation sends a signal to network-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.

C. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based network-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

2.3 CONTROL MODULE

A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); microprocessor-based, solid-state, 365-day timing and control unit. Unit shall be networked for control of indicated number of output circuits. Output circuits shall be switched on or off by internally programmed time signals or by program-controlled analog or digital signals from external sources. Output circuits shall be pilot-duty relays compatible with power switching devices, all located in other enclosures. An integral keypad shall provide local programming and control capability. A key-locked cover and a programmed security access code shall protect keypad use. An integral alphanumeric LCD shall display manual-control and programming steps. Modules and their associated control panels shall include the following features:
1. Multiple inputs for indicated occupancy sensors and hand-held programming device.

2.4 POWER DISTRIBUTION COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CAN/CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
   1. Cabinet: Steel with hinged, locking door.
      a. Barriers separate low-voltage and line-voltage components.
      b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
      c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
   2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
      a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
      b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
      c. Endurance: 50,000 cycles at rated capacity.
      d. Mounting: Provision for easy removal and installation in relay cabinet.

B. Electrically Operated, Molded-Case Circuit-Breaker Panelboard: Comply with NEMA PB 1 and UL 50 (CAN/CSA C22.2, No. 94), UL 67 (CSA C22.2, No. 29), UL 489 (CAN/CSA C22.2, No. 65), and UL 916 (CSA C22.2, No. 205).
   1. Cabinets: In addition to requirements specified below, comply with Division 26 Section "Panelboards."
   2. Electrically Operated, Molded-Case Circuit Breakers: Bolt-on type.
      a. Switching Endurance Ratings: Certified by manufacturer or by a nationally recognized testing laboratory (NRTL) for at least 20,000 open and close operations under rated load at 0.8 power factor.
      b. Minimum 30,000 open and close operations with load equal to circuit-breaker trip rating and consisting of 100 percent tungsten filament load.
      c. Minimum 30,000 open and close operations with load equal to circuit-breaker trip rating and consisting of 100 percent fluorescent ballasts rated for 10 percent total harmonic distortion.
      d. Listed and labeled as complying with UL SWD, HCAR, and HID ratings by an NRTL acceptable to authorities having jurisdiction.

C. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

D. Line-Voltage Surge Suppression: Field-mounting surge suppressors that comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

E. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels or field-mounting surge suppressors that comply with Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" for Category A locations.

2.5 FIELD-MOUNTED DIGITAL CONTROLS AND PLATES

A. Connection Type: RS-485 protocol, category 5e UTP cable, using RJ45 connectors. Power shall be from the control unit.

B. Pushbutton Switches: Modular, solid-state, programmable, digital, momentary contact, designed to connect to a microprocessor-based control unit as a manual control source.
   1. Mounting: Standard single-gang recessed switchbox, using device plates specified in Division 26 Section "Wiring Devices."
   2. Multi-Gang Mounting: One to six pushbuttons per gang.

2.6 CONDUCTORS AND CABLES

A. Structured Network Digital and Multiplexed Signal Cables: UTP cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable.

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Minimum conduit size shall be 1/2 inch (13 mm).

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

E. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

G. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.
4. Test system diagnostics by simulating improper operation of several components selected by Architect.

C. Lighting controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 SOFTWARE INSTALLATION

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting controls. See Division 01 Section "Demonstration and Training."

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

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SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
   1. Distribution transformers.
   2. Buck-boost transformers.

1.2 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Indicate dimensions and weights.
   1. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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:
   1. ACME Electric Corporation; Power Distribution Products Division.
   2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
   3. Eaton Electrical Inc.; Cutler-Hammer Products.
   4. General Electric Company.
   5. Magnetek Power Electronics Group.
   6. Powersmiths.
   7. Siemens Energy & Automation, Inc.
   8. Square D; Schneider Electric.

GENERAL TRANSFORMER REQUIREMENTS

B. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

C. Cores: Grain-oriented, non-aging silicon steel.

D. Coils: Continuous windings without splices except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Aluminum or Copper.

2.2 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Totally enclosed, nonventilated, NEMA 250, Type 2.
   1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Enclosure: Totally enclosed, nonventilated, NEMA 250, Type 3R.
   1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

F. Transformer Enclosure Finish: Comply with NEMA 250.
   1. Finish Color: Gray.

G. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.

H. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

I. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

J. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

K. Energy Efficiency for Transformers Rated 15 kVA and Larger:
   1. Complying with NEMA TP 1, Class 1 efficiency levels.
   2. Tested according to NEMA TP 2.

L. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
   1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
   2. Indicate value of K-factor on transformer nameplate.

M. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance. Transformers noted to be fully shielded shall have an overall, full-coverage grounded electrostatic shield.

N. Wall Brackets: Manufacturer's standard brackets.

2.3 BUCK-BOOST TRANSFORMERS

A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.

B. Enclosure: Ventilated, NEMA 250, Type 2.

   1. Finish Color: Gray

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
   1. Brace wall-mounting transformers as specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
      a. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
      b. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
      c. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

3.3 ADJUSTING

A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

PART 4 - METHOD OF MEASUREMENT

4.1 No separate measurement will be made for items required by this section.

PART 5 - BASIS OF PAYMENT

5.1 No separate payment will be made for items required by this section.
Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

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

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

C. Panelboard schedules for installation in panelboards.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

b. Outdoor Locations: NEMA 250, Type 3R.

c. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.

d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

5. Lockable, all keyed alike.

B. Incoming Mains Location: Top.

C. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs and Bus Configured Terminators: Mechanical type.

4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Lugs only.

E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. External Control-Power Source: 120-V branch circuit.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.

d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).

7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.

8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.

g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade depending on top or bottom fed.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.
4. Wall-switch and exterior occupancy sensors.
5. Communications outlets.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cooper; 5351 (single), 5352 (duplex).
   b. Hubbell; HBL5351 (single), CR5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; GF20.

b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).

b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 2221PL for 120 V and 277 V.

b. Hubbell; HPL1221PL for 120 V and 277 V.

c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.

d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 2221L.

b. Hubbell; HBL1221L.

c. Leviton; 1221-2L.

d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper; 1995.
    b. Hubbell; HBL1557.
    c. Leviton; 1257.
    d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper; 1995L.
    b. Hubbell; HBL1557L.
    c. Leviton; 1257L.
    d. Pass & Seymour; 1251L.

2.5 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; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices. Retain subparagraph above or below. If retaining below, insert other dimmers with their characteristics. UL 1472 covers ratings from 300 W to 2000 W in increments of 50 W.

2.6 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    a. Cooper; 6111 for 120 V, 6117 for 277 V.
    b. Hubbell; WS1277.
    c. Leviton; ODS 10-ID.
    d. Pass & Seymour; WS3000.
    e. Watt Stopper (The); WS-200.
    f. Douglas Controls

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Hubbell; ATP1600WRP.

b. Leviton; ODWWV-IRW.

c. Pass & Seymour; WA1001.

d. Watt Stopper (The); CX-100.

e. Douglas Controls

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

C. Exterior Occupancy Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Leviton; PS200-10.

b. Watt Stopper (The); EW-100-120.

2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.7 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

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.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 3562.

b. Leviton; 40595.

2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.8 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Smooth, high-impact thermoplastic.

3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant die-cast aluminum with lockable cover.

2.9 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 Category 6 jacks for UTP cable.

2.10 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: White or As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Emergency Power System: Red.

3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. 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 the 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 just before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.

b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. 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.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

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SECTION 26 36 00
TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes transfer switches rated 600 V and less.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. 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."

2. Dimensioned Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based.

D. Field quality-control test reports.

E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA ICS 1.

C. Comply with NFPA 70.

D. Comply with NFPA 99.

E. Comply with NFPA 110.

F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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:

1. Contactor Transfer Switches:

a. AC Data Systems, Inc.

b. Caterpillar; Engine Div.

c. Emerson; ASCO Power Technologies, LP.

d. Generac Power Systems, Inc.

e. GE Zenith Controls.

f. Kohler Power Systems; Generator Division.

g. Onan/Cummins Power Generation; Industrial Business Group.

h. Russelectric, Inc.

i. Spectrum Detroit Diesel.

j. ESL

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.

2. Switch Action: Double throw; mechanically held in both directions.

3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

H. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

I. Battery Charger: For generator starting batteries.

1. Float type rated 2 A.

2. Ammeter to display charging current.

3. Fused ac inputs and dc outputs.

J. Enclosures: General-purpose NEMA 250, Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase.

F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.

G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.

H. Automatic Transfer-Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

5. Test Switch: Simulate normal-source failure.

6. Switch-Position Pilot Lights: Indicate source to which load is connected.

7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

   b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.
    1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Identify components according to Division 26 Section "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 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 installation, including connections, and to assist in testing.
2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.
5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
    f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Remove and replace malfunctioning units and retest as specified above.

F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Division 01 Section "Demonstration and Training."

B. Coordinate this training with that for generator equipment.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 26 41 13

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes lightning protection for structures, building components, and building equipment.

1.2 SUBMITTALS

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

B. 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.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Certified by UL or LPI as a Master Installer/Designer, trained and approved for installation of units required for this Project.

B. System Certificate:

1. UL Master Label.

2. LPI System Certificate.

3. UL Master Label Recertification.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Comply with UL 96 and NFPA 780.

Roof-Mounted Air Terminals: NFPA 780, copper or stainless steel unless otherwise indicated. Design intent is to have a full dissipation array with charge dispersal air terminals.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Spline Ball Air Terminals as manufactured by Lightning Elimination Consultants, Inc., or comparable product by one of the following:

a. LBA Group.

b. Lightning Master Corporation.

c. Tower Beacon Lightning Protection

d. Heary Bros. Lightning Protection Co. Inc.

e. Independent Protection Co.

f. Preferred Lightning Protection.

g. Robbins Lightning, Inc.

h. Thompson Lightning Protection, Inc.

2. Air Terminals More than 24 Inches (600 mm) Long: With brace attached to the terminal at not less than half the height of the terminal.

3. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in Division 07 roofing Sections.

B. Main and Bonding Conductors: Copper

C. Ground Loop Conductor: As shown on the project drawings

D. Ground Rods: Copper-clad 3/4 inch (19 mm) in diameter by 10 feet (3 m) long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. 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 (60 m) of building.

C. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components. Use exothermic-welded connections in underground or inside concrete portions of the system.

D. 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.

E. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.

F. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components.

G. Ground Loop: Install ground-level, potential equalization conductor and extend around the perimeter of the area indicated in the project documents.

1. Bury ground ring not less than 24 inches (600 mm) from building foundation.

2. Bond ground terminals to the ground loop.

3. Bond grounded building systems to the ground loop conductor within 12 feet (3.6 m) of grade level.

H. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.

3.2 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.

3.3 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.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 26 43 13

TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

B. Submit shop drawings of catalog data with complete description of materials and performance data..

C. Operation and maintenance data.

D. Warranties: Sample of special warranties.

E. Submit a single impulse surge current test report issued by a nationally recognized testing facility. The test report should demonstrate that each SPD unit can withstand, in its installed configuration, the specified values (up to 200K transient amps per mode) without failure of any internal component (MOVs, wiring, printed circuit board, fusing and disconnect).

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

C. Comply with NEMA LS 1.

D. Comply with UL 1283 listing for EMI/RFI filters

E. .UL 1449, 4th Edition listing as a Type 1 SPD with a 20KA nominal discharge current.

1.4 WARRANTY

A. The SPD system shall have a TEN YEAR limited product warranty from date of shipment against transient failure, when installed in compliance with applicable national/local electrical codes and manufacturer’s installation manual.Verify available warranties and warranty periods for surge suppressors with manufacturers listed in Part 2 articles.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ABB USA.
2. Advanced Protection Technologies Inc. (APT).
3. Atlantic Scientific.
4. **Current Technology – Frank Pitts; 901-832-8811**
5. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
6. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

7. Intermatic, Inc.
8. Leviton Mfg. Company Inc.
9. Liebert Corporation; a division of Emerson Network Power.
10. Siemens Energy & Automation, Inc.
11. Square D; a brand of Schneider Electric.

B. Surge Protection Devices:
1. Non-modular.
2. LED indicator lights for power and protection status.
3. Comply with UL 1449.
4. Fuses, rated at 200-kA interrupting capacity.
5. Fabrication using bolted compression lugs for internal wiring.
6. Integral disconnect switch.
7. Redundant suppression circuits.
8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
10. LED indicator lights for power and protection status.

C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

D. Each SPD unit shall be capable of surviving at least the following Category C3 (20KV, 10KA) impulses without failing or degrading the UL 1449 surge suppression rating more than 10%:
1. Main Switchboard/Emergency Panel (>1600A) 6,500 impulses.
2. Main Switchboard/Emergency Panel (400A - 1600A) 5,500 impulses
3. Main Switchboard /Emergency Panel (<400A) 4,500 impulses
4. Branch Panel 3,250 impulses

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 480Y/277 V.
2. Line to Ground: 800 V for 480Y/277 V.
3. Neutral to Ground: 800 V for 480Y/277 V.

F. Protection modes and UL 1449 SVR for 240/120 V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

G. Protection modes and UL 1449 SVR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 400 V, 800 V from high leg.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

H. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

1. Line to Line: 2000 V for 480 V.
2. Line to Ground: 2000 V for 480 V.

2.2 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ABB USA.
2. AC Data Solutions.
3. Advanced Protection Technologies Inc. (APT).
4. Atlantic Scientific.
5. **Current Technology Inc.**
6. Danaher Power Solutions; United Power Products.
7. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
8. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
9. Intermatic, Inc.
10. LEA International.
11. Leviton Mfg. Company Inc.
12. Liebert Corporation; a division of Emerson Network Power.
13. Northern Technologies, Inc.; a division of Emerson Network Power.
14. Siemens Energy & Automation, Inc.
15. Square D; a brand of Schneider Electric.

B. Surge Protection Devices:

1. Non-modular.
2. LED indicator lights for power and protection status.
3. Fuses, rated at 200-kA interrupting capacity.
4. Fabrication using bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
8. LED indicator lights for power and protection status.

C. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:

1. Line to Neutral: 70,000A.
2. Line to Ground: 70,000A.
3. Neutral to Ground: 50,000A.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V or 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277 V; 400 V for 208Y/120 V

2. Line to Ground: 800 V for 480Y/277 V; 400 V for 208Y/120 V.
3. Neutral to Ground: 800 V for 480Y/277 V; 400 V for 208Y/120 V.

F. Diagnostic Monitoring System: Each SPD shall include an audible alarm system, Form C Contacts, and phase indicator lights.

G. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3-phase, 3-wire, delta circuits shall be as follows:

1. Line to Line: 2000 V for 480 V.
2. Line to Ground: 1500 V for 480 V.

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1.

B. Outdoor Enclosures: NEMA 250 Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multiple, 30-A circuit breaker as a dedicated disconnecting means for TVSS unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
3. Complete startup checks according to manufacturer's written instructions.

C. TVSS device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Do not energize or connect panelboards to their sources until TVSS devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to maintain TVSS devices.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Network Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
3. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. LED Fixtures: Comply with IES LM-80 and IES LM-79

E. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

F. Metal Parts: Free of burrs and sharp corners and edges.

G. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

H. 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.

I. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

    b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.

2. Designed for type and quantity of lamps served.

3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.

4. Total Harmonic Distortion Rating: Less than 10 percent.

5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

6. Operating Frequency: 42 kHz or higher.

7. Lamp Current Crest Factor: 1.7 or less.

8. BF: 0.88 or higher.

9. Power Factor: 0.95 or higher.

B. luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

E. Ballasts for Low-Temperature Environments: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

F. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

a. High-Level Operation: 100 percent of rated lamp lumens.

b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.

3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.

2. Automatic lamp starting after lamp replacement.

3. Sound Rating: Class A.

4. Total Harmonic Distortion Rating: Less than 20 percent.

5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

6. Operating Frequency: 20 kHz or higher.

7. Lamp Current Crest Factor: 1.7 or less.

8. BF: 0.95 or higher unless otherwise indicated.

9. Power Factor: 0.95 or higher.

10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Nightlight Connection: Operate one fluorescent lamp continuously.

3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.

5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

a. Battery: Sealed, maintenance-free, nickel-cadmium type.

b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.7 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.

7. Integral Time-Delay Relay: Holds unit on for fixed interval of [15] <Insert period> minutes when power is restored after an outage.

2.8 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).

2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).

3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).

4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).

5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).

7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 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 (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), 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 50 feet (15 m) high or less is 100 mph (45 m/s).
    a. Wind Importance Factor: 1.0.
    b. Minimum Design Life: 25 years.
    c. Velocity Conversion Factors: 1.0.

1.3 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

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.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. 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.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. 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.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

    a. Color: Dark bronze.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

    a. "USES ONLY" and include specific lamp type.

    b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.

    c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.

    d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.

    e. ANSI ballast type (M98, M57, etc.) for HID luminaires.

    f. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.

2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.

2. Sound Rating: Class A.

3. Total Harmonic Distortion Rating: Less than 10 percent.

4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.

5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.

6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

2.5 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 (Minus 30 deg C).

3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

2.6 HID LAMPS

A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), CCT color temperature 1900 K, and average rated life of 24,000 hours, minimum.

1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

B. Low-Pressure Sodium Lamps: ANSI C78.43.

C. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

D. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.

E. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.

2.7 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.

2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.

2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws. Provide on all, except wood poles.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.8 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: Square, straight.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.

2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.

3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."

2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.

3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected by Architect from manufacturer's full range.

2.9 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Shape: Square, straight.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.

2. Finish: Same as pole.

F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

2.10 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 12 inches (300 mm) above finished grade.

2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, that when mounted results in NEMA 250, Type 3R enclosure.

3. With cord opening.

4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

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. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

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:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).

2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).

3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.

2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.

3. Install base covers unless otherwise indicated.

4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.

2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.

2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.

3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.

4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.

2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.

2. Install grounding conductor and conductor protector.

3. Ground metallic components of pole accessories and foundations.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 27 05 00

COMMON WORK RESULTS FOR FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for pathways and cables.
2. Grout.
3. Common installation requirements.

1.2 SUBMITTALS

A. Product Data:

1. Raceways
    a. Electrical Metallic Tubing, boxes and fittings.
    b. Surface Metal Raceways
    c. Flexible Metal Conduit
2. Pathways
    a. J-Hooks
    b. Clips for Cable to Acoustical Ceiling Tile Grid Wire
3. Through Penetration Firestop Assemblies

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:
    a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.

b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials.

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

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SECTION 27 15 00
FIRE ALARM HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. Fire Alarm Cabling.
3. UTP cabling.
4. Cabling identification products.
5. Cabling administration system

1.2 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the Fire Alarm Control Unit and the fire alarm devices located through the system.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.4 SUBMITTALS

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

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
2. Cabling administration drawings and printouts.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance data.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.

2. Smoke-Developed Index: 50 or less.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

E. Fire Alarm Cable: UL 1424

F. Comply with NFPA 70, The National Fire Alarm Code

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Cable Support: NRTL labeled for support of Category 5e cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. J-hooks and bridle rings with accessories to fasten to walls and ceiling grid wires.

3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes for Electrical Systems."

1. Wall outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2. Junction boxes shall be no smaller than 4 inches wide and tall and 2-1/2 inches deep. Boxes and covers shall be factory finish red.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.

2.3 FIRE ALARM CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Belden CDT Inc.; Electronics Division.

2. Southwire

3. Berk-Tek; a Nexans company.

4. Genesis Cable Products; Honeywell International, Inc.

B. These requirements cover 60 - 250°C (140 - 482°F) single- and multiple-conductor cables for use as fixed wiring within buildings (some are also marked for direct burial) principally for power-limited fire-alarm circuits as described in Article 760 and other applicable parts of the National Electrical Code (NEC). Cables covered by these requirements are:

1. Type FPLP (plenum cable),

2. Type FPLR (riser cable), and

3. Type FPL (cable for other than plenum and riser uses in general and in trays), and "Power-limited fire-alarm circuit cable" (cable for limited use).

C. Cables shall be red finish.

D. A cable that contains one or more electromagnetic shields may be surface marked or have a marker tape to indicate that it is "shielded". A cable that contains one or more optical-fiber members has "-OF" supplementing the type letters and is marked in accordance with 45.1(d). A cable may consist of or contain one or more coaxial members.

E. The overall jacket on a cable that has "sun res" or "sunlight resistant" in a surface marking or on a marker tape complies with a 720-h sunlight-resistance test.

F. A cable that has "dir bur", "direct burial", or "for direct burial" in a surface marking or on a marker tape complies with a 1000-lbf crushing test. Direct-burial cable with wire armor, a metal braid, interlocked metal armor, or a smooth or corrugated metal sheath has a jacket over the metal covering.

G. TYPE FPLP CABLE - Cable that is intended for installation in accordance with section 760-154(A) of the National Electrical Code (ANSI/NFPA 70) in a duct, plenum, or other space used to transport environmental air without the cable being enclosed in a raceway in that space is to be tested for smoke and flame characteristics in accordance with the National Fire Protection Association Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces, ANSI/NFPA 262. A cable that complies exhibits a maximum flame-propagation distance that is not greater than 5 ft, 0 inch, a peak optical density of smoke produced of 0.50 or less (32 percent light transmission), and an average optical density of smoke produced of 0.15 or less.

H. TYPE FPLR CABLE - Cable that is intended for use in vertical runs in a shaft, or for installations in which the cable penetrates more than one floor, as specified in section 760-154(B) of the National Electrical Code ANSI/NFPA 70. This cable is to be tested for flame-propagation characteristics in accordance with the Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts, UL 1666. A cable that complies has a flame-propagation height less than 12 ft, 0 inch or 366 cm and temperatures are 850.0°F (454.4°C) or less at a height of 12 ft, 0 inch or 366 cm.

I. TYPE FPL CABLE - Type FPL cable complies with a 70,000 Btu/h (20.5 kW) vertical-tray flame test. The cable manufacturer chooses one of the following tests:

1. THE UL TEST REFERENCED IN 23.2.1 - This paragraph applies the test method described as the UL Flame Exposure (smoke measurements are not applicable) in the

Standard Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, UL 1685, to cable that is surface marked or designated by a marker tape as "FPL". A cable of a given construction shall not exhibit char that reaches the upper end of any specimen (a maximum of 8 ft, 0 inch).

2. THE FT4/IEEE 1202 TEST REFERENCED IN 23.3.1 - This paragraph applies the test method described as the FT4/IEEE 1202 Type of Flame Exposure (smoke measurements are not applicable) in the Standard Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables, UL 1685. This test differs from the UL tests in loading (more cables are used, with small cables bundled, and the spacing between cables or bundles is limited), burner angle, and failure criterion. For compliance, this test damages less than 150 cm (59 inches) of cable. A cable that complies either is not marked or it bears the designation "FT4/IEEE 1202" or "FT4" legible on or through the outer surface or on a marker tape.

J. POWER-LIMITED FIRE-ALARM CIRCUIT CABLE - Cable that is surface marked or designated by a marker tape as "power-limited fire-alarm circuit cable" or as "power ltd fire alarm cable" complies with the VW-1 vertical-specimen flame test. The cable is not marked "VW-1".

K. “Power-limited fire-alarm circuit cable" is used with protection such as raceway. All other cables covered in these requirements are not required by the NEC to be used in raceway and are capable of use without the physical protection of raceway but may be pulled into conduit or installed in other raceway.

L. "Power-limited fire-alarm circuit cable" is used:

1. In concealed spaces.

2. In raceway.

M. These requirements do not cover cables that contain conductors for electric-light, power, or Class 1 circuits. These requirements do not cover cables for Class 3 or Class 2 power-limited circuits (see the Standard for Power-Limited Circuit Cables, UL 13), communications cables (see the Standard for Communications Cables, UL 444), or cables for non-power-limited fire-alarm circuits (NPLF types).

N. These requirements do not cover the optical or other performance of any optical-fiber member or group of such members.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Thomas and Betts

2. Hubbell Premise Wiring.

3. Panduit Corp.

4. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 5e and Category 6.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 SOURCE QUALITY CONTROL

A. Factory test UTP cables according to TIA/EIA-568-B.2.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Methods:

1. Install cables in EMT raceways in open spaces including:

    a. Outdoors

    b. Mechanical Rooms

    c. Mechanical Chases

    d. Any room that does not have a ceiling.

    e. Any room that has a gypsum board ceiling.

2. Install cables in open pathway wiring methods where there is an acoustical ceiling.

3. Install plenum cable in environmental air spaces, including plenum ceilings.

4. Comply with requirements for raceways and boxes specified in Section "Raceway and Boxes for Electrical Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 24 inches apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.5 FIRESTOPPING

A. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Cable Schedule: Post in prominent location in each Fire Alarm Control Unit. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for SLC , NAC and low voltage power circuits. Follow convention of NICET and TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

D. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 10 feet.

3. Label each terminal strip and screw terminal in each panel.

a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.

4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel in fire alarm cable-plant management operations, including changing signal pathways for different devices, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new device outlets.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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SECTION 28 31 00

DIGITAL ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 260533 – Raceways and Boxes for Electrical Systems

B. Section 270500 – Common Work Results for Communications

C. Section 271500 - Fire Alarm Communications Horizontal Cabling

1.2 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994

C. The FACU and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

D. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

E. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 GUARANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.4 SUBMITTALS:

A. Submittals shall be approved by the Authority Having Jurisdiction.

B. Shop Drawings shall be prepared by the manufacturer by a NICET-certified fire alarm technician,

Level III. Submit name and contact information of designer.

C. Product data: For each type of product used.

D. Shop Drawings: For Fire Alarm System, include plans, risers and calculations for the complete system. Document locations of all devices and addresses on plans.

a. Include voltage drop calculations.

b. Include battery-size calculations.

c. Include sound pressure level output of notification appliances.

d. Include candela settings of notification appliances.

1.5 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 72	National Fire Alarm Code
No. 90A	Air Conditioning Systems
No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 101	Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems

No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL	Underwriters Laboratories, Inc
ULC	Underwriters Laboratories Canada
FM	Factory Mutual
FM 6320	Factory Mutual Gas Detection System
NYFD	New York Fire Department
CSFM	California State Fire Marshal

B. The system shall be certified for seismic applications in accordance with the International Building Code (IBC). The basis for qualification of seismic approval shall be via shake table

testing.

PART 2 - PRODUCTS

2.1 FIRE ALARM CONTROL UNIT

A. Fire alarm panel shall be non-proprietary.

B. Main FACU or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

C. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACU shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.

2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.

3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 SYSTEM CAPACITY AND GENERAL OPERATION

A. The FACU shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. The control panel shall be capable of expansion of up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points.

C. The Fire Alarm Control Unit shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.

D. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

E. The FACU shall be able to provide the following software and hardware features:

1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection

shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

2. Smoke Detector Pre-alarm Indication at Control Unit: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.

3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.

4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.

6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.

7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.

8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.

10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.

12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password

shall allow access to password change screens.

14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions

15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.

20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.

21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result of all cooperating detectors chamber readings.

22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.

24. Mass Notification Override:The system shall be UL 2572 listed for Mass Notification and

shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

25. Security Monitor Points: The system shall provide means to monitor any point as a type security.

26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.

30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.

31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.

32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.

33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect

against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

F. Network Communication

1. The FACU shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

G. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.

2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.

4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.

5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.

6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

H. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.

2. The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field

programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

I. Signaling Line Circuit (SLC) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.

2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.

3. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.

4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

J. Fire Alarm Power Supply (FAPS)

1. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power.

2. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.

3. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "A" or Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.

4. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.

5. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.

6. The interface to the power supply from the Fire Alarm Control Unit (FACU) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACU to the addressable power supply shall be a single unshielded twisted pair wire.

7. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACU via the SLC.

8. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACU will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.

9. The addressable power supply mounts in either the FACU backbox or it's own dedicated surface mounted backbox with cover.

10. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.

11. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.

12. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Steady, March Time, Dual Stage or Temporal.

13. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.

14. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.

15. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.

2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.

3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.

4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

L. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.

2. It shall be possible to program through the standard FACU keyboard all system functions.

3. All field defined programs shall be stored in non-volatile memory.

4. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.

5. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk/thumb drive shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.

6. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACU manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

M. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.

2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACU shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

N. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.

2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.

3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for

the parameters listed:

a. Device Status.

b. Device Type.

c. Custom Device Label.

d. Software Zone Label.

e. Device Zone Assignments.

f. Analog Detector Sensitivity.

g. All Program Parameters.

4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.

5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.

6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.

7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

2.3 SYSTEM COMPONENTS:

A. Communicators (UDACT)

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.

2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events

up to two different telephone numbers.

3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.

4. Communication shall include vital system status such as:

   a. Independent Zone (Alarm, trouble, non-alarm, supervisory)

   b. Independent Addressable Device Status

   c. AC (Mains) Power Loss

   d. Low Battery and Earth Fault

   e. System Off Normal

   f. 12 and 24 Hour Test Signal

   g. Abnormal Test Signal (per UL requirements)

   h. EIA-485 Communications Failure

   i. Phone Line Failure

5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

6. The UDACT shall be capable of being programmed with the same programming utility as the host FACU, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.

7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.

8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

C. Standard Annunciator

1. 640-character Liquid Crystal Display (LCD) annunciator and remote control for the IFC-3030/IFC2-3030 Fire Alarm Control Unit (FACU). The LCD-160 will mimic the top portion (160 characters) of the IFC-3030/IFC2-3030's 640-character display. This provides the event and preprogrammed custom messages as displayed on the main panel. The full screen contains soft key functions, and can display other panel information.

2. Flush mount in wall.

D. Graphic Annunciator

1. 22 inch LCD touchscreen display with a graphical representation of the Cannon Center and Cook Convention Center.

2. Main page to show orthogonal elevations of floors of buildings with color change of floor to indicate zone with trouble or alarm. Table adjacent to riser elevation to show zone name and status of alarm or trouble. Devices that caused alarm or trouble to be indicated.

3. User to be able to touch floor such that floorplan appears on the screen with the trouble or alarm zone indicated in a unique color. Floors will be selectable with the ability to zoom into specific areas to show unique devices with status.

4. Zones to be indicated by color. All interior walls to be shown with doors. All devices to be shown. Alarm and trouble signals to be shown.

5. Provide custom mapping of hospital and finished alarm system.

6. Flush mount in wall.

2.4 GATEWAY & WEBSERVER OPTIONS

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

C. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

D. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

E. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an

address in a range of 001 to 159.

2. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.

3. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.

4. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.

5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.

6. Using software in the FACU, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.

7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.

8. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

9. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACU based on real-time measured values. The FACU software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACU program and allowing the system operator to view the current analog value of each detector.

10. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.

11. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

12. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (Manual Pull Station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Photoelectric Smoke Detector

1. The intelligent photoelectric smoke detector shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

E. Ionization Smoke Detector:

1. The intelligent ionization smoke detector shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

G. Heat Detectors: The intelligent thermal detectors shall be rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACU, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely.

I. Combination Detector

1. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in

which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.

3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.

4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.

5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.

6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.

7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.

8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.

9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

   a. 4.0" (10.16 cm) square box with and without plaster ring.

   b. 4.0" (10.16 cm) octagonal box.

c. 3.5" (8.89 cm) octagonal box.

d. Single-gang box.

10. Meets Agency Standards

a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems

b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems

c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

M. Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.

2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits.

N. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits.

O. Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.

2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;

3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or

3 Style Z (Class A) control circuits.

P. Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids.

2. The module shall operate on a redundant protocol for added protection.

3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.

Q. 4-20 mA Module

1. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACU for monitoring and display.

2. The module shall support programming of up to five programmable event thresholds.

3. The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.

R. Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions.

2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.

4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

S. Two-In / Two-Out Monitor/Relay Module:

1. An addressable Two-In / Two-Out module shall be available.

2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

T. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit

(disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

U. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.

2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.

3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.

5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.

6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.

7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

V. Agency Listings and Approvals

a. The listings and approvals below apply to Advance Selectable Output Notification Devices. In some cases, certain modules may not be listed by certain approval agencies, or listing may be in process. Consult factory for latest listing status.

b. UL Listed

c. FM approved

d. MEA: 452-05-E

1. GENERAL DESCRIPTION

a. Horns, strobes, and horn/strobes shall mount to a standard 4.0" x 4.0" x 1.5" (10.16 x 10.16 x 3.81 cm) backbox, 4.0" (10.16 cm) octagonal backbox, or a double gang backbox. Two-wire products shall also mount to a single gang 2.0" x 4.0" x 1.875" (5.08 x 10.16 x 4.763 cm) backbox.

b. A universal mounting plate shall be used for mounting ceiling and wall products. The notification appliance circuit wiring shall terminate at the universal mounting plate. Also shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts. 12- volt rated notification appliance circuit outputs shall operate between 9 and 17.5 volts; 24-volt rated notification appliance products shall operate between 32°F and 120°F (0°C and 49°C) from a regulated DC, or full-wave-rectified, unfiltered power supply.

c. Strobes and horn/strobes shall have field-selectable candela settings including 15, 15/75, 30, 75, 95, 110, 115, 135, 150, 177, 185.

2. STROBE

a. The strobe shall be listed to UL 1971 and shall be approved for fire protective service. The strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe’s entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system.

3. HORN/STROBE COMBINATION

a. The horn/strobe shall be listed to UL 1971 and UL 464 and shall be approved for fire protective service. The horn/strobe shall be wired as a primary-signaling notification appliance and comply with the Americans with Disabilities Act requirements for visible signaling appliances, flashing at 1 Hz over the strobe’s entire operating voltage range. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. The horn shall have three audibility options and an option to switch between a Temporal 3 pattern and a Non-Temporal (continuous) pattern. These options are set by a multiple position switch. On four-wire products, the strobe shall be powered independently of the sounder. The horn on horn/strobe models shall operate on a coded or non-coded power supply.

4. OUTDOOR PRODUCTS

a. Outdoor horns, strobes and horn/strobes shall be listed for outdoor use by UL and shall operate between –40°F and 151°F (–40°C and 6°C). The products shall be listed for use with a System Sensor outdoor/weatherproof backbox with half-inch and three-fourths-inch conduit entries.

5. SYNCHRONIZATION MODULE

a. The module shall be listed to UL 464 and shall be approved for fire protective service. The module shall synchronize strobes at 1 Hz and horns at Temporal 3.

b. While operating the strobes, the module shall silence the horns on horn/strobe models over a single pair of wires.

c. The module shall mount to a 4.688" x 4.688" x 2.125" (11.906 x 11.906 x 5.398 cm) backbox. The module shall also control two Style Y (class B) circuits or one Style Z (Class A) circuit. The module shall synchronize multiple zones

d. Daisy-chaining two or more synchronization modules together will synchronize all the zones they control.

e. The module shall not operate on a coded power supply.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. See sections “HORIZONTAL CABLING” and “RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS”.

C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

E. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2 TESTING

A. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACU.

D. Verify activation of all waterflow switches.

E. Open initiating device circuits and verify that the trouble signal actuates.

F. Open and short signaling line circuits and verify that the trouble signal actuates.

G. Open and short notification appliance circuits and verify that trouble signal actuates.

H. Ground all circuits and verify response of trouble signals.

I. Check presence and audibility of tone at all alarm notification devices.

J. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACU and the correct activation of the control points.

L. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4 RECORD DRAWINGS

A. Field markups: on the on-site construction drawings, record:

1. Fire alarm device addresses.
2. Actual route of NAC and SLC circuits.
3. Pathways, whether EMT or bridle ring/j-hook/clip.
4. Location of junction boxes.

B. Closeout documents

1. Red line of as-built fire alarm system. Include all devices and cables.
2. Accurate fire alarm control unit schedules in Microsoft Excel.
3. Accurate fire alarm power supply schedules in Microsoft Excel.
4. Schedule of planned yearly tests.

3.5 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. Train personnel on the following:

1. System function.
2. Sequence of events after alarm, during evacuation and after clearance by Fire Marshal.
3. Common equipment failures and correct sequence of operation to address equipment failure.

4. Basic system programming.

B. Provide (3) days of training:

1. Day one for training of administration.
2. Day two for training of maintenance & security personnel
3. Day three for training of City of Memphis Fire Department.
4. Training may be combined if the group is small and the owner agrees to it.

C. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 34 70 00
IMPACT RESISTANT BOLLARDS

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data: Submit data on each type of product and accessory.
   1. Storage and handling requirements and recommendations.
   2. Preparation and installation instructions and recommendations.
   3. Cleaning methods.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
   1. Store in covered area away from direct sunlight.

B. Store materials in manufacturer's original sealed, labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

1.03 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 PRODUCTS

2.01 BOLLARDS

A. Impact-Absorbing Bollards: Shock Absorbing Steel core with HDPE cover.
   1. Basis of Design: FlexCore Bollard as manufactured by McCue Corp.
   2. Components:
      a. Core: High tensile steel.
         1) Flexes to absorb and distribute impact energy.
         2) Includes shock absorbing load ring.
      b. Cover: Rotating HDPE.
         1) Rotates to avoid snagging points.
         2) Absorbs glancing blows and minor impacts.
         3) Transfers energy to the core.
      c. Anchor assembly includes stress relieving damper to protect the concrete floor.

   3. Color: Yellow.

   4. FlexCore Bollard 4 inch:(exterior)
      a. Diameter: 5.16 inches (131 m).
      b. Height: 54 inches (1372 mm).
      c. Fasteners: 1/2 x 6 inch (13 x 152 mm) concrete anchors.
   5. FlexCore Bollard 6 inch: (interior)
      a. Diameter: 7.16 inches (182 m).
      b. Height: 54 inches (1372 mm).
      c. Fasteners: 1/2 x 6 inch (13 x 152 mm) concrete anchors.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions. Verify site conditions are ready to receive work.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions, approved submittals and in proper relationship with adjacent construction.

B. Anchor components as recommended by manufacturer. Install level and plumb.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

SECTION 41 22 00
BRIDGE CRANE

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. The Work under this section includes providing all labor, materials, equipment and products for one bridge crane as indicated in the drawings.

1.02 GOVERNING CODES, STANDARDS, AND REFERENCES

A. American Gear Manufacturers Association AGMA

B. American Institute of Steel Construction AISC

C. AISC, 8th Edition

D. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" design, fabrication, workmanship, materials and construction

E. American Iron & Steel Institute AISI

F. American National Standards Institute ANSI

G. American National Standards Institute A-58.1 design, fabrication, workmanship, materials and construction

H. ANSI B30.11 "Safety Code for Underhung Cranes and Monorail Systems" safety requirements

I. ANSI C1 control wiring

J. ANSI C1 magnetic control

K. American Society for Testing Materials ASTM

L. ASTM grade and quality - stock materials

M. ASTM iron and steel castings ("Medium Grade Steel Castings"), steel shafting, bronze babbit and other materials

N. ASTM A36 structural steel

O. American Welding Society AWS

P. AWS D1.0 "Code for Welding in Building Construction" field welding to the building structure

Q. AWS D14.1 "Specification of Welding Industrial and Mill Cranes" welding

R. Crane Manufacturers Association of America CMAA

S. Institute of Electrical & Electronic Engineers IEEE

T. Insulated Power Cable Engineers Association IPCEA

U. National Electric Code NEC

V. National Electric Code magnetic control

W. Article 610 National Electric Code control wiring

X. National Electric Manufacturers Association NEMA

Y. NEMA control enclosures

Z. Occupational Safety & Health Act OSHA

1.03 SUBMITTALS

A. Submit materials data of manufacturers' technical literature, standard details, product specifications, and installation instructions for all products. Submittals shall include the following:

1. Shop Drawings

1.04 QUALITY ASSURANCE

A. Materials and Standards: All materials shall be new, of the highest grade, free from defects and of recent manufacture. Materials, individually or collectively, shall conform to the most applicable specifications of the Standard Codes

B. Structural steel shall be coordinated with Bridge Crane

C. Materials used shall be as specified by Crane Engineer

D. Design, fabrication, and installation shall be by Crane Engineer

1.05 DESIGN AND LOADING CONDITIONS

A. All structural and mechanical parts of the crane shall be designed to resist live, dead and lateral loads and the forces produced by impact, thrust and the rated breakdown torque of motors, not concurrent with other loads.

B. Crane basics:

1. Crane shall have a 10 Ton capacity.
2. Crane's span shall be 40'-0" (field verify)
3. Crane's total travel distance of 96'-0" (field verify)

1.06 WARRANTY

A. The crane supplier will repair or replace products or components of its manufacture which prove defective within a period of one year from the date of shipment. Return of products for such repair or replacement shall be made at the expense of the purchaser. Supplier will make said repair or replacement if such defects are due to defective materials supplied by the manufacturer or defective workmanship of its employees, provided: 1) that the products and components have been properly installed, maintained and utilized during the period covered by this warranty, 2) that this warranty shall extend only to the original purchaser, and 3) that the supplier shall in no event be responsible for the cost of field labor or other charges incurred by any party in removing and reaffixing any portion of the above mentioned returned products. At all times, the supplier shall have and possess the sole right and option to determine whether to repair or replace defective equipment. Machinery, parts, accessories, and components manufactured by others are warranted only to the extent of the original manufacturer's warranty.

PART 2 PRODUCTS

2.01 CRANE

A. The crane shall be rated 10 tons; shall have electric power hoist, trolly, and bridge travel; and shall be equipped with all motors, motor controls, lights, hoisting and traveling machinery, hoisting ropes, electrical protective devices, emergency and operating brakes and all appurtenant items required for a complete and efficiently operating installation. It shall be manufactured and engineered to include all parts including but not limited to trolly, hoists, electrical controls, motors, power, and others as required for a complete operation. Contractor shall install crane on steel fame

system as indicated in the drawings. The rail shall be cleaned by a shot-blasting process prior to painting. The equipment shall be painted in safety yellow

PART 3 EXECUTION

3.02 DRAWINGS AND WIRING DIAGRAMS

A. Supply general assembly drawings (not detail drawings) for approval by the Designer before proceeding with manufacture and sets of wiring diagrams after shipment. If the equipment to be supplied varies from the specification requirements, the supplier shall make clearly identify such variations in its letter of drawing transmittal.

3.03 REPAIR PARTS BULLETINS

A. The manufacturer shall supply repair parts bulletins which shall include instructions for making adjustments in the equipment and lubrication instructions.

3.04 PROOF OF RELIABILITY

A. The manufacturer shall provide evidence that it has had similar equipment in successful operation for a period of at least five years prior to the date of the placing of the Contract.

PART 4 METHOD OF MEASUREMENT

4.01 No separate measurement will be made for items required by this section.

PART 5 BASIS OF PAYMENT

5.01 No separate payment will be made for items required by this section.

Payment will be made under:

CDF Control Facility – per lump sum

END OF SECTION

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MSCAA
DESIGN GUIDE and CONSTRUCTION STANDARDS

INDEX

Airfield Construction Standards

A. Joints and Joint Sealants

1. All joints to be beveled on new construction and reseal projects.
2. All concrete joint sealants to be a non-sag silicone or preformed material. Silicone is preferred on reseal projects.

B. Sodded Areas

1. All safety areas are to be 100% sod.
2. All areas that have had earth disturbed shall be sodded and fertilized.
3. Any sodded area within 2’ of an apron, pad or drainage structure shall be compacted to a minimum of 95% (Modified Proctor).

C. Drainage

1. Concrete down drains should be installed on any area that is sloped for drainage.
2. Any drain pipes that travel outside the SIDA fence should have proper security grates installed.
3. Outlets should have a run off pad; concrete if preferred but asphalt is acceptable for aprons or run-off pads.
4. The sub-base for concrete down drains, drain inlets or outlets should be compacted to a minimum of 95% (Modified Proctor).
5. All drain and under drain joints or connections should be properly grouted or sealed. All drain inlets and manholes boxes entries shall be properly grouted or sealed inside and outside junction structure.

D. Concrete Aprons

1. All sign bases, junction boxes and manholes on new construction are to have a minimum of a 6 ft. apron around the sign or structure, sloped away from the sign or structure.
2. Aprons should have a minimum thickness of 4”.
3. Aprons should be flush with the structure bases and sloped to be flush with soil. The slope shall not exceed the FAA maximum.
4. The sub bases should be compacted for the structure bases and aprons to a minimum of 95% (Modified Proctor).

E. Perimeter Fence

1. Perimeter fence shall be a minimum of 10’ tall fabric and shall include three-stand, double-sided barbed wire and 18” diameter concentric razor wire secured at 12” spacing.
2. Perimeter fence shall include a 6' paved lane under the fence. This will eliminate washouts, animal intrusions, reduce maintenance, and allow easy inspections by Airport Police.
3. Rolling, automatic gate operators shall be commercially/industrially rated and designed for high-security environments. Operators for gates with openings less than 15 feet must

operate at a minimum speed of 20” per second. Operators for gates with openings 15 feet or wider must include variable frequency drives and operate at a minimum speed of 36” per second.

F. Construction Contractors

1. The Contractor shall maintain all sodded areas through the duration of the contract. The Contractor shall be responsible for the upkeep of contracted areas including grass cutting, rut repair and maintaining proper drainage ditches.
2. Security grates that are installed must be maintained and in good working order by the contractor for the duration of the contract.
3. All areas that were used by the contractor must be left in conditions that will not hinder the normal routine maintenance of Airfield; this includes, but is not limited to debris removal, grading, drainage, and re-seeding or sod.

Airfield Electrical Construction Standards

A. General

1. Work performed shall be accomplished by crews with a minimum of one licensed journeyman per three apprentices.
2. All temporary cable installations shall be protected either by burying cable in grass areas or by installation in conduit for above ground applications. Other methods may be used for short term or emergency situations if approved by the Airfield Maintenance Electrical Supervisor. Location of temporary cables shall be marked sufficiently to prevent damage from construction and maintenance equipment.
3. In all circumstances enough cable shall be provided at light cans, junction cans and hand holes so as to allow a minimum of 3 feet extending above ground for maintenance purposes. The exception to this is in the installation of taxiway centerline lights on SMGCS routes where two interleaved circuits are present in the same light can. In this instance only the circuit that is attached to the transformer in an individual light can, should have the extra conductor provided. This prevents the can from becoming cluttered unnecessarily.
4. Constant current series circuits shall be limited in capacity to a maximum of 20kW. Preferred capacity is 15kW or less.

B. Testing

1. The contractor shall furnish all necessary equipment and appliances for testing the underground cable circuits after installation.
2. The contractor shall demonstrate that all lighting power and control circuits are continuous and free from short circuits and unspecified grounds.
3. The insulation resistance to ground of all non-grounded series circuits shall be not less than 500 MΩ and shall be maintained at the required level by the contractor during the term of the warranty period.
4. Each new series circuit, or new part of existing circuits being extended or replaced, shall be tested as follows:
    i. Low voltage megger tests shall be performed to comply with (c.) above. Circuits shall then be subjected to a Hi-Pot test in accordance with engineer's specifications.
5. All new fixture installations may, at the owner's request, be subjected to photometric testing to certify performance in accordance with FAA specifications.

C. Constant Current Regulators

1. The constant current regulators shall be magnetic designs; the susceptibility to extraneous signals of solid-state designs is not acceptable. The regulators shall not have solid-state controls in the series circuit and shall be designed to prohibit radio communications interference. The regulators shall limit transient current peaks without the use of solid-state series circuit controls with soft-on feature.
2. Each regulator shall include a true RMS ammeter, and ON/OFF/REMOTE switch and brightness controls.

3. In addition, the regulators shall be provided with SPDT contacts rated 2 amperes at 120 volts to indicate the following functions for remote monitoring:
4. REMOTE/LOCAL selected at control switch. Primary Power ON.
5. Constant current regulators, including standby regulators furnished or installed by the contractor shall be provided with seismic restraints and include all necessary equipment including control and monitoring equipment (Crouse-Hinds/Transtech digitrac units) to make the regulators operational.

D. Marking and Labeling

1. Wire identification. The contractor shall furnish and install self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks.
2. Series circuit cables shall be identified with Thomas and Betts ty-rap #TY546MT or approved equivalent suitable for wet environments. Metal tags secured by tie wire or other means shall not be acceptable. All marking means shall be approved by the Airfield Maintenance Electrical Supervisor.
3. All conductors of series circuit conductors shall be marked with their circuit designation at all points where the conductor is accessible.
4. The contractor shall furnish and install engraved plastic labels on the cases of regulators, breakers, and distribution and control relay cases. All circuit breakers or other disconnecting means shall be marked and identified with their circuit designation.
5. Fiber optic runs should include #10 THWN stranded yellow tracer wire for locating purposes and connected in its entirety as a continuous conductor. Alternatively, armored fiber optic cables will be considered in lieu of tracer wire.
6. Underground electrical warning tape shall be installed above all underground conduit installations not concrete encased in unpaved areas. Warning tape shall be located as shown on the plans above the counterpoise wire.

E. Lighting Cans, Junction Cans, Junction Can Plazas and Hand Holes

1. Except in extreme cases where other means are not practical, manholes or hand holes larger than 4 feet x 4 feet x 4 feet deep shall not be used.
2. Hand holes shall be equipped with spring loaded/assisted hinged covers of a design easily opened by one person.
3. The preferred method of connectivity shall be by use of junction can plazas consisting of FAA L-868 cans installed in concrete plazas. Each can shall contain a single circuit with the designation of the circuit imprinted in a brass marker embedded in the concrete adjacent to the can. If deemed necessary, and at the approval of the Airfield Maintenance Electrical Supervisor, more than one circuit may be installed in a conduit/can. Can lids should be flush with concrete plazas with dam rings on the cans.
4. All ducts installed under paved areas shall be encased in concrete.
5. All unused conduits shall have the open ends plugged with removable tapered plugs and be provided with a pull rope equivalent to IDEAL Power-Fish pull line (200 lb strength)

6. Drain lines shall be installed to provide positive drainage to eliminate standing water in airfield lighting bases, junction cans, and hand holes in locations determined by the designer.
7. L-868 cans used for the installation of in-pavement lights shall be of a two-piece design with the top section including a multi-hole ring (VEGA #2419MEM) as manufactured by Jaquith Industries.
8. Fixture hold down bolts shall be all-thread stainless steel, type 304 or as recommended by the fixture manufacturer.
9. Fixture hold down bolts for in-pavement lights shall be tightened to the proper torque per fixture manufacture's specifications. All bolt holes shall be cleaned using a source of compressed air prior to installation of any bolts. Threads on all bolts shall be coated with anti-seize compound approved for use on stainless steel. Bolts shall not extend past the threaded adapter ring or into the can. Final tightening of the bolts shall be done using a properly calibrated torque wrench of the required range and verified by the engineer. Electrically or pneumatically operated wrenches shall not be used to achieve the final torque on bolts.
10. Lock washers installed on hold down bolts for all fixtures shall be two piece 316 or 316L stainless steel washer. CRC type washers shall not be acceptable.
11. All cans shall have factory-installed hubs. Grommet cans are **not** acceptable unless approved for the application by the Airfield Maintenance Electrical Supervisor. Stub-in connections into existing light bases shall be Meyers hub installation.

F. Connectors

1. L-823 connectors used to splice L-824 type C #8 AWG cables shall be Elastimold style *54*-D4-D4 or equivalent. L-823 connectors shall be made waterproof by a double layer of rubber tape (scotch 23 or equal) covered by a double layer of plastic tape (scotch 88 or equal). Heat shrink, is not allowable. One-piece shrink kits that encapsulate the entire splice shall not be used. Provide Scotch 23/Scotch 88 waterproofing at center connection to extend 1-1/2" each side of break and at each end of splice kit.

G. Fixtures

1. Runway and taxiway elevated light fixtures shall use a quartz bi-pin type lamp of the minimum wattage required for the application unless LED fixtures are approved by Airfield Maintenance Electrical Supervisor.
2. In-pavement fixtures should be manufactured of aluminum and utilize no more than two lamps with a maximum total wattage of 100 watts per fixture. L-850C edge lights and fixtures used for stop bars and runway guard lights may exceed this wattage, however.

H. Signs

1. Signs should be re-lampable without the use of tools.
2. Concrete foundations for signs shall contain separate housings for transformers. Transformers shall not be housed under a leg of the sign or any portion of the sign. Sign power should be fed through the sign leg.

3. Where practical, signs should be style 5, size 3, and be installed on a dedicated circuit.
4. All signs installed on the airfield should be marked on each end with 4” vinyl reflective labels with the sign’s designation as shown on the plans.

Facilities Construction Standards

A. General

1. All work shall comply with the applicable construction codes and MSCAA standards. The contractor shall be responsible for construction code permits and shall arrange for all code required inspections. Copies of permits shall be supplied to the Manager of Building Maintenance.
2. Utilities will not be interrupted without prior coordination and approval from the MSCAA Building Maintenance Manager, telephone number (901) 922-8615 or the Maintenance Service Desk at (901) 922-8040. Approval is required for each and every interruption. A minimum of a 24-hour notice is required for utility interruptions.
3. All salvaged equipment shall be returned to MSCAA at their designated location for their use or disposed of off-site as directed by MSCAA.
4. Asbestos Containing Materials (ACMs) are specifically prohibited without specific written approval from MSCAA. Any installation of ACMs without prior written approval must be removed immediately by the installer in accord with local ACM removal regulations.

B. Penetrations

1. All concrete floor and roof penetrations must be accomplished by core drilling. Use of rotary hammer or other impact tools for this purpose is prohibited. Core drilling efforts must be coordinated with tenants occupying space below the cored floor slab. The contractor will be responsible for any damage resulting from core drilling.
2. Sealing of new and pre-existing floor penetrations must be filled full depth with hydraulic cement and sealed with epoxy or polyurethane caulk as noted under the Preferred Brands heading (pages 17 & 18). The installation shall be inspected by the MSCAA Development Division. Contractor shall coordinate with MSCAA Development Division for any x-ray or ultra-sound requirements for concrete floor/roof penetrations. No drilling through concrete beams unless approved by Development.
3. When drilling or core drilling through floors, walls, ceilings etc., the contractor is responsible for inspecting for electrical, plumbing, etc and is fully responsible for all repairs to anything damaged.
4. No drilling or ramset fastening is allowed in pan sections of the concrete structure. Any attachments installed above the ceiling will be suspended from the joist structure only.
5. No holes shall be drilled and no anchors shall be attached to the glazed brick, glazed wall tiles, or metal wall panels. Attachments shall be anchored in the mortar joints exclusively.
6. Penetrations through the roof are typically prohibited. When unavoidable, roof penetrations shall be coordinated with MSCAA and will be the responsibility of the contractor to restore the roof to such a condition as not to invalidate the roof warranty.
7. Hydraulic cement and core drill sealant shall be installed full depth. After curing, epoxy or polyurethane caulk shall be applied at the bottom of the plug and polyurethane caulk shall be applied at the top surface.

C. Signage

1. Signage shall comply with the standards established by MSCAA and final approval shall be the responsibility of MSCAA Development Division.

D. Electrical

1. Fiber optic runs should include #10 THWN stranded yellow tracer wire for locating purposes and connected in its entirety as a continuous conductor. Alternatively, armored fiber optic cables will be considered in lieu of tracer wire.
2. All electrical conductors will be installed in conduit and use of flex conduit is limited to runs of 6 feet or less. Conduit couplings and connectors utilizing setscrew fasteners are prohibited. Conduit shall be concealed from public view wherever possible. All conduits and electrical raceways shall contain an equipment grounding conductor.
3. All electrical conductors #14 AWG & larger shall be stranded copper wire unless otherwise approved in writing by MSCAA.
4. All emergency devices including emergency lights, exit lights, etc., shall be connected to emergency circuits. MSCAA does not allow battery packs.
5. MSCAA does not allow Bodine ballasts in fluorescent lighting fixtures. LED is preferred in all lay-in fixtures. Prior approval by Development must be received for use of fluorescent lay-in fixtures and the lamps shall be T8.
6. All use of cable trays is subject to MSCAA review and approval. Conduit installation must be independently supported and shall not be strapped to cable trays or any of the cable trays' support systems, including hangers and braces.
7. All equipment shall meet the appropriate UL listing for its intended purpose.
8. 23-kV rated cable shall conform to MLG&W standards. This requires cable having an aluminum or copper conductor, extruded conductor shield, ethylene propylene rubber insulation, extruded semi-conducting insulation shield, copper concentric neutral, and polyethylene jacket. The cable shall be suitable for direct burial, conduit/duct and aerial installations. All designers should re-verify MLG&W standards prior to publication of construction documents.

E. Mechanical

1. The use of flex duct shall not exceed more than four (4) feet and banded with metal straps, no tape. Use of flex duct other than at the end of a line or connected to air diffusers must be approved by MSCAA.
2. Controls for the HVAC system shall be open architecture and compatible with the JCI Metasys Extended Architecture System.
3. VAV Boxes shall be pressure dependent, electronic controls with no auxiliary fan or local filter.
4. A copy of the test and balance report shall be submitted to MSCAA Development. An independent contractor shall perform the testing and complete the report.
5. The contractor shall align all motors to the associated pump, gearbox, fan, etc. MSCAA Development and Maintenance shall inspect alignment prior to acceptance. Maximum

allowable angular and parallel misalignment is 0.003.

6. Heat trace cables shall have indicator lights installed in a visible location that illuminate when the cables are in operation.
7. UV lighting in HVAC and HEPA (MERV-14 Rating) filtration systems.

F. Plumbing

1. Brass ball valves shall be installed at the water supply point of origin and in the ceiling directly above any newly installed plumbing fixture where a utility chase wall is not present. If a walk-in utility chase exists, then ball valves shall be installed in the accessible chase no more than five (5) feet above finished floor. There shall be no more than 4 plumbing fixtures on one ball valve. Brass valve tags shall be placed on all newly installed valves clearly identifying the origin and destination.

G. Fire Alarm and Suppression Systems

1. The fire suppression system shall interface with the airport's Simplex Fire Alarm System.
2. All dry sprinkler pipe and fittings must be galvanized. All grooves in piping shall be the correct depth per industry standards.
3. See section Facilities Construction Standards – Construction Contractors for additional requirements.

H. Antennae

1. All work shall comply with the applicable construction codes and MSCAA standards.
2. No antenna is permitted on the roof; it must be installed within the infrastructure on one of the antenna farms or roof mounted antenna racks or in very limited cases with prior approval parapet mounted. Proposed antenna locations must be approved by MSCAA Development.
3. Cables are not allowed on the roof or to run bare down a wall. A conduit from the parapet location down the wall with an LB connector into the wall below the spandrel beam is required. Parapet mount must be properly sealed to prevent leaks through the concrete. Any wall penetrations must also be sealed. Cables from antennas mounted on racks must utilize the conduit pathway at the rack location.
4. Cables above the ceiling must be independently supported from the roof structure and run by a licensed low voltage contractor, or a licensed electrical contractor, in accordance with applicable codes.
5. Installer shall be responsible for construction code permits and shall arrange for all code required inspections. Copies of permits shall be supplied to the Manager of Building Maintenance.
6. MSCAA Maintenance will not provide the escort for antenna work; either installer or Operator must be badged or tenant will have to escort antenna personnel.

I. Miscellaneous

1. Relocation and/or removal of any security device including CCTV cameras, access control

equipment, etc. must be approved by MSCAA Development.

2. Non-shrink grout shall be used with all tile work, up to four (4) feet in height, laid on top of an approved waterproofing membrane.
3. All 12" X 12" ceiling tile shall be installed with the arrow on the back of the tile pointing south.
4. All flammable gas and liquid systems that are piped into buildings shall be properly equipped with seismic shutoff valves. Seismic shutoff valves shall be designed and installed to comply with all governing code requirements, insurance requirements, and MSCAA Construction Standard requirements. In the case of conflict between the listed requirements, the most stringent shall apply.
5. For in-pavement loop installations, loop wire must meet IMSA Spec 51-7. Lead-in wire, if needed, must meet IMSA Spec 50-2. Loop wire shall be one continuous length with no splices from the junction box or control cabinet and back again. The wire shall be twisted by hand four twists per foot in the lead-in slot. Loops must be cut in a rectangular shape, with each 90 degree corner transected with a 45 degree cut to prevent over bending/stressing of the loop wire. Loop saw cuts should be ¼" to 3/8" wide and a minimum of 1½" deep in concrete and 2" deep in asphalt. Loop Lead-in saw cuts should be 3/8" wide and a minimum of 1½" deep in concrete and 2" deep in asphalt. Properly seal the saw cuts with Dow Corning 890 SL self-leveling sealant.
6. The terrazzo floor shall be protected during construction. The removal, cutting, disfigurement or covering of the Terrazzo floor shall be reviewed and approved by MSCAA Development.
7. Only black steel pipe is permitted for use on systems containing diesel fuel, including tank vent stack piping, tank fill piping, and tank drain piping. No other material, including galvanized pipe, is allowed.
8. 90^{o} brushed stainless steel corner protectors shall be installed on all new interior wall construction. The protectors shall be type 304 grade stainless, 22 gauge, 44" tall, 1.5" wings with a 3/8" wall grip edge, and a 1" radius at the top. Protectors shall be installed on top of the cove base and be adhered to the wall with F-26 construction adhesive.
9. Fire rated solid wood blocking that extends from wall stud to wall stud shall be installed for support of framed openings, wall mounted cabinets, wall mounted door hardware, wall mounted monitors, plumbing fixtures, toilet partitions, toilet accessories, mirrors, etc. on all new construction walls or remodels, excluding brick or block walls.
10. All fryers in kitchens must include automated in-line used cooking oil containment systems for proper collection and disposal. Tenants will be responsible for installation, maintenance, and used cooking oil recycling.

J. Construction Contractors

1. Electrical work performed shall be accomplished by crews with a minimum of one licensed journeyman per three apprentices.
2. The Contractor shall be responsible for maintaining a clean construction site and any space used for the removal of debris. The contractor shall be responsible for repair of any damage

caused by construction to as good or better condition.

3. If directed by Development the Contractor shall erect a temporary wall around the construction site. All temporary walls shall be constructed of metal studs; anchored on bottom with double stick tape and anchored to the roof deck on top (attachment to ceiling tiles or grid is prohibited). The outside (public side) of the wall shall be finished floor to ceiling with 5/8" drywall with 2 coats of flat off white latex paint. The bottom of the wall shall be trimmed with 4" black cove base. A 2"x6" chair rail, blocked 2" off the wall, shall be installed 36" to center above finished floor. The chair rail shall be sanded and painted with two coats of bronze paint (PPG Pitt-Tech Acrylic High Gloss DTM Industrial Enamel – Bronze Tone). The Contractor shall retain responsibility during construction to maintain the wall for aesthetic and security issues. MSCAA Development Division shall approve its location, any attachments to terrazzo floors and all signage and/or graphics. For short durations and in areas of limited public visibility, temporary walls may consist of metal studs and BC grade plywood with a high build primer and premium latex paint; use of these materials is allowed only with specific approval from MSCAA Development Division.
4. Walk-off mats shall be used at all access points to the construction area to prevent tracking of dust and debris and is responsible for cleanup if any dirt, dust and/or debris gets outside their construction limits.
5. When accessible to the public, the schedule of construction efforts and removal of debris shall be coordinated so as not to disrupt other tenants or endanger the safety of the public. Final approval shall be the responsibility of MSCAA Development Division. Unless directed otherwise, working at MEM requires a badge; coordinate with MSCAA Operations Division for specific project requirements. For badging information, the Identification Office telephone number is (901) 922-8005.
6. The contractor shall inform MSCAA Development Division, telephone number (901) 922-8033 at least 48 hours prior to startup of construction.
7. A set of completed as-built drawings shall be supplied to Development upon completion of the project.
8. Fire Alarm System – the Contractor shall contact Simplex to verify that the designer worked with Simplex during the design. If design is the responsibility of the Contractor, Contractor shall contact Simplex to design the installation.
9. A pre-test of the modifications to the fire alarm system shall be conducted with Simplex and the Contractor. This pre-test must be scheduled and successfully completed at least 24 hours in advance of any test with the Memphis Fire Department. MSCAA's Development Maintenance and Communications will participate in the pre-test, so close coordination is required. A minimum of 72 hours advanced notification is required to both Simplex and MSCAA to schedule the pre-test. The pre-test must be performed after hours. Upon completion of the pre-test, Simplex will provide written confirmation of the successful completion of the pre-test, a copy of which is to be provided to the MFD fire marshal, and a copy is to be provided to MSCAA.
10. The test with the Memphis Fire Department for occupancy must be performed after hours and closely coordinated with MSCAA Development, Maintenance and t Communications. Provide MSCAA a copy of any documentation from MFD, including deficiencies noted

with the fire system, or approval of the system.

Painting Standards

A. Airfield

1. Airfield painting shall comply with the latest revision of the P-620 specification. Thermoplastic markings are not acceptable.

B. Roads

1. Road painting shall comply with the latest revision of the TT-P-1952 specification. Thermoplastic markings are not acceptable.

C. Paint Vendors

1. This vendor list is provided for reference only in regards to the specific products listed in the following paragraphs. The list is not exhaustive or exclusive as equivalent vendors will be considered by MSCAA Paint Shop.
2. PPG Architectural Finishes, Inc. (1525 Three Place, Memphis, TN, 38116)
3. Sherwin-Williams (3850 Lamar Avenue, Suite 1, Memphis, TN)
4. Farrell-Calhoun (3185 Millbranch Avenue, Memphis, TN)

D. Terminal, Concourses, and South Parking Garage

1. Exterior White Fasciae, Cargo Docks, Ramp, Walls, and Columns
   i. Sherwin-Williams Universal Primer (or equivalent)
   ii. PPG Pitt-Tech Acrylic Satin – White
   iii. Sherwin-Williams A-100 Acrylic Satin – White
2. Exterior CMU Walls
   i. Block Filler
   ii. PPG Pitt-Tech Acrylic Satin – White
   iii. Sherwin-Williams A-100 Acrylic Satin – White
3. Interior Walls
   i. Sherwin-Williams B31W4400 Promar 400 Interior Latex Semi-Gloss – White
   ii. Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House
   iii. Offices (including Airport Police, most of Building Maintenance, and Cargo Building Offices): Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House
   iv. Offices (Mezzanine & Apron level concourse B): Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Snowglory
   v. Gypsum Ceilings/Walls: Pittsburgh Paints PPG 1006-1 Color: Gypsum Various Sheens
   vi. Aluminum Curtainwall: Valspar Sherwin Williams Fluorpon Special Color: Special White 391B495

4. Doors and Frames
   i. Brown Doors: Sherwin Williams Pro Industrial Acrylic Semi-Gloss – Kodiak Olive
   ii. Green Doors: Sherwin Williams Pro Industrial Acrylic Semi-Gloss – Blarney Stone
   iii. Brown Frames: Sherwin Williams Pro Industrial Acrylic Semi-Gloss – Bronze Tone
   iv. Grey Frames and doors: Farrell-Calhoun Interior Alkyd Enamel Semi-Gloss – Zen Retreat
   v. White Frames and doors (Concourse B): Farrell-Calhoun Interior Alkyd Enamel Semi-Gloss - Gypsum
5. Window Bases
   i. Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House
6. Exterior Metal Structures
   i. Alkyd Industrial Gloss Enamel – White
   ii. Alkyd Industrial Gloss Enamel – Farrell Calhoun Zen Retreat
7. Interior Metal Structure (Concourse B)
   a. PT-2 Valspar Super Special White
8. Rotunda Columns (located in the "Y" of the B Concourse)
   a. PT-2 Valspar Super Special White
9. ID Office
   i. Walls: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Carriage House
   ii. Doors and Frames: match Terminal & Concourses doors and frames
10. Management Work Room
   i. Walls: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Carriage House
   ii. Doors and Frames: match Terminal & Concourses doors and frames
11. FIS
   i. Walls: Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House
   ii. Doors: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-475 – Quick Silver
   iii. Frames: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-709/05 – Dark Silver
12. Painted Floors (Building Maintenance areas)
   i. Farrell-Calhoun Floor and Deck Enamel 702 – Medium Gray

E. Administration Building

1. Walls
   i. Ceilings: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Zurich White

ii. Walls: Farrell-Calhoun Interior Premium Eggshell Latex Enamel 370 – Carriage House

2. Interior Doors and Frames

i. Sherwin-Williams Semi-Gloss Oil Base 1019 – Grey Statue

F. Airfield Maintenance Building

1. Walls

i. Walls: Farrell-Calhoun Acrylic Interior Semi-Gloss Latex Enamel 650 – Carriage House

2. Doors and Frames

i. Doors: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-475 – Quick Silver

ii. Frames: PPG Pitt-Tech Acrylic Satin DTM Industrial Enamel 90-709/05 – Dark Silver

G. Miscellaneous

1. De-Ice Tanks

i. Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – White

2. Exterior Light, Sign Pole, Sign Bases, and Bollards

i. PPG Alkyd Industrial Enamel Gloss Z-Line – Bronze Tone

3. Ticket Spitters and Bollards

i. Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – Safety Zone Yellow

4. Colored Metal Surfaces

i. Red: Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – International Red

ii. Orange: Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – International Orange

iii. Yellow: Farrell-Calhoun Premium Alkyd Industrial Gloss Enamel 800 – Safety Zone Yellow

Preferred Equipment

A. Architectural Finishes

1. Flooring: VCT – Armstrong
2. Cove Base
    i. Terminal Building: Armstrong or Roppe
    ii. Administration Building: Johnsonite Rubber 700 Series; 4” high; #24 Grey Haze
    iii. Offices: Flexco Rubber wallflowers series; 4” high; #03 Charcoal
3. 4” Rubber Wall Base
    i. Manufacturer: Roppe
    ii. Color: 123 Charcoal
4. 3/8” Epoxy Terrazzo TZ-3
    i. Manufacturer: Key Resin
    ii. Color: KEY 100-1779 Gull Wing Grey
    iii. Location: Concourse B
5. 3/8” Epoxy Terrazzo TZ-1
    i. Manufacturer: Key Resin
    ii. Color: KEY 001-563 White Diamond
    iii. Location: Concourse B
6. 3/8” Epoxy Terrazzo TZ-2
    i. Manufacturer: Key Resin
    ii. Color: Key 28-27 Hearthstone
    iii. Location: Concourse B
7. 3/8” Epoxy Terrazzo TZ-4
    i. Manufacturer: Key Resin
    ii. Color: KEY 100-675 Pewter
    iii. Location: Concourse B
8. 3/8” Epoxy Terrazzo TZ-5
    i. Manufacturer: Key Resin
    ii. Color: KEY 100-2018 Whale Gray
    iii. Location: Concourse B
9. 3/8” Epoxy Terrazzo TZ-6
    i. Manufacturer: Key Resin

ii. Color: KEY 001-563 White Diamond
iii. Location: Concourse B

10. 3/8” Epoxy Terrazzo TZ-7
    i. Manufacturer: Key Resin
    ii. Color: KEY 001-754 Whiteish
    iii. Location: Concourse A, B, & C Terminals
11. 3/8” Epoxy Terrazzo TZ-8
    i. Manufacturer: Key Resin
    ii. Color: KEY 012 Black
    iii. Location: Concourse B
12. 3/8” Epoxy Terrazzo TZ-9
    i. Manufacturer: Key Resin
    ii. Color: KEY 001-753 White Glass
    iii. Location: Concourse B
13. Accent Wall Tile T-1A
    i. Manufacturer: Fireclay
    ii. Product: Glazed Wall Tile White Clay Body (3”X12”)
    iii. Color: White Wash (V1)
    iv. Grout Color: Laticrete #89 Smoke Grey
    v. Location: Concourse B
14. Accent Wall Tile T-1B
    i. Manufacturer: Fireclay
    ii. Product: Glazed Wall Tile White Clay Body (3”X12”)
    iii. Color: Foggy Morning
    iv. Grout Color: Laticrete #89 Smoke Grey
    v. Location: Concourse B
15. Accent Wall Tile T-1C
    i. Manufacturer: Fireclay
    ii. Product: Glazed Wall Tile White Clay Body (3”X12”)
    iii. Color: Powder Blue
    iv. Grout Color: Laticrete #89 Smoke Grey
    v. Location: Concourse B
16. Accent Wall Tile T-1D

i. Manufacturer: Fireclay
ii. Product: Glazed Wall Tile White Clay Body (3”X12”)
iii. Color: Mayan Blue
iv. Grout Color: Laticrete #89 Smoke Grey
v. Location: Concourse B

17. Accent Wall Tile T-1E
    i. Manufacturer: Fireclay
    ii. Product: Glazed Wall Tile White Clay Body (3”X12”)
    iii. Color: Martinique
    iv. Grout Color: Laticrete #89 Smoke Grey
    v. Location: Concourse B
18. Porcelain Tile T-2 (restroom Floor)
    i. Manufacturer: Casalgrande Padana
    ii. Product: Balsaltina 18”X18” Naturale Finish
    iii. Color: Linosa
    iv. Grout Color: Laticrete #45 Raven
    v. Location: Concourse B
19. Ceiling Tile
    i. Armstrong 2’ x 2’, Cortega Angled Tegular 704A (2’ x 2’ x 5/8”)
    ii. Armstrong 2’ x 2’, Fissured Square Lay-in 756A (2’ x 2’ x 5/8”)
    iii. Armstrong 2’ x 4’, Cortega Second Look 2765 (2’ x 4’ x ¾”)
    iv. Armstrong 44”X 48”, Optima Techzone
    v. Armstrong 2’ X 2’, Ultima
20. Ceiling Grid: Armstrong Prelude
    i. Mains: 7300
    ii. 4’ Ts: XL7348
    iii. 2’ Ts: XL7328
    iv. Wall mold: 7800
21. Ceiling Grid: Armstrong Suprafine XL
    i. Location: Concourse B
22. Ceiling Metal Panel:
    i. Accent Ceilings & Walls
    ii. Perforated Aluminum Acoustic Backing Torsion Spring Hinged Pans

iii. Color: Ultra White

iv. Location: Concourse B

23. Ceiling Linear Metal

i. Accent Ceilings & Walls

ii. Pattern: Barcode

iii. Color: 8424 Walnut

iv. Location: Concourse B

24. Carpet (Hold Rooms)

i. Style Name: Resonance

ii. Style Number: J0118

iii. Color: 00406 Saddle

iv. Vendor: Continental Flooring (800-825-1221 Ext 206)

v. The pattern for the carpet is to run perpendicular to the concourse for hold room installations.

25. Carpet (Offices)

i. Style Name: Live Wire

ii. Style Number: 54733

iii. Color: 33506 Animated

iv. Vendor: Continental Flooring (800-825-1221 Ext 206)

26. Carpet (MEM Executive Offices)

i. Style Name: Ripple Effect

ii. Style Number: J0116

iii. Color: 00501 Laughs & Yawns

iv. Vendor: Continental Flooring (800-825-1221 Ext 206)

27. Carpet CPT-1 (Concourse B)

i. Manufacturer: Interface

ii. Product: Custom Soundwave Verse Sample

iii. No: 265317-005

28. Carpet Tile CPT-1A (Concourse B)

i. Manufacturer: Interface

ii. Product: Custom Groundwaves Verse Samples

iii. No: 265317-008

29. Carpet Tile CPT-1B (Concourse B)

i. Manufacturer: Interface
ii. Product: Custom Off Line Sample
iii. No: 265317-007

30. Carpet Tile CPT-1 (Concourse B)
    i. Manufacturer: Interface
    ii. Product: Custom Off Line Sample
    iii. No: 265317-002
31. Carpet Tile CPT-1D (Concourse B)
    i. Manufacturer: Interface
    ii. Product: Custom SL910 Sample
    iii. No: 265317-013
32. Wood Paneling (Concourse B)
    i. Strait Grain
    ii. Species: White Oak
    iii. Color: Custom
33. Quartz QZ-1 (Concourse B)
    i. Manufacturer: Silestone
    ii. Color: Blanco Maple
34. Quartz QZ-2 (Concourse B)
    i. Manufacturer: Silestone
    ii. Color: Cemento Spa. Polished Finish
35. Quartz QZ-3 (Concourse B)
    i. Manufacturer: Cambria
    ii. Color: Berwyn
36. Quartz QZ-4 (Concourse B)
    i. Manufacturer: Cambria
    ii. Color: Whitehall
37. Quartz QZ-5 (Concourse B)
    i. Manufacturer: Silestone
    ii. Color: Cemento Spa. Polished Finish
38. Quartz QZ-6 (Concourse B)
    i. Manufacturer: Silestone
    ii. Color: Whitehall

39. Quartz QZ-7 (Concourse B)
    i. Manufacturer: Silestone
    ii. Color: Whitehall
40. Curtain Wall (Concourse B)
    i. Manufacturer: Kawneer
    ii. Product: 1600 System 2
    iii. Color: Interior Valspar Super Special White / Exterior Clear Anodized
41. Epoxy Flooring (Concourse B)
    i. Manufacturer: BASF Building Systems
    ii. Product: BASF Masterdeal 2500 LT Duty
    iii. Color: Gray
42. Epoxy Flooring (Concourse B)
    i. Manufacturer: Dex-O-Tex
    ii. Product: Color Flake L
    iii. Color: BX 520
43. Exterior Aluminum Composite Metal Paneling (Concourse B)
    i. Manufacturer: Alucobond
    ii. Product: Alucobond Plus – fire rated core
    iii. Colors:
        1. Type 1: Titanium Metallic II
        2. Type 3A: Southwest Gold Metallic
        3. Type 3B: Harvest Gold Mica
        4. Type 3C: Driftwood Mica

B. Plumbing & Restrooms

1. Flush valves: Sloan, Royal
2. Electronic flush valve retrofits:
    i. Urinals: Zurn ZRK-C-3.5, 3.5 GPF
    ii. Water Closets: Zurn ZRK-C-3.5, 3.5 GPF
3. Plumbing fixtures: Crane, American Standard, Kohler
4. Partitions: Accurate, Stainless Steel, No sight design, overhead braced, Continuous, Hinge type-Integral, Hinge In-swing/out-swing standard closed position, Floor mounted
5. Sinks: American Standard, 0355.012 Lucerne wall mounted Lav. sink w/4" centers

6. Service Sinks: 8” centers w/ ZURN Z841M1 Faucet
7. Urinals: 6501.010 wash brook urinal American Standard white. Zurn Retro Flush Valve.
8. Water Closets
    i. Wall-mounted: American Standard 2257.103 af wall toilet 4 bolt wall mount, white
    ii. Floor-mounted: Kohler K-4368
9. Lavatories
    i. Non-ADA: American Standard, vandal resistant lavatory faucet with grid drain 2385.130 polished chrome
    ii. ADA: Delta – 511-WFHDF
10. Faucets: Sloan Optima EBF-85M infrared
11. Water closet gaskets: Wade Part # M-8 for wall hung closets
12. Backflow devices: Watts
13. Water coolers: Halsey Taylor – model #HAC8FS-Q(SS) wall-mounted
14. Toilet Accessories: Bobrick
    i. Recessed towel dispenser and waste receptacle: B-3961
    ii. Surface mounted toilet tissue dispenser: B-2888
    iii. Sanitary napkin disposal: B-270
    iv. Heavy duty robe hook: B-2116
    v. Handicap tilt mirror: B-293 (24” x 36”)
    vi. Grab bars: stainless steel with Snap Flange
15. Toilet Accessories: Non-Bobrick
    i. Foam Dispenser – Spartan Chemical Company 975700
    ii. Toilet paper dispenser: Shoreline 830 from Memphis Chemical (not for use in public restrooms)
    iii. Toilet Seat Cover Cabinet: Franklin Brass #1988 (Stainless Steel)
16. Eye Wash Station: Bradley S19314F
17. Angle Stops: Brasscraft

C. Doors

1. Exterior: Steelcraft Door; 16 gauge metal, galvanized; fully reinforced for door closer and continuous gear hinge; with 24” x 32” window prep (if specified)
    a. Standard doors shall be 3.0’ x 7.0’.
    b. Jet Bridge doors shall be 4.0’ x 7.0’.
2. Interior: 3070 (3.0’ x 7.0’) solid core wooden door with prep for continuous gear hinge; with 24” x 32” window prep (if specified)

3. Window Kits (if specified): Anemostat #LOPRO Visionlite 24”x32” with Tempered Glass
4. Metal Frames: Fit door openings to frame for a Steelcraft door or solid core wooden door with fully reinforced frame for door closer and continuous gear hinge
5. Threshold: Aluminum to fit door frame
6. Drip Caps: 16 ad if outside door
7. Closers:
    a. Standard Doors: LCN model 4041, arm RW/ PA, finish to match existing areas adjustment size 1-6 PC 23
    b. Jet Bridge Doors: Dorma 1816HT Series with smoke detector
8. Hinges:
    a. New doors shall have reinforcement on the hinge side and hinges shall be continuous geared hinges by National Guard Products, Stanley, or PBB. Minimum 0.120-inch thick hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame. Fabricate hinges non-handed and to template screw locations. Continuous hinges guaranteed for the life of the opening.
        1. At electrified hardware locations provide electric transfer continuous hinges with a 12” removable hinge modification accessible without de-mounting door from the frame and Molex standardized plug connectors to accommodate up to 12 wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Preferred hardware is Von Duprin EPT10.
    b. Existing doors without reinforcement on the hinge side shall use hinges by Stanley FBB 179-4.5 x 4.5 x USP x NRP
9. Lock Prep: Yale 6-pin lockset-PB5407LN 694X497 Finish – US 10B
10. Keyways: 6-pin LFIC Cores with SA keyway
11. Panic Hardware: Dorma 9000 Series or Von Duprin RX QEL 98NL-F
12. Flush Bolts: Trimco, Burns, or Ives. Provide manual flush bolts with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be 8” in length and U.L. listed for labeled fire doors.
13. Low voltage door operators: Dorma ED900 Series or LCN 9000 Series

D. Electrical

1. Wire: THHN or equal for insulation
2. VFDs: PowerFlex 400 by Allen-Bradley including latest harmonic distortion units w/ Metasys board
3. High Voltage Substations: General Electrical, Cutler Hammer
4. Panels, breakers, and contactors: Westinghouse, ITE (Siemens), Square D, Allen Bradley,

Cutler Hammer

5. Devices: Leviton, Bryant, P&S, Hubbell
6. Device Covers: Stainless Steel
7. Lighting: G.E, Phillips, Sylvania, Lithonia
8. Fittings (no Set screws, couplings, or connectors): Raco, Steel City
9. Conduit/Wire: No MC or BX cable other than 6' or less to be used as whips from junction box to item being fed

E. Mechanical

1. Heaters: Trane, McQuay
2. Electronic Controls: Johnson Controls (FEC, NAE, BACnet MS/TP), Barber Coleman, Trane, McQuay
3. Valves, Hot/Chill Water: Johnson Controls, Barber Coleman, Honeywell
4. AHUs: Trane
5. Boilers: Cleaver Brooks
6. Chillers: Trane
7. Pumps: Peerless, Bell & Gossett, Aurora, Ingersoll Rand, Pyramid Pump, Grundfos
8. VAV Boxes (All VAVs shall be pressure dependent with electronic controls): Environmental Tech, Varitrane Systems, Tuttle & Bailey
9. Electronic Thermostats: TE-6700, BACnet MS/TP, N2, Johnson Control
10. Cooling Towers: Marley, BAC

F. Miscellaneous

1. Joint Seals and Floor Penetration Seals: Evazote 380 E. S. P. with Hindered Amine Light Stabilizer
2. Automatic Perimeter Fence Gate Operators: HySecurity

Memphis-Shelby County Airport Authority
COMPREHENSIVE STORM WATER POLLUTION PREVENTION PLAN

For Contractors Performing
Construction Activities at the
Memphis International Airport
Under Permits TNR10-0000 and TNR15-0091

Comprehensive Storm Water Pollution Prevention Plan

Prepared By:
Lori Morris, P.E.
Manager of Environmental Services, MSCAA

Version 4
August 2017

TABLE OF CONTENTS

Tables

Appendices

COMPREHENSIVE STORM WATER POLLUTION PREVENTION PLAN
CERTIFICATION PAGE

Name of Construction Project: All Construction Projects at Memphis International Airport (FY2017-FY2021)

Location of Facility: Memphis International Airport (MEM)
2491 Winchester Road, Suite 113
Memphis, Tennessee 38116-3856

MANAGEMENT CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared by me, or under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. As specified in Tennessee Code Annotated Section 39-16-702(a)(4), this declaration is made under penalty of perjury."

_____ _____

Signature: Mr. Terry Blue Date
Memphis-Shelby County Airport Authority
Vice-President, Operations

CONTRACTOR CERTIFICATION

"I certify under penalty of law that I have reviewed this document, any attachments, and the SWPPP referenced above. Based on my inquiry of the construction site owner/developer identified above and/or my inquiry of the person directly responsible for assembling this NOI and SWPPP, I believe the information submitted is accurate. I am aware that this NOI, if approved, makes the above-described construction activity subject to NPDES permit number TNR100000, and that certain of my activities on-site are thereby regulated. I am aware that there are significant penalties, including the possibility of fine and imprisonment for knowing violations, and for failure to comply with these permit requirements. As specified in Tennessee Code Annotated Section 39-16-702(a)(4), this declaration is made under penalty of perjury."

_____ _____

Signature Date

_____ _____

Printed Name Title

_____ _____

Company Name Phone Number

_____

Company Address

1.0 INTRODUCTION

The State of Tennessee Department of Environment and Conservation (TDEC) has authorized the discharges of storm water from all construction sites at the Memphis International Airport (MEM) under the Tennessee General Permit Number TNR10-0000 and the MEM Permit Tracking Number TNR15-0091, provided that the permit provisions are adhered to and the State of Tennessee (the State) receives formal application 30 days before groundbreaking from the parties responsible for a construction project at MEM. Under TNR10-0000 and TNR15-0091, both the Memphis-Shelby County Airport Authority (MSCAA) and the contractors performing the construction activities are responsible for complying with the permits. MSCAA has developed this Comprehensive Storm Water Pollution Prevention Plan (SWPPP) to assist contractors in complying with the provisions of TNR10-0000 and TNR15-0091 and to coordinate the compliance responsibilities of the contractors and subcontractors engaged in construction activities on properties owned or managed by MSCAA.

MSCAA originally obtained permit coverage and prepared a SWPPP under TNR10-0000 in 2001. On June 16, 2005, MSCAA obtained coverage under a new general permit and prepared a revised SWPPP (Version 2) dated June 2006. On May 24, 2011, MSCAA obtained coverage under a new general permit and prepared a revised SWPPP (Version 3) dated November 2011. On October 1, 2016, MSCAA received automatic coverage under the new general permit and has prepared this revised SWPPP (Version 4) dated February 2017. This SWPPP must be updated no later than 12 months following any new permit effective date.

1.1 Construction Activities at MEM

MEM is an onshore air transportation facility located in the south-central area of the City of Memphis, Tennessee. Construction of taxiways, runways, parking areas, and terminals is ongoing. MEM is a full-scale air transportation facility with tenants that provide commercial passenger and freight service, aircraft maintenance, fueling, de-icing, storage for private aircraft, and executive flight services.

Of the 4,800 acres at MEM, up to 300 acres are expected to be disturbed by construction during the term of this permit. A significant portion of the construction will take place on currently impervious airport facilities being retrofitted. However, a net loss of pervious area at the airport is expected over the next 5 years.

1.2 Areas Covered Under TNR15-0091

Construction projects covered under this permit include, but are not limited to, Concourse B Modernization, CONRAC facility construction, Centralized Deicing Pad construction, and Airfield Maintenance Building Construction that are underway. Equipment staging areas, materials storage areas, excavated materials holding and/or disposal areas and borrow areas are also covered, and are subject to all of the provisions of TNR15-0091, whether the areas are contiguous to the main construction area or at remote locations. These areas, the activities to be conducted in these areas, and the storm water pollution control measures to be implemented must be incorporated into the site-specific Erosion Prevention and Sediment Control Plan (EPSCP). When one or more of these areas are operated by and/or utilized by more than one contractor, the pollution control provisions for that area shall be coordinated so the effectiveness of the pollution control provisions are not compromised.

The following figures are incorporated as Appendix A of this SWPPP to adequately address the areas and projects covered under TNR15-0091. Both MSCAA construction projects and tenant construction projects are included.

- The first map in Appendix A is the *MEM Storm Drainage* map that shows storm drainage basins, outfalls, storm drainage features, tenants, and industrial National Pollutant Discharge Elimination System (NPDES) permit information.

- The second map in Appendix A is the *Airport Property Map* that depicts each parcel owned by the airport to ensure that any construction projects on MEM parcels outside the main airport activity area are covered under TNR15-0091. This map additionally serves as a site location map with roads and streams depicted.

1.3 Tennessee General Permit for Construction Activities Requirements

TNR10-0000, included as Appendix B, authorizes the discharge of storm water from sites that are under construction, provided that the permit provisions are adhered to and TDEC receives formal application from the parties responsible for the construction. Under this general permit, both the owner/developer of the property and the contractors performing the construction activities are responsible for complying with the permit. MSCAA has developed this SWPPP to comply with the provisions of TNR10-0000 and to coordinate the compliance responsibilities of the contractors and subcontractors engaged in construction activities on properties owned or managed by MSCAA. MEM drains into water with Unavailable Parameters (Days Creek, Hurricane Creek and Nonconnah

Creek); therefore, all construction at MEM is subject to more stringent permit requirements for erosion and sediment control. These requirements are incorporated into this SWPPP.

The parties subject to this permit include the owner/developer of the construction site (MSCAA) and all contractors and subcontractors who have either the authority to make or modify the plans and specifications or the day-to-day responsibility for execution of the plans and/or compliance with the specifications. Table 1-1 summarizes TNR10-0000 permit requirements at MEM:

Table 1-1
Permitted Storm Water Discharges

Discharges Covered	Permit #/ Tracking #	Permit Required Activities
Storm Water Associated with Construction Activity		
Storm Water Under Construction General Permit (CGP)	TNR10-0000/ TNR15-0091	Contractors must conduct all activities in compliance with the CGP, including but not limited to: • Sign Notice of Intent and Storm Water Pollution Prevention Plan (SWPPP), keep SWPPP onsite, and update SWPPP as needed; • Hire a qualified person to conduct biweekly erosion prevention and sediment control inspections (72 hours apart) and keep site inspector's certification onsite; • Make corrections to site before next rain event but in no case more than 7 days after the need is identified; • Update SWPPP within 7 days of correction to site; • Document twice-weekly inspections on Tennessee Department of Environment and Conservation form and maintain inspection file and SWPPP at the construction site or Memphis-Shelby County Airport Authority (MSCAA); • A quality assurance site assessment of erosion prevention and sediment controls must be conducted by a Professional Engineer or other qualified individual at each outfall involving drainage totaling 5 or more acres within a month of construction commencing at each portion of the site that drains the 5 or more acres; • Stabilize soils (temporary or permanent) 14 days after construction ceases; • Post a copy of the notice of permit coverage, contact information, project description and location of the SWPPP at the MSCAA; • Install and maintain a rain gauge at the site; and • Maintain a form onsite that tracks the acreage of disturbed area each day (no more than 50 acres may be disturbed at one time unless linear project).

2.0 ACQUIRING PERMIT COVERAGE AT MEM

To acquire permit coverage under TNR15-0091, owner must:

- Submit a complete sub-project Notice of Intent (NOI) using the TNR15-0091 tracking number, along with a construction site map and site specific EPSCP (provided by project designer) with drawings:

  Construction Site map: excerpt (8 ½" by 11" or 11" by 17") from the appropriate 7.5 minute United States Geological Survey (USGS) topographic map, with the proposed construction site centered. For additional information, see Section 3.1.

  - The entire proposed construction area must be clearly identified (outlined in red) on this map.
  - The total area to be disturbed (in acres) should be included on the map.
  - Outline the boundaries of projects, developments and the construction site in relation to major roads, streams or other landmarks.
  - Identify all outfalls where runoff will leave the property
  - Identify stream(s) receiving the discharge, and storm sewer system(s) conveying the discharge from all site outfalls

  Site-specific EPSCP: The plan showing the approximate location of each control measure along with a description of the timing during the construction process for implementing each measure (e.g., prior to the start of earth disturbance, as the slopes are altered and after major grading is finished). The different stages of construction (initial/major grading, installation of infrastructure, final contours, etc.) and the erosion preventions and sediment control measures that will be utilized during each stage should be depicted on multiple plan sheets (see Section 3.0).

- have a full understanding of this SWPPP and the requirements of TNR10-0000 and have the ability to be in compliance with permit terms and conditions.

2.1 Notice of Intent

To become an authorized party to this permit, owners wishing coverage must first develop an EPSCP specific to the construction activities being contracted and submit the site plan and a

properly signed NOI to the State and the City via MSCAA. The project designer will submit EPSCP drawings to MSCAA for review prior to TDEC submittal. An NOI is included at the end of Appendix B with the permit forms.

Contractors performing construction activities at MEM are required to be signatories on the NOI under TNR10-0000 and TNR15-0091 if they have either the authority to make or modify the plans and specifications or have the day-to-day responsibility for execution of the plans and/or compliance with the specifications. The MSCAA requires the following responsibilities of these signatories.

The MSCAA must:

- Ensure the project specifications the contractors develop meet the minimum requirements of Section 3.0 of this SWPPP and all other applicable conditions.

- Ensure that the site plan for the contracted project indicates the areas of the project where contractor has design control (including the ability to make modifications in specifications).

- Ensure all other permittees implementing portions of the SWPPP for their part of the project that will be impacted by any changes signatories make to the SWPPP are notified of such modifications in a timely manner.

- Ensure that all common facilities (e.g., sediment treatment basin and drainage structures) that are necessary for the prevention of erosion or control of sediment are maintained and effective until all construction is complete and all disturbed areas in the entire project are stabilized.

- If parties with day-to-day operational control of the construction site have not been identified at the time the SWPPP is initially developed, the MSCAA shall be considered to be the responsible party until such time the supplemental NOI is submitted, identifying the new operator(s). These new operators (e.g., general contractor, utilities contractors, subcontractors, erosion control contractors, hired commercial builders) are considered secondary permittees. The EPSCP must be updated to reflect the addition of new operators as needed to reflect operational or design control.

- Ensure that all operators on site have permit coverage and are complying with the SWPPP.

Tenants and contractors with day-to-day operational control must:

- Ensure that the SWPPP for portions of the project where they are operators meets the minimum requirements of Section 3.0 of the SWPPP and identify the parties responsible for implementation of control measures identified in the plan.

- Ensure that measures in the SWPPP are adequate to prevent erosion and control sediment that may result from their earth-disturbing activity.

- Permittees with operational control over only a portion of a larger construction project are responsible for compliance with all applicable terms and conditions of this permit as it relates to their activities on their portion of the construction site. This includes, but is not limited to, implementation of Best Management Practices (BMPs) and other controls required by the SWPPP.

NOIs must be filed at least 30 days prior to the start of the construction project activities or the addition of a new party to the permit. If there is a change in contractor responsibilities, a NOI must be filed at least 48 hours before responsibilities are transferred from one contractor to another. To the extent possible, all contractors filing NOIs for a scope of work should be joint signatories to a single NOI.

A NOI submitted for authorization to discharge under TNR10-0000 and TNR15-0091 shall be submitted by the contractor to MSCAA Manager of Environmental Services or MSCAA's construction management team (Parsons). Three original copies shall be submitted. MSCAA will review the NOI and site plan for completeness and, if they are found to be complete, forward original copies of the NOI and site plan to TDEC. A copy of the NOI will also be forwarded to the City of Memphis Department of Public Works Storm Water Program for notification purposes.

2.2 Storm Water Pollution Prevention Plan

Owners and Contractors wishing to obtain coverage under a NPDES permit must develop and submit a site-specific EPSCP with their NOI. The project designer will submit the EPSCP for review and approval prior to submittal to TDEC. This SWPPP constitutes the comprehensive SWPPP addressing all construction-related activities from the date construction commences at MEM to the

date of termination of permit coverage. The SWPPP was developed, implemented, and updated according to the requirements in TNR10-0000. The SWPPP has been an effective tool since 2001 when coverage under TNR10-0000 was obtained at MEM. Because there is more than one operator at MEM, preparation and implementation of the SWPPP has been a cooperative effort. New operators with design and operational control of their portion of the construction site are required to adopt and implement this comprehensive SWPPP.

2.3 Permit Application Fees

MSCAA has paid the permit application fee for all construction projects at MEM by submittal of a one-time maximum fee of $7,500.00 for the maximum acreage permitted. Contractors and tenants do not need to pay permit application fees.

2.4 Notice of Coverage

TDEC will review the NOI for completeness and will issue a Notice of Coverage (NOC) to the MSCAA for each project identified on the NOI form. Each project will be independently tracked by TDEC with a project tracking number. Before initiation of construction activities, copies of the NOI, this SWPPP, the EPSCP, and the NOC must be located at each construction site management office. The NOC must be posted along with the following information:

- Name, company name, e-mail address (if available), telephone number, and address of the project site owner or a local contact person;

- A brief description of the project; and
- The location of the SWPPP if the site is inactive or does not have an onsite location to store the plan.

Necessary copies of the NOC and the project-specific EPSCP will be distributed by MSCAA to all parties assigned responsibility for oversight of the construction project.

2.5 Notice of Termination

Individual contractors who have completed their responsibilities must submit a Notice of Termination (NOT) to be relieved of their responsibilities under the permit. Upon completion of the project, MSCAA, in conjunction with the contractors covered by the permit, is to submit a NOT. NOT forms are included at the end of Appendix B with the permit forms. NOTs are to be submitted to the contracting official at MSCAA. MSCAA (via Parsons) will forward the NOTs to TDEC.

Contracted projects must retain permit coverage until all construction within the site (including, but not limited to, infrastructure, common areas, storm water drainage structures, sediment control basin, etc.), is completed, all disturbed soils have been finally stabilized, and temporary erosion and sediment control measures have been removed.

TDEC will notify MSCAA of the final decision within 30 days from receipt of a complete NOT and may deny termination of coverage if there are any existing deficiencies.

2.6 Permitted Discharges

TNR10-0000 and TNR15-0091 authorize discharges of storm water from construction activities such as clearing, grading, filling, and excavation activities in preparation for paving or construction activities on projects sized 1-acre or greater. It also authorizes storm water discharges from support activities (e.g., equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) provided that:

- the support activity is primarily related to a construction site that is covered under this permit;

- that the owner/contractor of the support activity is the same as the owner/contractor of the construction site;
- the support activity is not a commercial operation serving multiple unrelated construction projects by different contractors and does not operate beyond the completion of the construction activity at the last construction project it supports; and

- appropriate storm water pollution prevention controls and measures are identified in a SWPPP covering the discharges from the support activity areas.

The following non-storm water discharges from active construction sites are authorized by TNR10-0000 and TNR15-0091, provided the non-storm water component of the discharge is in compliance with the permit:

- dewatering of work areas of collected storm water and groundwater;

- waters used to wash vehicles (of dust and soil, not process materials such as concrete) where detergents are not used and detention and/or filtering is provided before the water leaves the site;

- water used to control dust;

- potable water sources including waterline flushings;

- routine external building wash-down that does not use detergents;

- uncontaminated groundwater or spring water; and

- foundation or footing drains where flows are not contaminated with process materials such as solvents.

Discharges of storm water or wastewater authorized by and in compliance with a different NPDES permit (other than this permit) may be mixed with discharges authorized by this permit. All non-storm water discharges authorized by this permit must be free of sediment or other solids and must not cause erosion of soil or the stream bank or result in sediment impacts to the receiving stream.

TNR10-0000 does not authorize storm water or other discharges that would result in a violation of State water quality standards (TDEC Rules, Chapters 1200-4-3, 1200-4-4). Such discharges constitute a violation of this TNR10-0000. Where a discharge is already authorized under the permit and the division determines the discharge to cause or contribute to the violation of applicable state water quality standards, the permitting authority will notify the operator of such violation(s). The permittee shall take all necessary actions to ensure future discharges do not cause or contribute to the violation of a water quality standard and shall document these actions in the SWPPP.

The construction activity shall be carried out in such a manner as to prevent violations of water quality criteria as stated in the TDEC Rules, Chapter 1200-4-3-.03. This includes but is not limited to the prevention of any discharge that causes a condition in which visible solids, bottom deposits, or turbidity impairs the usefulness of waters of the state for any of the uses designated for that water body by TDEC Rules, Chapter 1200-4-4. There shall be no distinctly visible floating scum, oil, or other matter contained in the storm water discharge. The storm water discharge must not cause an objectionable color contrast in the receiving stream. The storm water discharge must result in no materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.

3.0 POLLUTION PREVENTION SITE PLAN DEVELOPMENT

The grading, drainage, and erosion prevention and sediment control plans for each project at MEM are considered to be part of the overall site plan and must accompany the individual project's NOI submittal. Each construction project must calculate its post-construction runoff coefficient and, where appropriate, send a Geotechnical Report for the site with the site plans to the TDEC office with the job-specific NOI via the MSCAA.

Storm water leaving construction sites at MEM enters the MSCAA's storm sewer system going to either Days Creek or Hurricane Creek, which then enters Nonconnah Creek. In general, construction projects at MEM have an estimated post-construction runoff coefficient of 0.70.

The EPSCP must be prepared in accordance with good engineering practices and the latest edition of the Tennessee Erosion and Sediment Control Handbook. The handbook is designed to provide information to planners, developers, engineers, and contractors on the proper selection, installation, and maintenance of BMPs. In addition, tenants and contractors must consult the City of Memphis Storm Water Management Manual (SWMM) to ensure compliance with local storm water requirements. Appendix C of this SWPPP provides the current web site address to the TDEC Erosion and Sediment Control Handbook, as well as the SWMM. Because the receiving streams for MEM storm water discharges are water with unavailable parameters, beginning May 24, 2013, the EPSCP must be prepared by a person who, at a minimum, has completed the TDEC's *Level II Design Principles for Erosion Prevention and Sediment Control for Construction Sites* course. A copy of the certification or training record for inspector certification should be included with the EPSCP.

The EPSCP must:

- Identify all potential sources of pollution that are likely to affect the quality of storm water discharges from the construction site.

- Describe practices to be used to reduce pollutants in storm water discharges from the construction site.

- Assure compliance with the terms and conditions of this permit.

Once a definable portion of a project has been finally stabilized, the co-permittee and MSCAA may identify the stabilized area on the EPSCP. At that time, no further SWPPP or inspection requirements apply to that portion of the site (e.g., earth-disturbing activities around one of three buildings in a complex are done and the area is finally stabilized; 1 mile of a roadway or pipeline project is done and finally stabilized, etc.).

Plans and specifications for any building or structure, including the design of sediment basins or other sediment controls involving structural, hydraulic, hydrologic or other engineering calculations shall be prepared by a licensed professional engineer or landscape architect and stamped and certified in accordance with the Tennessee Code Annotated, Title 62, Chapter 2 and the rules of the Tennessee Board of Architectural and Engineering Examiners. Engineering design of sediment basins and other sediment controls must be included in SWPPPs for construction sites involving drainage to an outfall totaling 5 acres or more due to the receiving water having unavailable parameters status.

3.1 Site Description

The EPSCP must provide a description of pollutant sources and other information as indicated:

- A description of all construction activities at the site (not just grading and street construction)

- The intended sequence of major activities that disturb soils for major portions of the site (e.g., grubbing, excavation, grading, utilities, and infrastructure installation, etc.)

- Estimates of the total area of the site and the total area that is expected to be disturbed by excavation, grading, filling, or other construction activities

- A description of the topography of the site including an estimation of the percent slope and the variation in percent slope found on the site; such estimation should be on the basis of a drainage area serving each outfall, rather than an entire project.

- Any data describing the soil (data may be referenced or summarized) and how the soil type will dictate the needed control measures and the expected quality of any discharge from the site

- An estimate of the runoff coefficient of the site after construction activities are completed and how the runoff will be handled to prevent erosion at the permanent outfall and receiving stream.

- An erosion prevention and sediment control map of the site with the proposed construction area clearly outlined. The map should indicate:

  — the boundaries of the permitted area;
  — drainage patterns and approximate slopes anticipated after major grading activities;
  — areas of soil disturbance;
  — an outline of areas that are not to be disturbed;
  — the location of major structural and nonstructural controls identified in the SWPPP;
  — the location of areas where stabilization practices are expected to occur;
  — surface waters including wetlands;
  — sinkholes;
  — and careful identification of outfall points intended for coverage under the general permit for storm water discharges from the site.

- A description of any discharge associated with industrial activity other than construction storm water that originates onsite and the location of that activity and its permit number.

- Identification of any stream or wetland on or adjacent to the project, a description of any anticipated alteration of these waters, and the permit number or the tracking number of the Aquatic Resources Alteration Permit or Section 401 Certification issued for the alteration.

- The name of the receiving water(s) and approximate size and location of affected wetland acreage at the site.

- If applicable, identify and outline the buffer zones established to protect waters of the state located within the boundaries of the project.

- For projects of more than 50-acres, the construction phases must be described. (No more than 50 acres may be disturbed at any one time.)

- If only a portion of the total acreage of the construction site is to be disturbed, then the protections employed to limit the disturbance must be discussed (i.e., caution fence, stream side buffer zones, etc.)

- Limits of disturbance shall be clearly marked in the SWPPP and areas to be undisturbed clearly marked in the field before construction activities begin.

3.2 Description of Storm Water Runoff Controls

The EPSCP must include a description of appropriate erosion prevention and sediment controls and other BMPs that will be implemented at the construction site. The plan must clearly describe each major activity that disturbs soils for major portions of the site (e.g., grubbing, excavation, grading, utilities, and infrastructure installation, etc.) and indicate the following:

- Appropriate control measures and the general timing for the measures to be implemented during construction activities

- Which permittee is responsible for implementation of which controls

The EPSC plans must show the approximate location of each control measure along with a description of the timing during the construction process for implementing each measure (e.g., prior to the start of earth disturbance, as the slopes are altered and after major grading is finished). The different stages of construction (initial/major grading, installation of infrastructure, final contours, etc.) and the erosion prevention and sediment control measures that will be utilized during each stage should be depicted on multiple plan sheets (see following paragraphs). Half sheets are acceptable. One sheet showing all EPSCs that will be used during the life of the multi-phase project implementing different EPSC controls at each stage will not be considered complete.

For site disturbances less than 5-acres, at least two separate EPSC plan sheets must be developed. At least two stages must be identified, with associated EPSC measures addressed. The plan stages must be addressed separately in plan sheets, with each stage reflecting the conditions and EPSC measures necessary to manage storm water runoff, erosion and sediment during the initial land disturbance (initial grading) and the conditions and EPSC measures necessary to manage storm water, erosion and sediment at final grading.

For site disturbances more than 5-acres, at least three separate EPSC plan sheets must be developed. Three stages must be identified. The first plan sheet should reflect the conditions and EPSC measures necessary to manage storm water runoff, during the initial land disturbance (initial grading). The second plan sheet shall reflect the conditions and the EPSC measures necessary to manage storm water runoff from interim land disturbance activities. The third plan sheet shall reflect the conditions and EPSC measures necessary to manage storm water runoff, erosion and sediment at final grading.

3.3 Construction Sequencing

In general, the construction sequence to be followed in order to reduce erosion and prevent sediment from leaving the construction site is:

- Install erosion control devices (i.e., ditch blocks, silt fencing).
- Remove existing topsoil (if re-grading site) to a minimum of 6 inches to a stockpile with erosion controls.
- Remove existing pavement.
- Grade and prepare subgrade for new building slab and/or paving.
- Construct new building and/or paving.
- Place earthen fill for side slopes from shoulder to existing grade.
- Clean out any ditch blocks/ponds.
- Sod areas of soil disturbance.

3.4 Erosion Prevention and Sediment Controls

The following are the general TNR10-0000 and TNR15-0091 criteria that will be required for the development of the EPSCP:

- The construction-phase erosion prevention controls shall be designed to eliminate (or minimize if complete elimination is not possible) the dislodging and suspension of soil

in water. Sediment controls shall be designed to retain mobilized sediment on site to the maximum extent practicable.

- The design, inspection and maintenance of BMPs described in this SWPPP must be prepared in accordance with good engineering practices and at a minimum, must be consistent with the requirements and recommendations contained in the current edition of the Tennessee Erosion and Sediment Control Handbook. In addition, all control measures must be properly selected, installed, and maintained in accordance with the manufacturer's specifications (where applicable). All control measures selected must be able to slow runoff so that rill and gully formation is prevented. When steep slopes and/or fine particle soils are present at the site, additional physical or chemical treatment of storm water runoff may be required. Proposed physical and/or chemical treatment must be researched and applied according to the manufacturer's guidelines and fully described in the SWPPP. If periodic inspections or other information indicates a control has been used inappropriately, or incorrectly, the permittee must replace or modify the control for relevant site situations.

- If permanent or temporary vegetation is to be used as a control measure, then the timing of the planting of the vegetation cover must be discussed in the SWPPP. Planning for planting cover vegetation during winter months or dry months should be avoided.

- If you plan to add cationic treatment chemicals (see definitions) to stormwater and/or authorized non-stormwater prior to discharge, you may not submit your Notice of Intent (NOI) unless and until you notify an appropriate EFO (see section 2.8 above) in advance and the EFO authorizes coverage under this permit after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to discharges that cause an exceedance of water quality standards.

  Chemicals used for treating stormwater runoff must be shown to be non-toxic to sensitive aquatic species through a 48-hour or 96-hour acute toxicity test as reported in the product's Material Safety Data Sheets. The chemical feed rate shall be such that the effluent concentration of the product is lower than the LC50 toxicity value for sensitive aquatic species as reported in the products Safety Data Sheets. Calculations used to determine the

chemical feed rate so that runoff or effluent is not toxic to sensitive aquatic species shall also be included in the SWPPP. Chemicals used for treating stormwater runoff shall be applied in accordance with manufacturer specifications and securely stored on-site within the contractor's staging and storage area if not stored off-site or provided by others. Chemicals shall not be applied directly to any stream.

- If sediment escapes the permitted area, offsite accumulations of sediment that have not reached a stream must be removed at a frequency sufficient to minimize offsite impacts (e.g., fugitive sediment that has escaped the construction site and has collected in a street must be removed so that it is not subsequently washed into storm sewers and streams by the next rain and/or so that it does not pose a safety hazard to users of public streets). Permittees shall not initiate remediation/restoration of a stream without consulting the TDEC first. TNR00000 does not authorize access to private property. Arrangements concerning removal of sediment on adjoining property must be settled by the permittee with the adjoining landowner.

- Sediment should be removed from sediment traps, silt fences, sedimentation ponds, and other sediment controls as recommended in the Tennessee Erosion and Sediment Control Handbook, and must be removed when design capacity has been reduced by 50 percent.

- Litter, construction debris, and construction chemicals exposed to storm water shall be picked up prior to anticipated storm events or before being carried offsite by wind (e.g., forecasted by local weather reports), or otherwise prevented from becoming a pollutant source for storm water discharges (e.g., screening outfalls, daily pick-up, etc.). After use, materials used for erosion prevention and sediment control (such as silt fence) should be removed or otherwise prevented from becoming a pollutant source for storm water discharges.

- Erodible material storage areas (including but not limited to overburden and stockpiles of soil etc.) and borrow pits used primarily for the permitted project and which are contiguous to the site are considered a part of the site and shall be identified on the NOI, addressed in the SWPPP and included in the fee calculation.

- Pre-construction vegetative ground cover shall not be destroyed, removed or disturbed more than 14 days prior to grading or earth moving activities unless the area is seeded

and/subsequently temporarily or mulched or other temporary cover is permanently stabilized.

- Clearing and grubbing must be held to the minimum necessary for grading and equipment operation. Existing vegetation at the site should be preserved to the maximum extent practicable.

- Construction must be sequenced to minimize the exposure time of graded or denuded areas.

- Construction phasing is recommended on all projects regardless of size as a major practice for minimizing erosion and limiting sedimentation. Construction should be phased to keep the total disturbed area less than 50-acres at any one time. Areas of the completed phase must be stabilized within 14 days. No more than 50-acres of active soil disturbance should be planned at any time during the construction project. This includes offsite borrow or disposal areas that meet the conditions previously listed. However, the MSCAA historically negotiated an exception with TDEC because many MEM projects require more than 50 acres to be disturbed at one time. In the new permit, this exception has become standardized for linear projects, like those at MEM; therefore, the use of this exception has new requirements as shown in the following list. Even with this exception, MSCAA encourages tenants and contractors to make every effort to phase all projects at MEM.
  - The 50-acre limitation does not apply to linear construction projects (such as roadway, pipeline, and other infrastructure construction activities at MEM) if the following conditions are met:
    - Where no one area of active soil disturbance is greater than 50-acres and the various areas of disturbance have distinct receiving waters; or
    - Where contiguous disturbances amount to greater than 50-acres, but no one distinct water is receiving runoff from more than 50 disturbed acres; or
    - With the MSCAA's written concurrence, where more than 50 acres of disturbance is to occur and where one receiving water will receive runoff from more than 50 acres; or

- Where no one area of active soil disturbance is greater than 50-acres and the various areas of disturbance are more than 5 miles apart.

— In order for a linear project at MEM to take advantage of the 50-acre rule exemption outlined in this paragraph, the contractor shall conduct monthly site assessments as described in Section 4.3 of this SWPPP until the site is permanently stabilized.

- Erosion prevention and sediment control measures must be in place and functional before earth moving operations begin and must be constructed and maintained throughout the construction period. Temporary measures may be removed at the beginning of the workday but must be replaced at the end of the workday.

- The following records shall be maintained on or near site: the dates when major grading activities occur; the dates when construction activities temporarily or permanently cease on a portion of the site; the dates when stabilization measures are initiated; inspection records and rainfall records. MSCAA maintains daily log books with this information; information is collected by the MSCAA contracted inspectors, via Parsons.

- Offsite vehicle tracking of sediments and the generation of dust shall be minimized. A stabilized construction access (a point of entrance/exit to a construction site) shall be described and implemented, as needed, to reduce the tracking of mud and dirt onto public roads by construction vehicles.

- Permittees shall maintain a rain gauge and daily rainfall records at the site, or use a reference site for a record of daily amount of precipitation.

3.4.1 General Permit Requirements for Stabilization Practices

The EPSCP shall include a description of interim and post-construction stabilization practices, including site-specific scheduling of the implementation of the practices. Site plans should ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized. Site plans should comply with buffer zone requirements (for new construction only) for any projects in which construction activities, borrow, and/or fill are prohibited. Stabilization practices may include temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, preservation of mature vegetation, and other appropriate measures. Use of impervious surfaces for final stabilization in lieu of a

permanent vegetative cover should be avoided where practicable. No stabilization, erosion control, or sediment treatment measures are to be installed in a stream without obtaining a Section 404 Permit and an Aquatic Resource Alteration Permit, if such permits are required and appropriate.

Stabilization measures shall be initiated as soon as possible in portions of the site where construction activities have temporarily or permanently ceased. Temporary or permanent soil stabilization at the construction site (or a phase of the project) must be completed no later than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. In the following situations, temporary stabilization measures are not required:

- Where the initiation of stabilization measures is precluded by snow cover or frozen ground conditions or adverse soggy ground conditions. In this situation, stabilization measures shall be initiated as soon as practicable.

- Where construction activity on a portion of the site is temporarily ceased and earth disturbing activities will be resumed within 14 days.

Steep slopes (natural or created slope of 35 percent grade or greater) shall be temporarily stabilized no later than 7 days after construction activity on the slope has temporarily or permanently ceased.

Permanent stabilization with perennial vegetation (using native herbaceous and woody plants where practicable) or other permanently stable, non-eroding surface shall replace any temporary measures as soon as practicable. Unpacked gravel containing fines (silt and clay sized particles) or crusher runs will not be considered a non-eroding surface.

3.4.2 General Permit Requirements for Structural Practices

The EPSCP shall include a description of structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and discharge of pollutants from exposed areas of the site. Such practices may include silt fences, earth dikes, drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, rock outlet protection, reinforced soil-retaining systems, gabions, and temporary or permanent sediment basins. Structural controls shall not be placed in streams or wetlands except as authorized by a Section 404 Permit and/or Aquatic Resource Alteration Permit.

Erosion prevention and sediment control measures must be prepared in accordance with good engineering practices and the latest edition of the Tennessee Erosion and Sediment Control Handbook. In addition, erosion prevention and sediment controls shall be designed to minimize erosion and maximize sediment removal resulting from a 5-year, 24-hour storm due to the receiving stream being water with unavailable parameters (the design storm — see definition in text box to right), as a minimum, either from total rainfall in the designated period or the equivalent intensity. When clay and other fine particle soils or highly erodible soils are present at the construction site, chemical treatment of the stormwater runoff (cationic treatment chemicals) may be necessary to minimize the amount of sediment being discharged.

> **"5-year design storm depths and intensities"** means the estimated design rainfall amounts, for any return period interval (i.e., 2-year, 5-year, 25-year, etc.) in terms of either 24-hour depths or intensities for any duration, can be found by accessing the following NOAA National Weather Service Atlas 14 data for Tennessee: http://hdsc.nws.noaa.gov/hdsc/pfds/orb/tn_pfds.html.
>
> Other data sources may be acceptable with prior written approval by TDEC Water Pollution Control.

For an onsite outfall which receives drainage from 10 or more acres, a minimum sediment basin volume that will provide treatment for a calculated volume of runoff from a 5-year, 24-hour storm

and runoff from each acre drained, or equivalent control measures as specified in the Tennessee Erosion and Sediment Control Handbook, shall be provided until final stabilization of the site. A drainage area of 10 acres or more includes both disturbed and undisturbed portions of the site or areas adjacent to the site, all draining through the common outfall. Where an equivalent control measure is substituted for a sediment retention basin, the equivalency must be justified to the division. Runoff from any undisturbed acreage should be diverted around the disturbed area and the sediment basin. Diverted runoff can be omitted from the volume calculation. Sediment storage expected from the disturbed areas must be included.

All calculations of drainage areas, runoff coefficients and basin volumes must be provided as a part of the EPSCP submittal. The discharge structure from a sediment basin must be designed to retain sediment during the lower flows. Muddy water to be pumped from excavation and work areas must be held in settling basins or filtered or chemically treated prior to its discharge into surface waters. Water must be discharged through a pipe, well-grassed or lined channel, or other equivalent means so that the discharge does not cause erosion and sedimentation. Discharged water must not cause an objectionable color contrast with the receiving stream.

3.5 Storm Water Management

The EPSCP must be developed to ensure that measures have been completed that will be installed during the construction process to control pollutants in storm water discharges that will occur after construction operations have been completed. The plan should also consider measures that will be installed during the construction process to control pollutants and any increase in the volume of storm water discharges that will occur after construction operations have been completed. For steep slope sites, the plan will also consider measures that will be installed to dissipate the volume and energy of the storm water runoff to predevelopment levels. This permit only addresses the installation of storm water management measures and not the ultimate operation and maintenance of such structures after the construction activities have been completed, the site has undergone final stabilization, and the permit coverage has been terminated. Permittees are only responsible for the installation and maintenance of storm water management measures prior to final stabilization of the site and are not responsible for maintenance after storm water discharges associated with construction activity have been eliminated from the site. All construction at MEM must comply with the city of Memphis SWMM, available at www.stormwatermatters.com, regarding requirements to limit the amount of post-construction runoff in order to minimize in-stream channel erosion in the receiving stream.

Construction storm water runoff management practices may include storm water detention structures (including ponds with a permanent pool); storm water retention structures; flow attenuation by use of open vegetated swales and natural depressions; infiltration of runoff onsite; and sequential systems (that combine several practices). Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel to provide a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (no significant changes in the hydrological regime of the receiving water). The EPSCP must include an explanation of the technical basis used to select the practices to control pollution where flows exceed predevelopment levels. The Tennessee Erosion and Sediment Control Handbook provides measures that can be incorporated into the design or implemented onsite to decrease erosive velocities. An Aquatic Resources Alteration Permit may be required if such velocity dissipation devices installed would alter the receiving stream and/or its banks.

3.6 Other Items Needing Control

The EPCSP must also include consider and describe the following other items potentially needing controls at the site:

- No solid materials, including building materials, shall be placed in waters of the state, except as authorized by a Section 404 Permit and/or Aquatic Resource Alteration Permit.

- Offsite vehicle tracking of sediments and the generation of dust shall be minimized. A stabilized construction access (a point of entrance/exit to a construction site) shall be described and implemented, as needed, to reduce the tracking of mud and dirt onto public roads by construction vehicles.

- Describe any waste disposal systems, sanitary sewer, or septic system onsite, and provide for the necessary sediment controls. Tenants and contractors must also comply with applicable state and/or local waste disposal sanitary sewer or septic system regulations for such systems to the extent that these are located within the permitted area.

- Describe construction and waste materials expected to be stored onsite with updates as appropriate. In addition, the EPSCP must consider the controls to be used to reduce pollutants from materials stored onsite, including storage practices to minimize exposure of the materials to storm water and spill prevention and response.

- Describe storm water sources from areas other than construction and a description of controls and measures that will be implemented at those sites.

- Describe measures necessary to prevent "taking" of legally protected aquatic threatened or endangered species and/or critical habitat (if applicable).

3.7 Best Management Practices

All construction at MEM must comply with the most current TDEC Erosion and Sediment Control Handbook and City of Memphis Storm water Control Manual. See Appendix C for website address. MSCAA encourages implementation of a series of BMPs and recommends that storm water controls be designed to limit the discharge of storm water pollutants offsite to predevelopment levels to the maximum extent practicable (MEP). Due to colloidal clay soils in the Memphis area, sediment removal BMPs may not yield clear storm water.

Additionally, erosion prevention and sediment control measures must be maintained in good and effective operating condition. Maintenance needs identified by inspections or other means shall be addressed before the next storm event, but in no case more than 7 days after the need is identified. The EPSCP must provide maintenance requirements for BMPs. As a reference, the maintenance of typical measures is included in Appendix C.

4.0 INSPECTIONS

Inspections of erosion controls must be performed to ensure proper maintenance and effectiveness of the devices.

4.1 Inspector Training and Certification

Inspectors performing the required twice-weekly inspections must have at least 1 of the following credentials:

- a person with a valid certification from the "Fundamentals of Erosion Prevention and Sediment Control Level I" course,
- a licensed professional engineer or landscape architect,
- a Certified Professional in Erosion an Sediment Control (CPESC), or
- a person who has successfully completed the "Level II Design Principles for Erosion

A copy of the certification or training record for inspector certification is maintained at the MSCAA's Project Center.

An integral part of improving water quality at the airport is the training of those requesting coverage under TNR15-0091. To meet this need, MSCAA recommends the *Fundamentals of Erosion Prevention and Sediment Control Level I* course for its contractors. The Level I Fundamentals workshop is a one-day foundation-building course for individuals involved in land-disturbing activities and is intended for contractors, developers, plan preparers, reviewers, designers, engineers, and inspection and enforcement personnel from all levels of government. The fundamentals course aims to build a solid working knowledge of erosion and sedimentation processes and practices. Topics include Construction General Permit and related SWPPP requirements; function, installation, limitations, inspection, and maintenance of BMPs; roles of local officials and state government agencies involved in the permitting process; and basic hydrologic and erosion processes. The Level I Fundamentals workshop provides a Certificate of Completion with 7 hours of Professional Development Hours (PDH) credit upon successful completion of the short Course Certification Exam.

4.2 Schedule of Inspections

Inspections must be performed at least twice every calendar week. Inspections must be performed at least 72 hours apart. Where sites or portions of construction sites have been temporarily stabilized or where runoff is unlikely due to winter conditions (e.g., site covered with snow or ice), or due to extreme drought, such inspection only has to be conducted once per month until thawing or participation results in runoff or construction activity resumes. Inspections requirements do not

apply to definable areas that have been finally stabilized. Written notification of the intent to change the inspection frequency and the justification for such request must be submitted to the local Environmental Field Office.

4.3 Inspection Items

- Qualified personnel, as defined in section 3.5.8.1 of the Permit (provided by the permittee or cooperatively by multiple permittees) shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, structural control measures, locations where vehicles enter or exit the site, and each outfall.

- Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the site's drainage system. Erosion prevention and sediment control measures shall be observed to ensure that they are operating correctly.

- Outfall points (where discharges leave the site and/or enter waters of the state) shall be inspected to determine whether erosion prevention and sediment control measures are effective in preventing significant impacts to receiving waters. Where discharge locations are inaccessible, nearby downstream locations shall be inspected. Locations where vehicles enter or exit the site shall be inspected for evidence of offsite sediment tracking.

4.4 Schedule for Corrections

Based on the results of the inspection, any inadequate control measures or control measures in disrepair shall be replaced or modified, or repaired as necessary, before the next rain event if possible, but in no case more than 7 days after the need is identified.

Based on the results of the inspection, the site description identified in the SWPPP in accordance with section 3.5.1 of the Permit and pollution prevention measures identified in the SWPPP in accordance with section 3.5.2 of the Permit, shall be revised as appropriate, but in no case later than 7 days following the inspection. Such modifications shall provide for timely implementation of any changes to the SWPPP, but in no case later than 14 days following the inspection.

4.5 Inspection Documentation

All inspections shall be documented on this Construction Stormwater Inspection Certification form. Alternative inspection forms may be used as long as the form contents and the inspection certification language are, at a minimum, equivalent to the division's form and the permittee has obtained a written approval from the division to use the alternative form. The form must contain the printed name and signature of the inspector and the certification must be executed by a person who meets the signatory requirements of the permit. Inspection documentation will be maintained on site and made available to the division upon request. Inspection reports must be submitted to the division within 10 days of the request.

Trained certified inspectors shall complete inspection documentation to the best of their ability. Falsifying inspection records or other documentation or failure to complete inspection documentation shall result in a violation of this permit and any other applicable acts or rules.

4.6 Site Assessment

A site assessment must be conducted at each outfall involving drainage totaling 5 acres or more when discharging to waters with unavailable parameters or Exceptional Tennessee Waters (all MEM stormwater discharges to Exceptional Tennessee Waters). The site assessment must be conducted within a month of construction commencing at each portion of the site that drains the qualifying acreage of such portion of the site. The site assessment can take the place of one of the twice-weekly inspections.

The site assessment must be performed by individuals with following qualifications:

- A licensed professional engineer or landscape architect;
- A Certified Professional in Erosion and Sediment Control; or
- A person that has successfully completed the *Level II Design Principles for Erosion Prevention and Sediment Control for Construction Sites* course.

The site assessment will be performed to verify the installation, functionality and performance of the erosion protection and sediment control measures described in this Plan. Following the

site assessment, a thorough review and update (if applicable) of the SWPPP will be conducted; modifications of plans and specifications for any building or structure, including the design of sediment basins or other sediment controls shall be prepared by a licensed Professional Engineer or landscape architect.

The site assessment findings shall be documented and the documentation kept with the SWPPP at the site. At a minimum, the documentation shall include information included in the inspection form provided in Appendix B of this permit. The documentation, an assessment of any failing or unmaintained EPSC(s), causes of failure and any action necessary to bring the site into compliance with this permit. The documented quality assurance site assessments shall also indicate if all EPSC(s) have been installed as designed in the submitted SWPPP and EPSC plans and if not, measures that need to be taken so those EPSCs meet the design specifications in the submitted SWPPP and EPSC plans. The documentation must contain the printed name and signature of the individual performing the site assessment and the following certification:

> "I certify under penalty of law that this report and all attachments are, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. *As specified in Tennessee Code Annotated Section 39-16-702(a)(4), this declaration is made under penalty of perjury."*

The site assessment can take the place of one of the twice-weekly inspections. Additional site assessments may be required if TDEC observes site conditions that have potential of causing pollution to the waters of the state.

5.0 POLLUTION PREVENTION

5.1 Non-Storm Water Discharges

Construction projects at MEM may have some occasional non-storm water discharges that are authorized by the permit. The following non-storm water discharges from active construction sites are authorized by TNR00000 provided the non-storm water component of the discharge is combined with storm water discharges associated with construction activity, identified in the EPSCP with an appropriate pollution prevention measures and discharged through stable discharge structures. The estimated volume of the non-storm water component(s) of the discharge must be included in the design of all impacted control measures.

- Dewatering of work areas of collected storm water and ground water (filtering or chemical treatment may be necessary prior to discharge);

- Waters used to wash vehicles (of dust and soil, not process materials such as oils, asphalt or concrete) where detergents are not used and detention and/or filtering is provided before the water leaves site;

- Water used to control dust;

- Potable water sources including waterline flushings from which chlorine has been removed to the maximum extent practicable;

- Routine external building washdown that does not use detergents or other chemicals;

- Uncontaminated groundwater or spring water; and

- Foundation or footing drains where flows are not contaminated with pollutants (process materials such as solvents, heavy metals, etc.).

All non-storm water discharges authorized by this permit must be free of sediment or other solids and must not cause erosion of soil or the stream bank, or result in sediment impacts to the receiving stream.

There will be no pumping of any water standing on the outside of the erosion control structures. The water will be allowed to drain down naturally. One or more of the following will used for dust control at the site:

- Exposing the minimum area possible of erodible earth
- Using water sprinkler trucks
- Using covered haul trucks
- Using dust palliatives or penetration asphalt on haul roads
- Storing construction materials and waste materials at an offsite location

5.2 Description of the Support Areas

All support areas for construction projects at MEM will be included in the site plan. The support areas may be used to stockpile soils and construction debris, park construction equipment, stage construction materials, and house the construction offices of the contractors. In addition, the support areas may also be used to conduct routine maintenance of construction equipment during the project. Using the Memphis-Shelby County BMP Manual at www.stormwatermatters.com, BMPs will be identified for each of the activities at the support areas to reduce the pollution from the support activities.

5.2.1 Soil Stockpiles

Designated stockpile areas and other construction and waste materials to be stored onsite or in support areas will have erosion controls in place to prevent pollution. BMPs will be selected for each area.

5.2.2 Construction Debris

Designated stockpile areas and other construction and waste materials to be stored onsite or in support areas will have erosion controls in place to prevent pollution. No solid materials will be discharged directly into storm water conveyance systems from support areas. BMPs will be selected for each area.

5.2.3 Hauling

Offsite vehicle tracking of sediments will be minimized. Dust control is mandated by MSCAA and frequent sprinkling of traffic areas is required. BMPs will be selected for each area and activity.

5.2.4 Construction Equipment Storage and Maintenance

Construction equipment and contractor vehicles may be stored at the support areas. Inspections for leaking vehicles will be made periodically (weekly) and repairs will be made promptly. Routine maintenance, such as oil changes, filter changes, greasing, and minor repairs may be conducted at support areas. Equipment is to be taken offsite for major repairs. No oil containers or other liquids are stored at the support area. Any spills of oils or other liquids at the support area will be promptly cleaned up and disposed of properly. Fuel stored onsite will be contained in certified fuel tanks equipped with self-contained secondary containment. BMPs will be selected for each area and activity.

5.2.5 Onsite Waste Disposal Systems, Sanitary Sewer, or Septic Systems

Portable restrooms will be used at the support areas for the construction sites. No onsite waste disposal systems, sanitary sewer or septic systems, or other systems requiring sediment controls or any permits are to be installed.

5.2.6 Fertilizer Application

Soil analysis should be performed prior to the application of fertilizer to any portion of the site. Soil analysis shall include soil pH, buffer value, phosphorus, potassium, calcium, magnesium, calculated cation exchange capacity (CEC) and base saturation at a minimum. Soil samples should be representative of the area for which fertilizer will be applied. Sample type should be composite and should be collected in accordance with the guidance provided in the University of Tennessee Extension "Soil Testing" brochure PB1061, available at: http://utextension.tennessee.edu/publications/Documents/PB1061.pdf. Soil analysis results shall be used to determine correct fertilizer application rates to prevent the over-application of fertilizer to the site.

6.0 SENSITIVE ENVIRONMENTAL FEATURES

6.1 Wetlands

The only wetlands on MEM are located south of Shelby Drive at the former McKeller Park. There are currently no construction projects planned in the wetland areas. If construction activities are ever planned in the areas south of Shelby Drive, wetland issues will be addressed in detail.

6.2 Threatened and Endangered Species

Threatened, and endangered species that are found throughout Shelby County include the Indiana bat — *Myotis sodalis* (Endangered), bald eagle— *Haliaeetus leucocephalus* (Threatened), wood stork — *Mycteria americana* (Endangered-single bird observed feeding 1988), turgid-blossom pearly mussel — *Epioblasma turgidula* (Endangered), and the Least tern — *Sterna antillarum* (Endangered). However, MEM does not support any of these state- or federally-listed threatened or endangered species or their critical habitat. Should habitat for any of these species be encountered, MSCAA will follow all TDEC requirements and the site plan will be modified to include protective measures acceptable to TDEC, MSCAA, and the contractor(s).

6.3 Total Maximum Daily Loads

The SWPPP must include documentation supporting a determination of permit eligibility with regard to waters that have an approved total maximum daily load (TMDL) for a pollutant of concern, including:

- Identification of whether the discharge is identified, either specifically or generally, in an approved TMDL and any associated allocations, requirements, and assumptions identified for the discharge

- Summaries of consultation with TDEC on consistency of SWPPP conditions with the approved TMDL

- Measures taken to ensure that the discharge of pollutants from the site is consistent with the assumptions and requirements of the approved TMDL, including any specific wasteload allocation that has been established that would apply to the construction storm water discharge

The approved 2010 303(d) list includes TMDLs for pathogens in Hurricane Creek, Days Creek and Nonconnah Creek TN080121100711-2000 (all three are listed as water with unavailable parameters

for Escherichia coli). No TMDLs for siltation have been developed for these three receiving water bodies, although Nonconnah is listed as water with unavailable parameters for loss of biological integrity due to siltation. Hurricane Creek is listed as water with unavailable parameters for low dissolved oxygen, total phosphorus, and other anthropogenic substrate alterations. All three receiving waters are listed as water with unavailable parameters for total phosphorus and other anthropogenic substrate alterations.

Because there is no current TMDL for any of the receiving streams that would apply construction storm water discharges from MEM, there are no additional requirements at this time.

6.4 Discharges to Water with Unavailable Parameters or Exceptional Tennessee Waters

Discharges that would cause measurable degradation of waters with unavailable parameters or that would cause more than de minimis degradation of Exceptional Tennessee Waters are not authorized by this permit. Because the discharges from MEM flow to receiving streams which are impaired for loss of biological integrity due to siltation, low dissolved oxygen, total phosphorus, and other anthropogenic substrate alterations, the following SWPPP requirements must be met per Section 5.4 of the permit, in addition to the other requirements mentioned throughout this SWPPP:

- SWPPP must certify that EPSC measure used at the site are designed to control stormwater runoff generated by a 5-year, 24-hour storm event
- SWPPP must be prepared by a qualifying by individuals with following qualifications:
    - A licensed professional engineer or landscape architect;
    - A Certified Professional in Erosion and Sediment Control; or
    - A person that has successfully completed the *Level II Design Principles for Erosion Prevention and Sediment Control for Construction Sites* course.

For an on-site outfall in a drainage area totaling five or more acres, a minimum sediment basin volume that will provide treatment for a calculated volume of runoff from a 5 year, 24 hour storm and runoff from each acre drained; or equivalent control measures as specified in the Tennessee Erosion and Sediment Control Handbook, shall be provided until final stabilization of the site. The drainage area includes both disturbed and undisturbed portions of the site and areas adjacent to the site, all draining through a common outfall. Where an equivalent control measure is substituted for a sediment retention basin, the equivalency must be justified in the SWPPP narrative. Runoff

from any undisturbed acreage should be diverted around the disturbed area and the sediment basin. Diverted runoff can be omitted from the volume calculation. Sediment storage expected from the disturbed areas must be included and a marker installed signifying when sediment accumulation has reduced the wet storage volume by 50%. In a case that sediment marker is damaged by the volume of water or sediment, a best professional judgement should be used in evaluating sediment basin capacity.

For an on-site outfall in a drainage area totaling 3.5 - 4.9 acres, a minimum sediment trap volume that will provide treatment for a calculated volume of runoff from a 5-year, 24-hour storm and runoff from each acre drained, is recommended until final stabilization of the site. A drainage area of 3.5 - 4.9 acres includes both disturbed and undisturbed portions of the site or areas adjacent to the site, all draining through the common outfall. Runoff from any undisturbed acreage should be diverted around the disturbed area and the sediment trap. Diverted runoff can be omitted from the volume calculation. Sediment storage expected from the disturbed areas must be included and a marker installed signifying when sediment accumulation has reduced the wet storage volume by 50%.

In the event TDEC finds that a discharger is complying with the SWPPP but contributing to the impairment of a receiving stream, the director will notify the discharger in writing that the discharge is no longer eligible for coverage under the general permit. The permittee may update the SWPPP and implement the changes designed to eliminate further impairment of the receiving stream. If the permittee does not implement the SWPPP changes within 7 days of receipt of notification, the permittee will be notified in writing that continued discharges must be covered by an individual permit. To obtain the individual permit, the operator must file an individual permit application. The project must be stabilized until such time as the SWPPP is redeveloped and the individual permit is issued. No earth-disturbing activities, except those necessary for stabilization, are authorized to continue until the individual permit is issued.

6.5 Water Quality Riparian Buffer Zone Requirements for Discharges into Waters With Unavailable Parameters or Exceptional Waters

A 60-foot natural riparian buffer zone adjacent to the receiving stream designated as waters with unavailable parameters shall be preserved, to the maximum extent practicable, during construction activities at the site. All three receiving streams are listed as waters with unavailable parameters for one or more reasons; however, the buffer zone requirement only applies to new construction sites. Buffer zones are **not** required at portions of the buffer where certain land uses exist, or where pre-approved construction planned prior to June 16, 2005, and are to remain in place, according to the rules cited in the text box at right.

For projects that could arise in the future that would be considered new construction, the water quality riparian buffer zone is required to protect waters of the state that are not wet weather conveyances (e.g., perennial and intermittent streams, rivers, lakes, wetlands) located within or immediately adjacent to the boundaries of the project, as identified using methodology from Tennessee's standard operating procedures for hydrologic determinations. Because of heavy sediment load associated with construction site runoff, water quality riparian buffers are not primary sediment control measures and should not be relied on as such. However, the primary purpose of water quality riparian buffers is additional pollutant removal. Stormwater discharges must enter the water quality riparian buffer zone as sheet flow, not as concentrated flow, where site conditions allow. Rehabilitation and enhancement of a natural buffer zone is allowed, if necessary, for improvement of to improve its effectiveness of protection of the waters of the state.

The water quality riparian buffer zone should be established between the top of stream bank and the disturbed construction area. The 60-foot criterion for the width of the buffer zone can be established on an average width basis at a project, as long as the minimum width of the buffer zone is more than 30-feet at any measured location.

Every attempt should be made for construction activities not to take place within the water quality riparian buffer zone and for any existing forested areas to be preserved. Where it is not practicable to maintain a full water quality riparian buffer, BMPs providing equivalent protection to a receiving stream as a natural water quality riparian buffer zone may be used at a construction site. Such equivalent BMPs shall be designed to be as effective in reduction of sediment in storm water runoff

as a natural buffer zone. Such equivalent BMPs are expected to be routinely used at construction projects typically located adjacent to surface waters. These projects include, but are not limited to sewer line construction, roadway construction, utility line or equipment installation, greenway construction, construction of a permanent outfall, or a velocity dissipating structure, etc.

This requirement does not apply to any valid Aquatic Resource Alteration Permits or equivalent permits issued by federal authorities. Memphis and Shelby County have established a 25-foot buffer zone from the top of bank for impoundments, pools, lakes, and wetlands.

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7.0 SPILLS AND LEAKS

The discharge of hazardous substances or oil in the storm water discharge(s) from the site will be prevented or minimized. Appendix D includes spill response notification and response resources. TNR10-0000 and TNR15-0091 do not relieve the contractor of the reporting requirements of Title 40 of the Code of Federal Regulations (CFR) Part 117 and 40 CFR 302. Where a release containing a hazardous substance, fuel, or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR 117 or 40 CFR 302 occurs during a 24-hour period:

1. The contractor is required to notify the National Response Center (NRC) ([800] 424-8802) and the Tennessee Emergency Management Agency (emergencies: [800] 262-3300; non-emergencies: [800] 262-3400) in accordance with the requirements of 40 CFR 117 and 40 CFR 302 as soon as he or she has knowledge of the discharge.

2. The contractor shall submit to the TDEC Memphis Field Office, 8383 Wolf Lake Drive, Bartlett, Tennessee, 38133, within 14 calendar days of knowledge of the release a written description of the release (including the type and estimate of the amount of material released), the date that such release occurred, the circumstances leading to the release, what actions were taken to mitigate effects of the release, and steps to be taken to minimize the chance of future occurrences.

3. This SWPPP must be modified within 14 calendar days of knowledge of the release to incorporate a description of the release, the circumstances leading to the release, and the date of the release. In addition, the plan must be reviewed to identify measures to prevent the reoccurrence of such releases and to respond to such releases, and the plan must be modified where appropriate.

Any spills or leaks of oils or other liquids will be promptly cleaned up and disposed properly regardless of their potential to be carried offsite by a storm event.

It should be noted that a reportable quantity of a fuel or other petroleum product is the quantity that will form a visible sheen (e.g., a very small quantity).

MSCAA's Manager of Environmental Services must be kept fully informed in a timely manner of all spills or leaks and the actions taken in response to them.

Airport Spill Response Procedures

The general procedure for cleaning up spills or releases of potential pollutants at the MEM is as follows:

All spills and releases of potential pollutants that might contaminate storm water are to be completely contained upon discovery and the source of the spill is to be identified and halted immediately. The spilled material is to be cleaned up immediately. Personnel involved in the cleanup shall take precautions to protect personal health and safety, as outlined in the Material Safety Data Sheet (MSDS) for the spilled substance. The spilled material and all disposable, contaminated cleanup equipment shall be disposed in the appropriate containers. Non-disposable cleanup equipment shall be thoroughly cleaned, with precautions taken to not spread contamination.

Responsible personnel must be informed of any spills or releases that occur at the facility. It is their responsibility to see that the release reporting requirements, detailed in Appendix D of this SWPPP, are followed, as applicable. Following a spill or release, the responsible personnel also have the responsibility for evaluating whether changes are needed in pollution prevention plans for the construction site and for implementing necessary modifications.

8.0 RISK IDENTIFICATION AND SUMMARY OF POTENTIAL POLLUTANT SOURCES

8.1 Construction Activity

All outfalls will be protected with erosion control devices to prevent sediment from leaving the construction site. Additionally, there will be upstream structural controls, such as ditch blocks, and nonstructural controls, such as sodding, in place.

8.2 Spills and Leaks

Any spills or leaks of oils or other liquids on the construction site will be promptly cleaned up and disposed properly.

Construction site plans will denote the locations of all known underground fuel lines, storage tanks, and other utilities at the site. Previous ruptures of fuel lines have occurred during construction due to unknown, unmarked fuel line and vent pipe locations. Work has been conducted to mark all fuel line locations; however, if construction encounters a suspect stand pipe, possibly denoting the location of a vent pipe for an unmarked underground fuel line, work will stop in the immediate area until the pipe can be investigated and measures taken to ensure that any potential for a spill or leak has been mitigated.

8.3 Soil Stockpiles

Designated stockpile areas and other construction and waste materials to be stored onsite or in support areas will have erosion controls in place to prevent pollution. BMPs will be implemented for each site.

8.4 Construction Debris

Designated stockpile areas and other construction and waste materials to be stored onsite or in support areas will have erosion controls in place to prevent pollution. BMPs will be implemented for each site.

8.5 Hauling

Offsite vehicle tracking of sediments will be minimized. Dust control is mandated by the MSCAA and frequent sprinkling of traffic areas is required. Airport roads, taxiways, ramps, and runways that become tracked with soil or sediment are promptly cleaned with mechanical sweepers. BMPs will be implemented for each site.

8.6 Construction Equipment Storage and Maintenance

Construction equipment and contractor vehicles may be stored at the support areas. Inspections for leaking vehicles will be made periodically (weekly) and repairs will be made promptly. Routine maintenance, such as oil changes, filter changes, greasing, and minor repair may be conducted at support areas. Equipment is to be taken offsite for major repairs. No oil containers or other liquids are to be stored at the support area. Any spills of oils or other liquids at the support area will be promptly cleaned up and disposed of properly. Fuel stored onsite will be contained in certified fuel tanks equipped with self-contained secondary containment. BMPs will be implemented for each site.

8.7 Onsite Waste Disposal

No wastes will be disposed at the construction site or the support area. All wastes will be transported offsite for proper disposal.

9.0 MANAGEMENT OF POST-CONSTRUCTION RUNOFF

Due to the adequacy of the existing storm water management (collection and transport) systems, additional storm water management practices are not necessary due to the new construction at this site.

The MSCAA and its construction project engineers will review the construction plans for each construction project to assess the necessity for additional storm water management practices related to increased impervious area.

10.0 RECORD KEEPING AND INTERNAL REPORTING PROCEDURES

The contractor responsible for each construction site will keep records of incidents such as spills or other discharges, along with other information describing the quality and quantity of storm water discharges. Records of spills, inspections, and maintenance activities will be maintained with the SWPPP.

MSCAA shall retain copies of the SWPPP and all reports required by this permit and records of all data used to complete the NOI for each construction site to be covered by TNR10-0000 and TNR15-0091, for a period of at least 1 year from the date the NOT is filed. This period may be extended by written request of TDEC.

Each contractor must retain a copy of the SWPPP (which includes TNR10-000 as Appendix B) at the construction site or other local location accessible to TDEC from the date construction commences to the date of final stabilization and submission of the NOT. The contractors with day-to-day operational control over pollution prevention plan implementation shall have a copy of the site plan available at a central location onsite for the use of all contractors and those identified as having responsibilities under the site plan whenever they are on the construction site. Once coverage is terminated, the permittee must maintain a copy of all records for a period of 3 years.

The contractor shall post a notice at the MSCAA Project Center with the following information:

- A copy of the NOC with the NPDES permit tracking number for the construction project;
- Name, company name, e-mail address (if available), telephone number and address of the project site owner/operator or a local contact person;
- A brief description of the project; and
- The location of the SWPPP.

The notice must be maintained in a legible condition. If posting this information near a main entrance is infeasible due to safety concerns, or not accessible to the public, the notice shall be posted in a local public building.

The contractor shall also retain following items/information in an appropriate location onsite:

- A rain gauge;
- A copy of twice-weekly inspection reports;
- A documentation of quality assurance site assessments; and
- A copy of the site inspector's Fundamentals of Erosion Prevention and Sediment Control Level 1 certification.

11.0 STORM WATER POLLUTION PREVENTION PLAN ADMINISTRATION

11.1 Signature Requirements

All NOIs shall be signed as follows:

For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a federal agency includes (1) the chief executive officer of the agency, or (2) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of the U.S. Environmental Protection Agency [USEPA]).

Storm water pollution prevention plans, reports, certifications or other information submittals shall be signed by a person described above or by a duly authorized representative of that person.

A person is a duly authorized representative only if:

- The authorization is made in writing by a person described in the previous paragraphs and submitted to TDEC.

- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of manager, contractor, superintendent, or position of equivalent responsibility or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position).

- If an authorization under this section is no longer accurate because a different contractor has responsibility for the overall operation of the construction site, a new NOI satisfying the requirements of this section must be submitted to the state prior to, or together with, any reports, information, or applications to be signed by an authorized representative.

11.2 Availability, State Review, and Modification of the SWPPP

This SWPPP will be maintained by the contractor at the construction site trailer. A copy of the SWPPP has been submitted to the state for review and approval, as required by TNR10-0000 and TNR15-0091. This SWPPP shall be modified, if required by TDEC.

11.3 Storm Water Pollution Prevention Plan Update

This SWPPP applies to specific construction projects at MEM and will be modified whenever:

- There is a change in the scope of the project that would be expected to have a significant effect on the discharge of pollutants to the waters of the state and that has not otherwise been addressed in the SWPPP.

- Inspections or investigations by site operators, local, state, or federal officials indicate the SWPPP is proving ineffective in eliminating or significantly minimizing pollutants, or is otherwise not achieving the general objectives of controlling pollutants in storm water discharges associated with construction activity.

- Any new operator (typically contractor and/or subcontractor) has been identified as needed to reflect operational or design control that will implement a measure of the SWPPP.

- Measures need to be included to prevent a negative impact to legally protected federal or state-listed fauna or flora (or species proposed for such protection).

Amendments to the SWPPP may be reviewed by the TDEC, the City of Memphis, or an authorized regulatory agency. In the event that a release of a reportable quantity of hazardous substances or oil occurs, this SWPPP will be reviewed. The review will identify measures to prevent the recurrence of such releases, and the SWPPP will be modified where appropriate to include these measures. In accordance with state regulations, all revisions and/or modifications to the SWPPP will be reviewed and certified by an official of MSCAA who meets the signatory requirements as previously described.

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MSCAA requires that all construction activity on airport property must be in compliance with TDEC and City of Memphis requirements. All recommended techniques and materials, along with guidelines on implementation and use are provided in the following documents:

MSCAA recommends that all Contractors working on MSCAA property become fully educated on the contents of this documents and request assistance from both organizations if questions or concerns arise.

TDEC Erosion and Sediment Control Handbook

http://tnepsc.org/handbook.asp

City of Memphis Storm Water Control website

http://www.cityofmemphis.org/Portals/0/pdf_forms/001-Volume1_PolicyManual.pdf

MSCAA maintenance expectations, at a minimum, throughout the entire project:

Temporary Seeding and Planting

- Ensure proper calculation of seeding rate, based on seed purity and germination information
- Inspect frequently to verify that vegetation is growing
- Reseed areas to prevent sheet and rill erosion
- Spot seed in small areas

Permanent Seeding and Planting

- Ensure proper calculation of seeding rate, based on seed purity and germination information
- Inspect frequently to verify that vegetation is growing
- Reseed areas to prevent sheet and rill erosion
- Spot seed in small areas

Soil Binders

- Apply according to manufacturer's specification
- Apply stabilizers/tackifiers with sufficient drying time before rainfall (typically 24 hours)
- Select a product that is best suited for the area installed (considering longevity, curing time, resistance to abrasion, and compatibility with existing vegetation)
- Soil binders must be maintained by reapplying in high traffic areas, after storm events, or after being in-place for an extended period.

Mulches

- Inspection of the application should be performed along with other regularly scheduled erosion and sediment control inspections.
- Any areas that have washed out due to high storm water flows should be reconsidered for different BMP use, or at least retreated.
- Areas that have been disturbed by blowing wind should be retreated.
- Maintenance needs identified in inspections or by other means shall be accomplished before the next storm event if possible, but in no case more than 7 days after the need is identified.

Silt Fence

Silt fence stake pockets should be placed on the uphill side of the sediment fence, so if the stitching of the pocket pulls out, the fabric will still drape against the stakes. The bottom of the fabric of the fence should be trenched into the ground, or else water and sediment can flow under the sediment fence. The silt fence should be placed on the contour, or else a "flume" will be created where flow and sediment can concentrate. A failure is likely to occur at such a concentration point and the flume will release concentrated flow and sediment down the face of the slope. Silt fence is designed for sheet flow only and should never be placed over concentrated flows, such as channels or streams. Silt fence is designed for relatively small drainage areas and should not be placed at the bottom of a large drainage area that will overwhelm the sediment fence in the first storm event.

- Sediment fences should be cleaned of accumulated sediment after each major storm, or when deposition is one-half of the barrier height.

- Breaks or overtopped areas should be replaced or repaired immediately. Fences should be repaired and the accumulated sediment dispersed to a stable area.

- Sediment fence should be removed when the area being protected is fully stabilized and prior to termination of permit coverage.

Storm Drain Inlet Protection

Using inlet protection measures that divert flow, rather than filter flow, can result in flooding of adjacent areas, or overwhelming adjacent inlets. Common problems are bypassing of inlet protection due to insufficient packing of the ends of Biofilter bags and bypassing of the inlet protection due to overflow slots on drain inlet insert devices.

Inlet filters for storm drains should be inspected and cleaned after each significant storm event and repaired promptly. Sediment shall be removed after each significant storm event and deposited in a stable area where it will not be subject to erosion.

If the inlet protection device becomes clogged with sediment, it must be carefully removed from the inlet and either cleaned or replaced.

Temporary Sediment Basin

- Constructing a basin that is too wide and not long enough can result in short-circuiting of the basin and discharge of sediment out of the basin.

- Temporary and post-construction sediment basins should be cleaned of accumulated sediment after every significant storm event, or when sediment reaches the basin capacity as designed in the EPSCP.

- Removed sediment shall be properly disposed in a stable area that is not susceptible to erosion.

Entrance/Exit Tracking Controls

- While gravel for temporary construction entrances should be coarse enough to shake loose soil that adheres to the vehicles' wheels and undercarriage, it should not be so coarse and angular that it causes damage to tires.

- Stabilized gravel construction entrances shall be inspected for the transport of sediment onto public rights-of-way and any tracked sediment shall be removed immediately by vacuum sweeping and not washed off by water trucks. If tracking is an ongoing problem, a wheel wash facility should be added to the site.

Entrance/Exit Tire Wash

- Installation of tire wash with other entrance/exit tracking controls to reduce sediment loading on tire wash

Remove accumulated sediment from tire wash

Diversion of Run-On

- Diversion channels must be properly sized to convey design flows around disturbed soil areas or other areas of concern.

- Diversion measures must be maintained to remove debris and sediment, repair linings, and replace lost rip rap as needed.

Check Dams

- Place check dams or barriers so that the abutments are at a higher elevation than the center of the barrier so that flow around the ends of the barrier does not occur. Trench the bottom of the check dam or barrier so that undermining of the barrier does not occur.

- Check dams should be checked for undermining and/or short-circuiting and repaired or replaced if necessary.

- Check dams should be cleaned after each significant storm event or when accumulated sediment reaches one-half the height of the check dam.

- Check dams should be keyed into the channel banks a minimum of 18 inches to prevent flow around the dam or as designed in the EPSCP.

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IMMEDIATE RESPONSE PROCEDURES
ON-SCENE PERSONNEL

1. Initiate evacuation, if necessary.

2. Notify MSCAA Environmental Manager at (901) 922-8754 or Airport Police at (901) 922-8298, and report the following information, if it is known or can reasonably be determined:

- Name of individual reporting spill
- Location of spill
- Number of injured personnel and number of injuries, if applicable
- Substance spilled
- Estimated amount spilled
- Estimated rate at which material is currently spilling
- Estimated time of spill occurrence
- Extent of spill travel
- Necessity of fire department to respond to protect life, property, and environment
- Any additional pertinent information such as other potential hazards.

3. Stop spill flow when possible without undue risk of personal injury.

4. Contain the spill using whatever means is readily available.

5. Make spill scene OFF LIMITS to unauthorized personnel.

6. Restrict all sources of ignition when flammable substances are involved.

7. Report to the emergency spill response designee upon his/her arrival to the scene.

EMERGENCY NOTIFICATIONS AND RESPONSE RESOURCES

Table D-1 contains installation and local phone numbers that are to be used to alert personnel of the incident or to request additional assistance.

Table D-1
Emergency Telephone Numbers

Prioritized Contact List	Response Role	Contact Timeline	Day Phone	24-Hour Phone
USEPA, Region 4, Emergency Response (24-hour Hotline)	Regulator	As indicated in Table D-2	(404) 562-8700	(404) 562-8700
U.S. Coast Guard, 8th District Marine Safety Office (for coastal waters)	Regulator	As indicated in Table D-2	(901) 544-3912 x2122	(901) 544-3912 x2122 or (866) 777-2784
Tennessee Department of Environment & Conservation (TDEC) Memphis Office	Regulator	As indicated in Table D-2	(901) 371-3000	(800) 262-3300
TN Emergency Management Agency (TEMA) 24-hr	Regulator	As indicated in Table D-2	(800) 262-3300 or (615) 741-0001	(800) 262-3300
National Response Center www.nrc.uscg.mil	Receiver of all reports of spills to waters of the U.S., or potential to affect waters.	Immediately	(800) 424-8802	(800) 424-8802
City of Memphis Storm Water	Regulator	As indicated in Table D-2	(901) 576-4349	(901) 576-6721 (hotline)
City of Memphis POTW	Regulator	As indicated in Table D-2	(901) 353-2392	
Shelby County Storm Water Hotline	Regulator	As indicated in Table D-2	(901) 545-3870	
City of Memphis Fire Department and Local Emergency Planning Committee (LEPC) within 15 minutes of spill	Emergency Assistance MFD Hazmat	Immediately As needed	911 (901) 320-5368	911 (901) 320-5368
City of Memphis Fire Department	Emergency Assistance	As needed	(901) 458-3311	(901) 458-3311
YOUR on call first responders	Spill Response Contractor	As needed	TBD	TBD
MLGW Emergency	Utility Issues	As needed	(901) 528-4465	(901) 528-4465
Local Health Department	Public Health Concerns	As needed	(901) 576-7600	(901) 576-7600

Note:
The NRC will notify the U.S. Coast Guard and USEPA.

NOTIFICATION REQUIREMENTS

Table D-2 provides a cross-reference matrix that identifies specific release scenarios and associated reporting and notification requirements, including respective timeframes.

Table D-2
Notification Requirements

Scenario #	Basis For Reporting	Agencies To Contact	Time Frame For Contact	Information To Be Provided
1	Discharge of Petroleum Product to the Grass/Soil — A 25-gallon or greater release of petroleum product to grassy or soil areas must be reported.	A	Within 24 hours	• Location, source(s), time, and duration of the release • Chemical name or identity and of any substance involved in the release • Estimate of the quantity (pounds or gallons) released • The medium (land, water, or air) in which the release occurred or exists • Extent of the release • Any known or anticipated acute or chronic health risks with the release and advice regarding medical attention necessary for exposed individuals • Proper precautions to take as a result of the release or discharge, including evacuation and other proposed response actions • The name and telephone number of the person(s) to be contacted for further information
2	Discharge of Petroleum Product to Surface Water — A discharge of petroleum product that violates 40 CFR 110.6 must be reported. This is basically any amount of petroleum product that reaches surface water (overland or through sewers).	A, B, C, D, E, G	Immediately	Same as Scenario 1 with these additions: • Location of spill and name of receiving water Shelby County Code Section 30-62 requires a written report within 5 days to Memphis and Shelby Emergency Management Agency at: Manager, P.O. Box 111249, Memphis 38111. The following particulars must be included in the report: • A description of the discharge, including an estimate of the volume. • The exact dates, times, and duration of the discharge. • Steps being taken to eliminate and prevent recurrence. • A site drawing showing the location of the spill, direction of flow, and topographical grade of the property, the impacted watercourse(s), and the properties adjacent to the spill site.

Notes:

A Tennessee Emergency Management Agency — (800) 262-3300/Local TDEC Office (901) 368-7939
B NRC — (800) 424-8802
C USEPA, Region 4 — (404) 562-8700 (NRC will call)
D U.S. Coast Guard, 8th District Marine Safety Office — (901) 544-3912 x2122 (NRC will call)
E Memphis-Shelby Emergency Management Agency /City of Memphis Fire Department — (901) 458-1515 / 911
F City of Memphis' WWTP — (901) 353-2392
G City of Memphis or Shelby County Storm Water Hotline — City at (901) 576-6721 / County at (901) 545-3870

Table D-2 Notification Requirements				
Scenario #	**Basis For Reporting**	**Agencies To Contact**	**Time Frame For Contact**	**Information To Be Provided**
4	Discharge of Petroleum Product to Surface Water in Excess of 1,000 gal.— If the facility has a spill in 1,000 gal or has two spills that violate 40 CFR 110.6, a report to the USEPA Regional Administrator is required (40 CFR 112.4).	A, B, C, E, G A, C	Immediately Within 3 days of event that violates 40 CFR 112.4	Same as Scenario 2 Written report that describes: • Name of facility • Name(s) of the owner or operator of the facility • Location of the facility • Date and year of initial facility operation • Maximum storage or handling capacity of the facility and normal daily throughput • Description of the facility, including maps, flow diagrams and topographic maps • A complete copy of the SPR Plan with any amendments • The cause(s) of such spill, including a failure analysis of system or subsystem in which failure occurred • The corrective actions and/or countermeasures taken, including an adequate description of equipment repairs and/or replacements • Additional preventive measures taken or contemplated to minimize the possibility of reoccurrence • Such other information as the Regional Administrator may reasonably require pertinent to the Plan or spill event
5	Spill of Hazardous Substances in Excess of the Reportable Quantity — Table 302.4 (40 CFR 302.4 and Attachment K of this SPR) lists the spill quantity of hazardous substances that triggers reporting under 40 CFR 302. (Use "Final RQ" column) If a hazardous substance does not have a reportable quantity, use 100 pounds.	A, B, C, G E	Immediately Within 2 hours	• Facility name and address • Reporter's name and phone number • Type and quantity of material spilled • Time of spill • Is spill continuing? • Location of spill • Current response action
6	Discharge to Sanitary Sewer — Accidental spill of petroleum product, hazardous waste/material, or any other material which by reason of their nature or quantity are sufficient to cause fire or explosion or be injurious in any other way to the sewerage system or to the operation of the waste reclamation facilities.	A, E, F B, E	Immediately Immediately (depending upon substance and quantity)	• Facility name and address • Reporter's name and phone number • Type and quantity of material spilled • Time of spill • Is spill continuing? • Location of spill • Current response action

Notes:

A Tennessee Emergency Management Agency — (800) 262-3300/Local TDEC Office (901) 368-7939
B NRC — (800) 424-8802
C USEPA, Region 4 — (404) 562-8700 (NRC will call)
D U.S. Coast Guard, 8th District Marine Safety Office — (901) 544-3912 x2122 (NRC will call)
E Memphis-Shelby Emergency Management Agency / City of Memphis Fire Department — (901) 458-1515 / 911
F City of Memphis' WWTP — (901) 353-2392
G City of Memphis or Shelby County Storm Water Hotline — City at (901) 576-6721 / County at (901) 545-3870

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GEOTECHNICAL EXPLORATION
GLYCOL MANAGEMENT PROGRAM
CONTROL FACILITY
MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

Prepared for:

ROSS-WITT, PLLC
BARTLETT, TENNESSEE

Prepared by:

GEOTECHNOLOGY, INC.
MEMPHIS, TENNESSEE

Date:

MARCH 30, 2021

Geotechnology Project No.:

J038221.01

SAFETY
QUALITY
INTEGRITY
PARTNERSHIP
OPPORTUNITY
RESPONSIVENESS

GEOTECHNOLOGY INC
FROM THE GROUND UP

March 30, 2021

Mr. Benjamin Witt
Principal Architect
Ross-Witt, PLLC
6500 Stage Road, Suite 3
Bartlett, Tennessee 38154

Re: Geotechnical Exploration
Glycol Management Program Control Facility
Memphis International Airport
Memphis, Tennessee
Geotechnology Project No. J038221.01

Dear Mr. Witt:

Presented in this report are the results of the geotechnical exploration performed by Geotechnology, Inc. for the referenced project. The report includes our understanding of the project, observed site conditions, conclusions and/or recommendations, and support data as listed in the Table of Contents.

We appreciate the opportunity to provide geotechnical services for this project. If you have any questions regarding this report, or if we can be of any additional service to you, please do not hesitate to contact us.

Respectfully submitted,

GEOTECHNOLOGY, INC.

Amber S. Meadows
Project Engineer

Dale M. Smith, P.E.
Geotechnical Manager

DALE SMITH
REGISTERED ENGINEER
XVI
AGRICULTURE
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3/30/21

ASM/DBA/DMS:asm

Copies submitted: Client (email)

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MEMPHIS INTERNATIONAL AIRPORT
MEMPHIS, TENNESSEE

March 30, 2021 | Geotechnology Project No. J038221.01

1.0 INTRODUCTION

Geotechnology, Inc. has prepared this geotechnical exploration report for Ross-Witt, PLLC for the proposed Glycol Management Program Control Facility in Memphis, Tennessee. Our services documented in this report were provided in general accordance with our scope of services as discussed in our Proposal P038221.01, dated January 25, 2021. Our services were authorized by your signed acceptance of our terms on February 8, 2021.

The purposes of the geotechnical exploration were to develop a general subsurface profile at the site and prepare recommendations for the geotechnical aspects of the design and construction of the project as defined in our proposal. Our scope of services included site reconnaissance, geotechnical borings, laboratory testing, engineering analyses, and preparation of this report.

A copy of "Important Information about This Geotechnical-Engineering Report," published by the Geotechnical Business Council of the Geoprofessional Business Association, is included in Appendix A for your review. The publication discusses report limitations and ways to manage risk associated with subsurface conditions.

2.0 SITE DESCRIPTION

The site is located on Louis Caruthers Drive, approximately ½-mile north of its intersection with Shelby Drive in Memphis, Tennessee as shown on Figure 1 (Site Location and Topography) in Appendix B. The site is bound to the north, east, south, and west by airport property; Louis Carruthers Drive borders the western edge of the site. Based on site reconnaissance performed by our representative, construction and mass grading is currently being performed along the east and west sides of Louis Carruthers Drive.

3.0 PROJECT INFORMATION

The project consists of the design and construction of a single-story building with an attached, three-story tower located in the northwest corner of the proposed building footprint. Associated parking and drive areas are planned around the perimeter of the building. Based on the provided plans, the proposed building will be expanded in the future. The information included in this geotechnical exploration should only be applied in design of these structures.

We understand the site has been graded and is at or near design grades. Based on the review of the provided grading plans[1], the finished grade across the site generally slopes downward to the northwest with final elevations ranging from approximately El[2] 318 to El 309; the FFE of the proposed building is El 314.5. Loading information was not provided. Based on our experience with similar projects, we have assumed maximum column and wall loads of 100 kips and 3 kips per linear foot (klf), respectively.

4.0 GEOTECHNICAL EXPLORATION

The geotechnical exploration consisted of nine borings, designated as Borings B-1 through -9. Borings B-2, -4 through -6, -8, and -9 were located in the footprint of the proposed building; Borings B-1, -3, and -7 were located in the proposed parking areas. The borings were located in the field by the client. The boring locations shown on Figure 2 (Aerial Photograph of Site and Boring Location) in Appendix B are approximate. The elevations shown on the boring logs in Appendix C were provided by client.

The borings were drilled March 10 through 26, 2021 using an ATV-mounted rotary drill rig (CME 750X) advancing hollow-stem augers as indicated in the boring logs presented in Appendix C. Sampling of the soils was accomplished ahead of the augers at the depths indicated on the boring logs, using 2-inch-outside-diameter (O.D.) split-spoons and 3-inch-O.D., thin-walled Shelby tube samplers in general accordance with the procedures outlined by ASTM D1586 and ASTM D1587m respectively. Standard Penetration Tests (SPTs) were performed using an automatic hammer to obtain the standard penetration resistance, or N-value[3], of the sampled material.

The drill crew kept a field log of the subsurface profile noting the soil types and stratifications, groundwater, SPT results, and other pertinent data. Observations for groundwater were made in the borings during drilling.

Representative portions of the split-spoon samples were placed in glass jars to preserve sample moisture. The Shelby tubes were capped and taped at their ends to preserve sample moisture and unit weight, and the tubes were transported and stored in an upright position. The glass jars and Shelby tubes were marked and labeled in the field for identification, then returned to our laboratory in Memphis.

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[1] Sheet titled, *Glycol Management Program – Control Facility*, *Grading and Drainage Plan*, drawn by Kimley Horn, dated November 6, 2020.

[2] Elevations are referenced in feet; datum not provided and assumed to be mean sea level (msl).

[3] The standard penetration resistance, or N-value, is defined as the number of blows required to drive the split-spoon sampler 12 inches with a 140-pound hammer falling 30 inches. Since the split-spoon sampler is driven 18 inches or until refusal, the blows for the first 6 inches are for seating the sampler, and the number of blows for the final 12 inches is the N-value. Additionally, “refusal” of the split-spoon sampler occurs when the sampler is driven less than 6 inches with 50 blows of the hammer.

5.0 LABORATORY REVIEW AND TESTING

Laboratory testing was performed on soil samples to assess engineering and index properties. The soil testing consisted of moisture contents (ASTM D2216), Atterberg limits (ASTM D4318), and unconsolidated-undrained triaxial compression (UU; ASTM D2850). Most of the laboratory test results are presented on the boring logs in Appendix C. The Atterberg limit and UU test results are also provided in Appendix D.

The boring logs were prepared by a geotechnical engineer from the field logs, visual classifications of the soil samples in the laboratory, and laboratory test results. Terms and symbols used on the boring logs are presented in the Boring Log: Terms and Symbols in Appendix C. Stratification lines on the boring logs indicate approximate changes in strata. The transition between strata could be abrupt or gradual.

6.0 SUBSURFACE CONDITIONS

6.1 Stratigraphy

From the ground surface, the soil stratigraphy in the borings consisted of predominantly fine-grained soils underlain by predominantly coarse-grained soils to the boring termination depths with the exception of Borings B-2 and -3. Fine-grained soils extended from the ground surface to the 20-foot boring termination depth in Borings B-2 and -3. More specific descriptions of the soil layers are provided below and on the boring logs in Appendix C.

Predominately Fine-Grained Soils. Soils classified as soft to very stiff, low plasticity, lean clay (CL) and high plasticity, fat clay (CH) with varying amounts of sand and gravel were encountered from the surface to depths ranging from 3 to 20 feet. Moisture contents of the tested samples ranged from 16 to 30 percent. Atterberg limits performed on select samples yielded liquid limits (LL) of 27 to 39 percent and plasticity indices (PI) of 13 to 20 percent. The UU test performed on a relatively undisturbed Shelby tube samples yielded undrained shear strength of 1,760 and 1,820 pounds per square foot (psf). SPT N-values measured in the fine-grained soils ranged from 2 to 18 blows per foot (bpf). The results of field and laboratory testing are indicative of soft to very stiff consistencies.

Predominately Coarse-Grained Soils. Soils classified as loose to very dense clayey sand (SC), intermixed sand (SP-SC) with varying amounts of gravel and clayey gravel (GC) were encountered below the fine-grained soils in Borings B-1 and -4 through -9 and extended to a maximum depth of 30 feet. SPT N-values measured in the coarse-grained soils ranged from 9 to 22 bpf, indicative of loose to medium dense conditions.

6.2 Groundwater

Groundwater was encountered in Boring B-5 at a depth of approximately 28 feet during drilling operations. Groundwater levels vary over time due to the effects of seasonal variations in precipitation or other factors not evident at the time of exploration.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Geotechnology has prepared the following conclusions and recommendations based on our understanding of the proposed project, the field and laboratory data presented in this report, engineering analyses, and our experience and judgment.

7.1 Site Preparation and Earthwork

Based on the provided information, the site has been graded and is at or near design elevations. The following paragraphs outline site grading recommendations for the site, if required.

Site Preparation. In general, cut areas and areas to receive new fill should be stripped of topsoil, vegetation, soft soils, and other deleterious materials. Topsoil should be placed in landscape areas or disposed of off-site. Vegetation and tree roots should be over-excavated.

The exposed subgrade should be proof-rolled with a tandem axle dump truck loaded to approximately 20,000 pounds per axle (or equivalent proof-rolling equipment). Soft areas that develop should be over-excavated and backfilled with soil compacted to the densities specified in subsequent paragraphs.

Cut Areas. After excavation, the top 6 inches of the resulting subgrade should be compacted to a minimum of 98% of the maximum dry unit weight as determined by a standard Proctor test (ASTM D 698).

Fill Materials, Placement, and Compaction. Fill material should consist of natural soils classifying as silt, lean clay, silty sand, or clayey sand (ML, CL, SM, or SC), have a maximum LL of 45 and a PI of no more than 20. Such materials should be free from organic matter, debris, or other deleterious materials, and have a maximum particle size of 2 inches. The onsite, surficial soils generally meet these criteria.

Fill and backfill should be placed in level lifts, up to 8 inches in loose thickness. For soils that exhibit a well-defined moisture density relationship, each lift should be moisture-conditioned to within the acceptable moisture content range provided in Table 1, and compacted to at least the minimum percent compaction indicated in Table 1. Moisture-conditioning can include: aeration and drying of wetter soils; wetting drier soils; and/or mixing wetter and drier soils into a uniform blend. For granular soils that do not exhibit a well-defined moisture density relationship, the soils should be compacted to at least the minimum relative densities indicated in Table 2. Thinner lifts should be used for lighter compaction equipment.

Table 1. Percent Compaction and Moisture-Conditioning Requirements for Fill and Backfill.

Area	Minimum Percent Compaction[a,b]	Acceptable Moisture Content Range[c]
Structural[d]	95%	±2%
Non-structural	92%	±2%
Pavement subgrades	98%	±2%

[a] In reference to the standard Proctor maximum dry unit weight measured by ASTM D698.
[b] For granular soils that do not exhibit a well-defined moisture-density relationship, refer to Table 2 for minimum relative density requirements.
[c] In reference to optimum moisture content as measured by ASTM D698.
[d] Structural fill and backfill for foundations are defined as fill and backfill located within the zones of influence of structures. The zone of influence of a structure is defined as the area below the footprint of the structure and 1V:1H outward and downward projections from the bearing elevation of the structure.

Table 2. Relative Density Compaction Requirements for Granular Fill and Backfill.

Area	Minimum Relative Density[a,b]
Structural[c]	70%
Non-Structural	70%
Pavement Subgrades	75%

[a] Relative density evaluated from the maximum and minimum index densities measured by ASTM D4253 and D4254, respectively.
[b] For granular soils that exhibit a well-defined moisture density relationship, refer to Table 1 for minimum percent compaction and moisture-conditioning requirements.
[c] Structural fill and backfill for foundations are defined as fill and backfill located within the zones of influence of structures. The zone of influence of a structure is defined as the area below the footprint of the structure and 1V:1H outward and downward projections from the bearing elevation of the structure.

Maintaining the moisture content of bearing and subgrade soils within the acceptable range provided in Table 1 is important during and after construction for the proposed structures. Silty and clayey bearing and subgrade soils should not be allowed to become wet or dry during or after construction, and measures should be taken to hinder water from ponding on these soils and to reduce drying of these soils.

Asphalt, concrete, or fill should not be placed over frozen or saturated soils, and frozen or saturated soils should not be used as compacted fill or backfill. Upon completion of earthwork, disturbed areas should be stabilized.

Site Water Management. Managing site water is important in successful performance of the pavement and foundation systems. Water from surface runoff, downspouts, and subsurface drains should be collected and discharged through a storm water collection system. Positive drainage should be established around the proposed structures to promote drainage of surface water away from the structures and reduce ponding of water adjacent to these structures.

Vegetation. Trees and other, deep-rooted vegetation should not be planted within 1.5 times their projected mature foliage radius from foundations, as their roots extract moisture from plastic and low-plastic soils alike, causing them to shrink, which can potentially result in foundation settlement. Shrubs and flowerbeds should be located a minimum of 5 feet away from the perimeter of foundations.

7.2 Seismic Site Classification and Seismic Design Parameters

The site lies within the influence of the New Madrid Seismic Zone (NMSZ). It is our understanding the proposed construction will be designed in accordance with the 2015 International Building Code (IBC) and Chapter 20 of the ASCE 7-10. The 2015 IBC/ASCE 7-10 stipulates structures be designed based an earthquake event with a probability of exceedance of 2% in 50 years. Based on the results of the field and laboratory testing, our experience in the vicinity, and our interpretation of the 2015 IBC/ASCE 7-10, it is our opinion that the site class and seismic parameters in Table 3 are applicable for this project.

Table 3. Site Class and Seismic Parameters.

Category/ Parameter	Designation/ Value	Reference
S_S	0.839g[a]	Latitude 35.028612°N/Longitude 89.981386°W
S_1	0.297g[a]	
Seismic Site Class	D	Chapter 20 of ASCE 7-10
F_a	1.164	2015 IBC Table 1613.3.3(1)
F_v	1.806	2015 IBC Table 1613.3.3(2)
F_{PGA}	1.026	ASCE 7-10 Table 11.8-1
S_{MS}	0.977g	2015 IBC Equation 16-37
S_{M1}	0.536g	2015 IBC Equation 16-38
S_{DS}	0.651g	2015 IBC Equation 16-39
S_{D1}	0.358g	2015 IBC Equation 16-40
PGA	0.474g	ASCE 7-10 Figure 22-7
PGA_M	0.486g	ASCE 7-10 Equation 11.8-1

* S_S and S_1 were computed using the web-based U.S. Seismic Design Maps (http://earthquake.usgs.gov/designmaps/us/application.php) using the indicated latitude and longitude coordinates of the project site.

7.3 Shallow Foundations

Loading information was not provided. We have assumed maximum column and wall loads of 100 kips and 3 kips per lineal foot, respectively. If column and wall loads exceed those reported, Geotechnology should be contacted to revise recommendations.

Shallow foundations can be proportioned using maximum net allowable bearing capacities of 2,400 and 2,000 pounds per square foot (psf) for spread and strip footings, respectively. Total and differential settlement of shallow foundations are anticipated to be less than 1 inch and ¾ of an inch, respectively. These recommendations are based on footing excavations being observed by the geotechnical engineer or their representative and soft soils being mitigated as

recommended in the Site Preparation and Earthwork section of this report. Additional recommendations may be required based on the results of the foundation observations.

Footing excavations should be made with a smooth-edged backhoe bucket, and foot traffic in the bottom of the excavation should be minimized. Footing excavations should be extended through zones of soft soil, if encountered; the over-excavations can be backfilled with compacted fill, lean concrete, or flowable fill.

For exterior footings, we recommend that the footings bear a minimum of 18 inches below finish grade. An additional 6 inches of embedment is recommended if the erosion of the cover material is not controlled. Drainage should be maintained away from the foundations throughout the life of the structure. Water should never be allowed to pond against the footings.

7.4 Floor Slabs

The slab-on-grade floors should be supported on stable subgrade or compacted fill. The subgrade should be prepared as recommended in the Site Preparation and Earthwork section of this report. The floor slab should be underlain by a minimum 4-inch-thick layer of granular material to serve as a capillary break and a base of support. The granular material layer should be compacted per the requirements of Table 2. The top 8 inches of floor slab subgrade should be compacted and moisture-conditioned per the requirements presented in Table 1 prior to placing the granular layer. As an alternative to the 4-inch thick, granular layer, the upper 6 to 8 inches of the floor slab subgrade can be treated with soil cement.

Care should be taken during slab-on-grade construction to not allow the subgrade to become desiccated or saturated. Additionally, consideration should be given to the timing of construction relative to the time of year and weather. If slab construction is performed during relatively cold and wet weather, lime- or cement-treatment of the subgrade could be beneficial to maintain progress during construction. Otherwise, the subgrade could be weakened by softening from saturation by rain and/or snow, leading to delays in reworking the subgrade to prepare it back to its pre-softened condition.

It is recommended control joints be provided within the concrete slab-on-grade floors. These joints should be sealed to mitigate surface water infiltration until the building is enclosed. The floor slab should be structurally separated from walls, columns, footings, and penetrations to allow independent movement of the floor. Alternatively, floor slabs that are not structurally independent should be designed to allow for differential movements of that normally occur between the floor slabs, columns, and foundation walls.

A 6- to 15-mil plastic sheet should be placed below the floor to reduce the potential for moisture to permeate the slab and the potential for mold growth within the building. Some designers prefer not to place a vapor barrier directly beneath the concrete floor because it could affect the curing of the concrete, resulting in “curling” of the slab. This concern can be addressed by embedding the vapor barrier in or below the crushed rock layer below the slab.

7.5 Pavements

Pavements are to be placed on stable in situ soil or compacted fill. The pavement subgrade should be proof-rolled and prepared as recommended in the Site Preparation and Earthwork section of this report. Once the subgrade is prepared, it should be promptly paved to protect it from the weather, as the naturally occurring soils in the area are susceptible to changes in the moisture content.

Vehicle loads and traffic patterns were not provided. The following recommendations are based on the soils encountered in the borings and our experience with similar projects. Geotechnology should be contacted if additional pavement designs are required.

Light-Duty, Flexible Pavement. We have assumed a light-duty, flexible pavement structure will be required for certain portions of the parking and drive areas. We recommend a 2-inch-thick asphalt concrete pavement be constructed over an 8-inch-thick soil cement treated base, or an 8-inch compacted, crushed stone layer.

Heavy-Duty, Flexible Pavement. A heavy-duty, flexible pavement structure may be required for portions of the parking and drive areas. We recommend a minimum 3-inch asphalt concrete pavement be constructed over a 10-inch soil cement treated base, or a 10-inch compacted, crushed stone layer.

Rigid Pavement. We have assumed rigid pavements may be required for portions of the parking and driveway areas. We recommend a 4-inch thick Portland cement concrete pavement be constructed over a 7-inch thick soil cement treated base, or a 7-inch compacted, crushed stone layer. The 28-day compressive strength of the concrete should be a minimum of 4,000 psi. For dumpster pads or areas that will support heavier vehicles, a 7-inch-thick Portland cement concrete pavement should be constructed over a 4-inch aggregate base or 6-inch soil cement base.

7.6 Utility Construction

Settlement of trench backfill can result in unsightly depressions and localized pavement failures. The magnitude of settlement can be reduced by mechanically compacting the trench backfill. Select granular backfill can be used for pipe bedding and minimum cover for utilities. The remainder of the utility trenches should be backfilled with flowable fill or compacted clayey soils up to the design subgrade elevation to reduce the potential for water collecting in these trenches and being absorbed by the surrounding clays, causing heave of foundations, slabs, pavement, etc.

Granular bedding and backfill that exhibits a well-defined moisture density relationship should be compacted and moisture-conditioned per the requirements presented in Table 1; otherwise, the granular material should be compacted to at least the minimum relative densities indicated in Table 2 in the Site Preparation and Earthwork section of this report.

Utility trench backfill should be placed in 6- to 8-inch thick lifts with each lift compacted to at least the specified degree of compaction. Thinner lifts should be used for lighter compaction equipment. The backfill should not be flushed with water in an attempt to obtain compaction.

For utilities within the perimeters of the proposed building, one of the following options can be implemented to further reduce the potential for water collecting in the utility trenches:

1. Use flowable fill in place of granular bedding and pipe zone backfill around utility pipes. Provisions should be implemented during construction to keep the pipes from floating in the flowable fill until the flowable fill sets.

2. The bottom of the utility excavation should generally be sloped to drain to a collection pipe (underdrain) in the bottom of the utility excavation at its downstream end. The collection pipe should then connect to an outlet, such as the proposed storm sewer system.

3. The granular bedding and pipe zone backfill should be capped with at least 1 foot of compacted clay backfill prior to the granular bedding and backfill collecting water. Additionally, concrete dams or anti-seepage collars should be provided where the utility crosses beneath the exterior footings of the proposed building. These dams or collars should extend at least 6 inches beyond the sides and bottoms of the utility trenches into the in-situ soils to stop water from migrating underneath the building. If groundwater seepage is observed in the utility excavations, this option should not be implemented, but rather one of the other two options.

Prior to placing the bedding and utilities within the utility trench, soft, saturated, and compressible material should be removed from the bottom of the trench to expose stiff soils.

8.0 RECOMMENDED ADDITIONAL SERVICES

The conclusions and recommendations given in this report are based on: Geotechnology's understanding of the proposed design and construction, as outlined in this report; site observations; interpretation of the exploration data; and our experience. Since the intent of the design recommendations is best understood by Geotechnology, we recommend that Geotechnology be included in the final design and construction process, and be retained to review the project plans and specifications to confirm that the recommendations given in this report have been correctly implemented. We recommend that Geotechnology be retained to participate in pre-bid and preconstruction conferences to reduce the risk of misinterpretation of the conclusions and recommendations in this report relative to the proposed construction of the subject project.

Since actual subsurface conditions between boring locations could vary from those encountered in the borings, our design recommendations are subject to adjustment in the field based on the subsurface conditions encountered during construction. Therefore, we recommend that Geotechnology be retained to provide construction observation services as a continuation of the design process to confirm the recommendations in this report and to revise them accordingly to

accommodate differing subsurface conditions. Construction observation is intended to enhance compliance with project plans and specifications. It is not insurance, nor does it constitute a warranty or guarantee of any type. Regardless of construction observation, contractors, suppliers, and others are solely responsible for the quality of their work and for adhering to plans and specifications.

9.0 LIMITATIONS

This report has been prepared on behalf of, and for the exclusive use of, the client for specific application to the named project as described herein. If this report is provided to other parties, it should be provided in its entirety with all supplementary information. In addition, the client should make it clear that the information is provided for factual data only, and not as a warranty of subsurface conditions presented in this report.

Geotechnology has attempted to conduct the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. The recommendations and conclusions contained in this report are professional opinions. The report is not a bidding document and should not be used for that purpose.

Our scope for this phase of the project did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client. Our scope did not include an assessment of the effects of flooding and erosion of creeks or rivers adjacent to or on the project site.

Our scope did not include: any services to investigate or detect the presence of mold or any other biological contaminants (such as spores, fungus, bacteria, viruses, and the by-products of such organisms) on and around the site; or any services, designed or intended, to prevent or lower the risk of the occurrence of an infestation of mold or other biological contaminants.

The analyses, conclusions, and recommendations contained in this report are based on the data obtained from the geotechnical exploration. The field exploration methods used indicate subsurface conditions only at the specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Consequently, subsurface conditions could vary gradually, abruptly, and/or nonlinearly between sample locations and/or intervals.

The conclusions or recommendations presented in this report should not be used without Geotechnology's review and assessment if the nature, design, or location of the facilities is changed, if there is a lapse in time between the submittal of this report and the start of work at the site, or if there is a substantial interruption or delay during work at the site. If changes are contemplated or delays occur, Geotechnology must be allowed to review them to assess their impact on the findings, conclusions, and/or design recommendations given in this report.

Geotechnology will not be responsible for any claims, damages, or liability associated with any other party's interpretations of the subsurface data or with reuse of the subsurface data or engineering analyses in this report.

The recommendations included in this report have been based in part on assumptions about variations in site stratigraphy that can be evaluated further during earthwork and foundation construction. Geotechnology should be retained to perform construction observation and continue its geotechnical engineering service using observational methods. Geotechnology cannot assume liability for the adequacy of its recommendations when they are used in the field without Geotechnology being retained to observe construction.

APPENDIX A – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

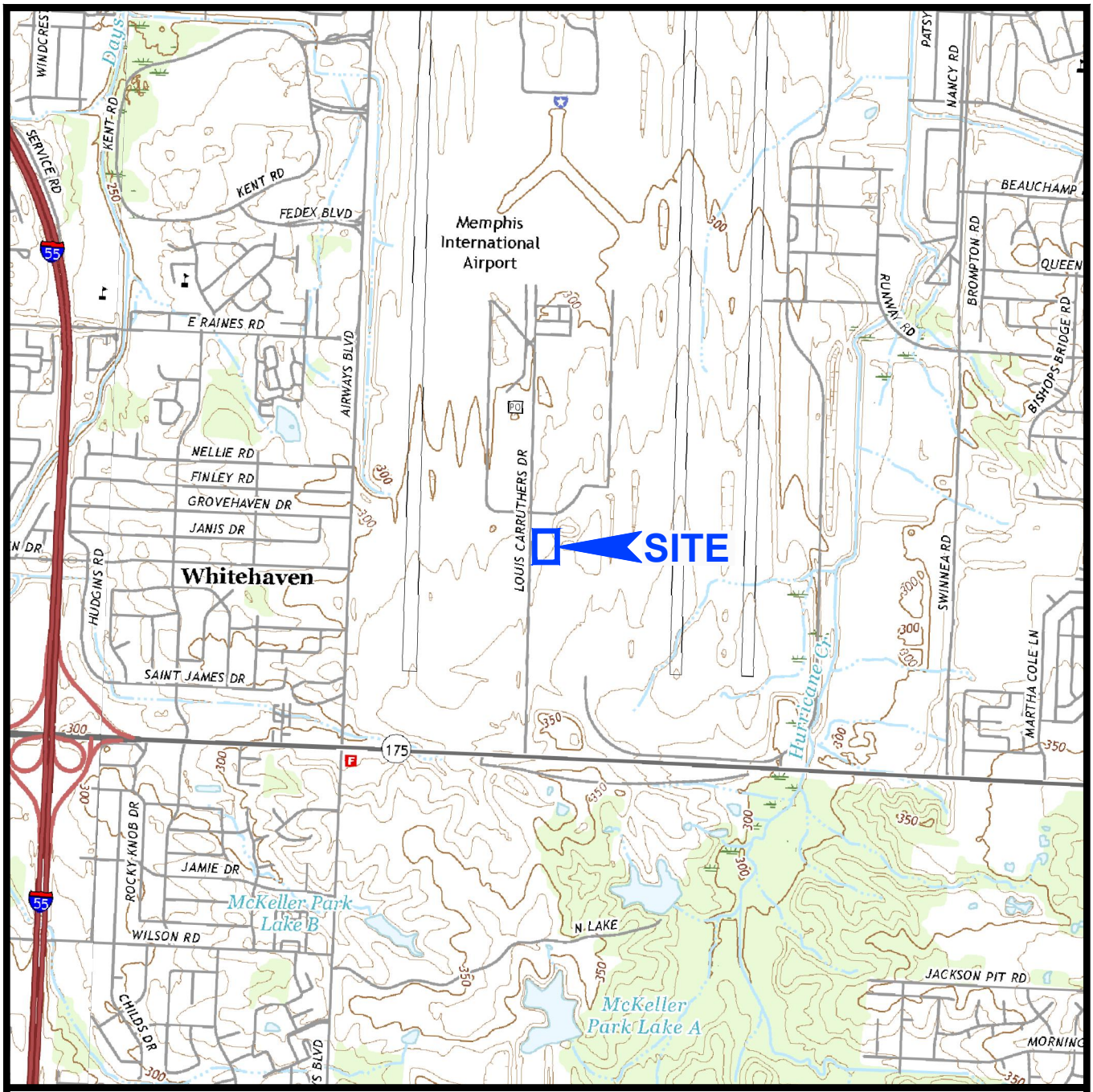
GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

APPENDIX B – FIGURES

Figure 1 – Site Location and Topography

Figure 2 – Aerial Photograph of Site and Exploration Locations



NOTES

1. Plan adapted from 7.5 minute U.S.G.S. maps for Southeast Memphis, Tennessee and Southwest Memphis, Tennessee-Arkansas quadrangles, last revised in 2016.

0 2,000 4,000

SCALE IN FEET

N

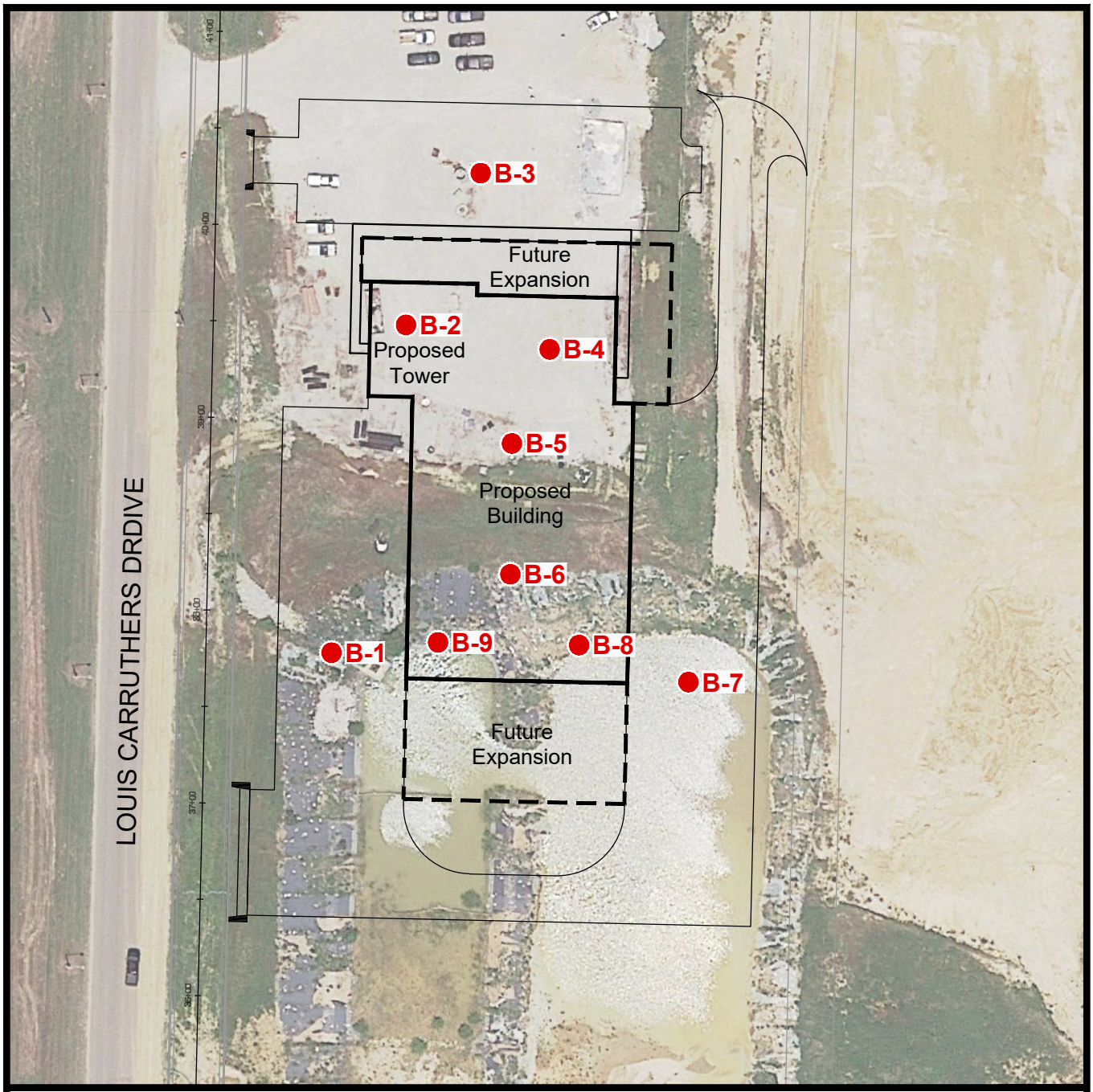
Drawn By: WAH	Ck'd By: ASM	App'vd By: DBA
Date: 3-26-21	Date: 3-29-21	Date: 3-29-21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

SITE LOCATION AND TOPOGRAPHY

Project Number	FIGURE 1
J038221.01	



NOTES

1. Plan adapted from a May 31, 2020 aerial photograph courtesy of Google Earth and a drawing dated November 6, 2020, titled "Geometric Layout Plan", supplied by the client.

2. Borings were located in the field with reference to site features and are shown approximate only.

LEGEND

● Boring Location

0 40 80 160

SCALE IN FEET

N

Drawn By: WAH	Ck'd By: ASM	App'vd By: DBA
Date: 3-26-21	Date: 3-29-21	Date: 3-29-21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS

Project Number	FIGURE 2
J038221.01	

APPENDIX C – BORING INFORMATION

Boring Log Terms and Symbols

Boring Logs

Surface Elevation: 312.1 Completion Date: 3/11/21

Datum NA

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Soft to stiff, gray, LEAN CLAY, trace organics - (CL)			
				2-2-2	SS1
		gravel seam			
				1-1-1	SS2
5	307				
				105	ST3
		little sand			
				2-3-5	SS4
10	302				
		Medium dense, brown and tan, CLAYEY GRAVEL, some sand - GC		7-6-5	SS5
15	297				
		Loose, tan and gray, CLAYEY SAND - SC		3-4-6	SS6
20	292	Boring terminated at 20 feet.			
25	287				
30	282				

SHEAR STRENGTH, tsf

Δ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-1

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC 0638301.GPJ 3/30/21

Surface Elevation: 311.1 Completion Date: 3/10/21

Datum NA

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, brown and gray, silty, LEAN CLAY - CL			
				2-3-5	SS1
				3-3-5	SS2
5	306				
		trace gravel and sand		3-3-4	SS3
		Medium stiff, brown and gray, sandy, LEAN CLAY, trace gravel - CL		2-4-3	SS4
10	301				
		Soft, tan, red and gray, FAT CLAY, trace gravel - CH		2-2-2	SS5
		Sand seam			
15	296				
		Medium stiff, tan, gray and red, sandy, LEAN CLAY - CL		2-2-3	SS6
20	291	Boring terminated at 20 feet.			
25	286				
30	281				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-2

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC 0638301.GPJ 3/30/21

Surface Elevation: 312.3 Datum NA

Completion Date: 3/10/21

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Stiff to medium stiff, brown to brown and gray, silty, LEAN CLAY - CL			
				3-4-5	SS1
				1-3-3	SS2
5	307				
					ST3
		Stiff, brown, sandy, LEAN CLAY - CL		4-4-5	SS4
10	302				
		Medium stiff, tan, gray and red, FAT CLAY - CH sand seam		2-3-4	SS5
15	297				
		Medium stiff, tan, gray and red, sandy, LEAN CLAY - CL		3-5-3	SS6
20	292	Boring terminated at 20 feet.			
25	287				
30	282				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-3

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC 0638301.GPJ 3/30/21

Surface Elevation: 312.8 Datum NA

Completion Date: 3/10/21

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff to stiff, brown and gray, LEAN CLAY - CL			
				1-2-3	SS1
				2-2-3	SS2
5	308				
		trace gravel and sand		3-5-5	SS3
		Stiff, brown, red and gray, sandy, FAT CLAY, trace gravel - CH		3-5-5	SS4
10	303				
		Soft, tan and gray, FAT CLAY - CH			
		sand seam		2-2-2	SS5
15	298				
		Medium dense, tan and gray, CLAYEY SAND - SC		5-8-7	SS6
20	293	Boring terminated at 20 feet.			
25	288				
30	283				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-4

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC 0638301.GPJ 3/30/21

Surface Elevation: 312.8 Datum NA

Completion Date: 3/10/21

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Stiff, brown, LEAN CLAY - CL			
				2-4-5	SS1
		little sand			
				1-3-7	SS2
5	308				
		Stiff, tan, gray and red, sandy, LEAN CLAY - (CL)		4-4-7	SS3
				109	ST4
10	303				
		Soft, tan, gray and red, sandy, FAT CLAY - CH		2-1-2	SS5
15	298				
		Medium dense, tan, gray and red, CLAYEY SAND - SC		3-5-7	SS7
20	293				
		Medium dense, tan and gray SAND, little clay - SP-SC		5-9-10	SS8
25	288		▽		
				6-12-10	SS9
30	283	Boring terminated at 30 feet.			

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 28.5 FEET ▽

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-5

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC 0638301.GPJ 3/30/21

Surface Elevation: 313.1 Datum NA

Completion Date: 3/11/21

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, brown, LEAN CLAY - CL			
				2-2-4	SS1
				2-3-4	SS2
5	308				
		Stiff to medium stiff, tan and red, sandy, FAT CLAY - CH		2-4-5	SS3
				3-4-4	SS4
10	303				
		Medium stiff, tan and gray, FAT CLAY - CH		2-4-3	SS5
15	298				
		Loose, tan, gray and red, CLAYEY SAND. trace gravel - SC		3-3-5	SS6
20	293	Boring terminated at 20 feet.			
25	288				
30	283				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-6

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC 0638301.GPJ 3/30/21

Surface Elevation: 315.2 Datum NA

Completion Date: 3/11/21

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Very stiff, brown and gray, LEAN CLAY, trace gravel - CL			
				3-6-12	SS1
		Medium dense, brown and red, CLAYEY GRAVEL, some sand - GC		6-14-13	SS2
5	310	Boring terminated at 5 feet.			
10	305				
15	300				
20	295				
25	290				
30	285				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-7

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC 0638301.GPJ 3/30/21

Surface Elevation: 314.0 Datum NA

Completion Date: 3/11/21

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Medium stiff, brown and gray, LEAN CLAY - (CL)			
				2-3-4	SS1
		trace gravel			
				1-2-3	SS2
5	309				
		Medium stiff to stiff, brown and gray, sandy, LEAN CLAY - CL		2-2-3	SS3
10	304	trace gravel			
				4-5-5	SS4
15	299				
		Medium dense, brown and gray, CLAYEY SAND - SC		3-5-8	SS5
20	294	Boring terminated at 20 feet.			
25	289				
30	284				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-8

Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC.0638301.GPJ 3/30/21

Surface Elevation: 313.0 Datum NA

Completion Date: 3/11/21

DEPTH IN FEET	ELEVATION IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
		Stiff to medium stiff, gray to brown and gray, LEAN CLAY - CL			
				2-2-3	SS1
				2-4-5	SS2
5	308				
				2-3-4	SS3
10	303				
		little sand			
				2-3-3	SS4
15	298				
		Loose, brown and gray, CLAYEY SAND - SC		3-4-5	SS5
20	293	Boring terminated at 20 feet.			
25	288				
30	283				

SHEAR STRENGTH, tsf

△ - UU/2 ○ - QU/2 □ - SV

0.5 1.0 1.5 2.0 2.5

STANDARD PENETRATION RESISTANCE

(ASTM D 1586)

▲ N-VALUE (BLOWS PER FOOT)

WATER CONTENT, %

PL 10 20 30 40 50 LL

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

X FREE WATER NOT ENCOUNTERED DURING DRILLING

DRILLING DATA

___ AUGER 3 3/4 HOLLOW STEM

WASHBORING FROM ___ FEET

KJB DRILLER WEC LOGGER

CME 750X DRILL RIG

HAMMER TYPE Auto

HAMMER EFFICIENCY 90 %

REMARKS:

Drawn by: EJH	Checked by: ASM	App'vd. by: DBA
Date: 3/12/21	Date: 3/29/21	Date: 3/29/21

GEOTECHNOLOGY INC
FROM THE GROUND UP

Glycol Control Facility
Memphis, Tennessee

LOG OF BORING: B-9

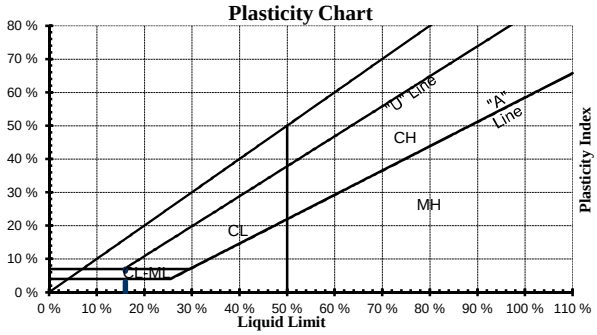
Geotechnology Project No. J038221.01

LOG OF BORING 2002.WL J038221.01.GPJ GTINC.0638301.GPJ 3/30/21

BORING LOG: TERMS AND SYMBOLS

LEGEND

CS	Continuous Sampler
GB	Grab Sample
NQ	NQ Rock Core
PST	Three-Inch Diameter Piston Tube Sample
SS	Split-Spoon Sample (Standard Penetration Test)
ST	Three-Inch Diameter Shelby Tube Sample
*	Sample Not Recovered
PL	Plastic Limit (ASTM D4318)
LL	Liquid Limit (ASTM D4318)
SV	Shear Strength from Field Vane (ASTM D2573)
UU	Shear Strength from Unconsolidated-Undrained Triaxial Compression Test (ASTM D2850)
QU	Shear Strength from Unconfined Compression Test (ASTM D2166)



SOIL GRAIN SIZE

US STANDARD SIEVE

12"	3"	3/4"	4	10	40	200

BOULDERS	COBBLES	GRAVEL		SAND			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		

300	76.2	19.1	4.76	2.00	0.42	0.074	0.005

SOIL GRAIN SIZE IN MILLIMETERS

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			*Symbol*	*Description*
Coarse-Grained Soils (More than 50% Larger than No. 200 Sieve Size)	Gravel and Gravelly Soil	Clean Gravels Little or no Fines	GW	Well-Graded Gravel, Gravel- Sand Mixture
			GP	Poorly-Graded Gravel, Gravel-Sand Mixture
		Gravels with Appreciable Fines	GM	Silty Gravel, Gravel-Sand-Silt Mixture
			GC	Clayey-Gravel, Gravel-Sand-Clay Mixture
	Sand and Sandy Soils	Clean Sands Little or no Fines	SW	Well-Graded Sand, Gravelly Sand
			SP	Poorly-Graded Sand, Gravelly Sand
		Sands with Appreciable Fines	SM	Silty Sand, Sand-Silt Mixture
			SC	Clayey-Sand, Sand-Clay Mixture
Fine-Grained Soils (More than 50% Smaller than No. 200 Sieve Size)	Silts and Clays	Liquid Limit Less Than 50	ML	Silt, Sandy Silt, Clayey Silt, Slight Plasticity
			CL	Lean Clay, Sandy Clay, Silty Clay, Low to Medium Plasticity
			OL	Organic Silts or Lean Clays, Low Plasticity
	Silts and Clays	Liquid Limit Greater Than 50	MH	Silt, High Plasticity
			CH	Fat Clay, High Plasticity
			OH	Organic Clay, Medium to High Plasticity
	Highly Organic Soils		PT	Peat, Humus, Swamp Soil

STRENGTH OF COHESIVE SOILS

Consistency	*Undrained Shear Strength (tsf)*	*Unconfined Comp. Strength (tsf)*
Very Soft	less than 0.125	less then 0.25
Soft	0.125 to 0.25	0.25 to 0.5
Medium Stiff	0.25 to 0.5	0.5 to 1.0
Stiff	0.5 to 1.0	1.0 to 2.0
Very Stiff	1.0 to 2.0	2.0 to 3.0
Hard	greater than 2.0	greater than 4.0

DENSITY OF GRANULAR SOILS

Descriptive Term	*Approximate N_{60}-Value Range*
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	>50

N-Value (Blow Count) is the last two, 6-inch drive increments (i.e. 4/7/9, N = 7 + 9 = 16). Values are shown as a summation on the grid plot and shown in the Unit Dry Weight/SPT column.

RELATIVE COMPOSITION

Trace	0 to 10%
Little	10 to 20%
Some	20 to 35%
And	35 to 50%

OTHER TERMS

Layer - Inclusion greater than 3 inches thick.

Seam - Inclusion 1/8-inch to 3 inches thick

Parting - Inclusion less than 1/8-inch thick

Pocket - Inclusion of material that is smaller than sample diameter

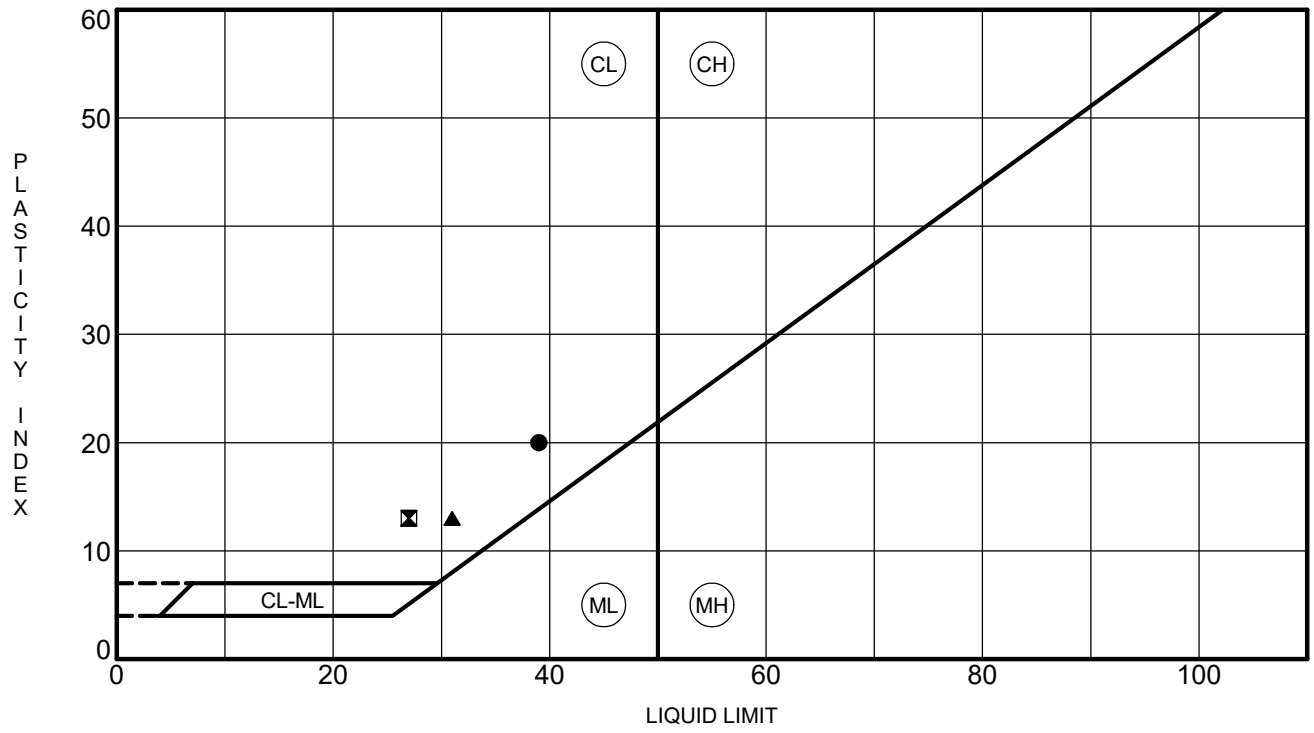
GEOTECHNOLOGY INC
FROM THE GROUND UP

Relative composition and Unified Soil Classification System (USCS) designations are based on visual descriptions and are approximate only. If laboratory tests were performed to classify the soil, the USCS designation is shown in parenthesis.

APPENDIX D – LABORATORY TEST DATA

Atterberg Limits

Unconsolidated-Undrained Triaxial Compression



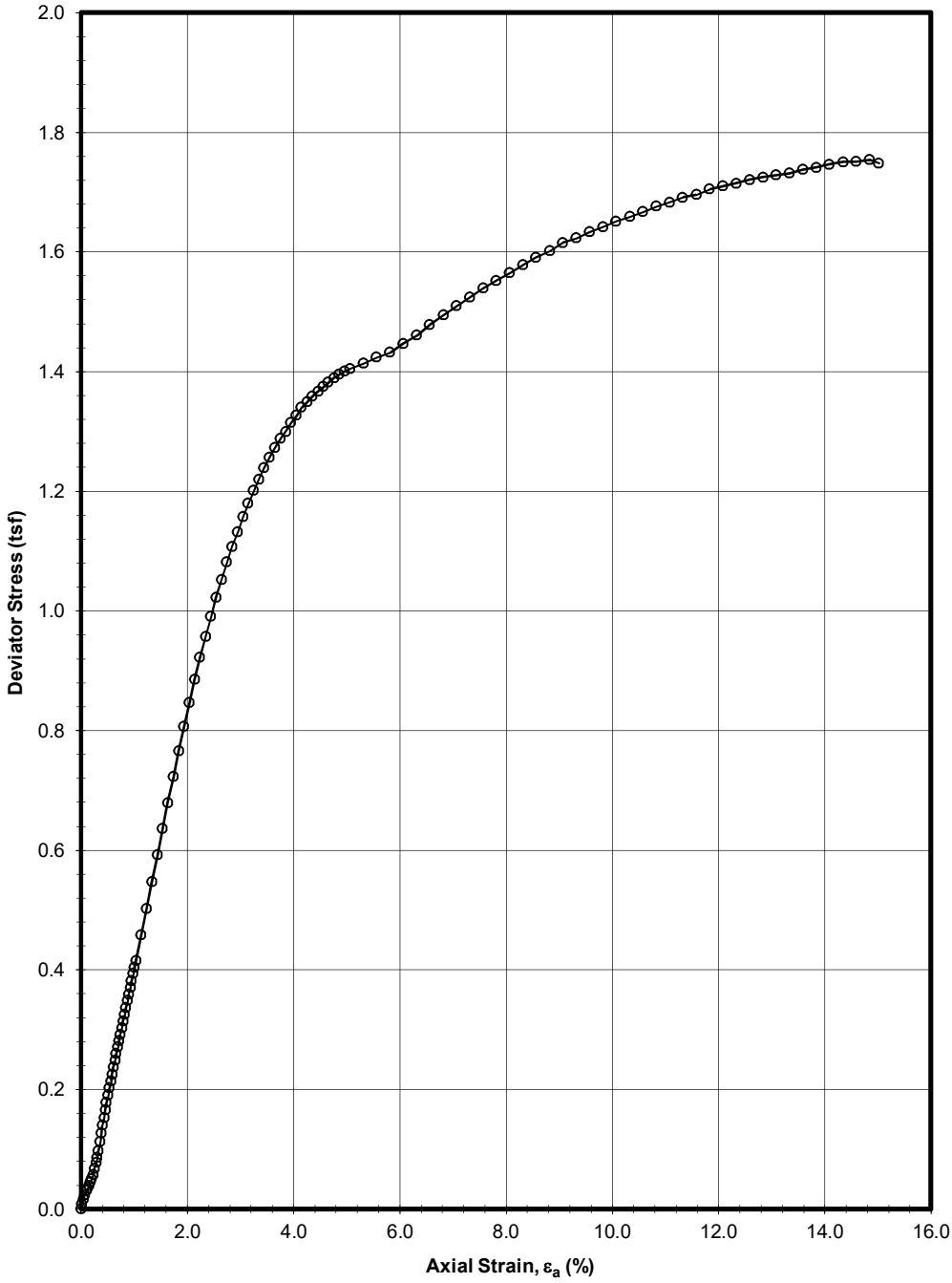
	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-1**	**6.0**	**39**	**19**	**20**		
⊠	**B-5**	**8.0**	**27**	**14**	**13**		
▲	**B-8**	**3.5**	**31**	**18**	**13**		

GEOTECHNOLOGY INC
FROM THE GROUND UP

ATTERBERG LIMITS RESULTS

Glycol Control Facility
Memphis, Tennessee
J038221.01

US_ATTERBERG_LIMITS_J038221.01.GPJ_US_LAB.GDT_3/26/21



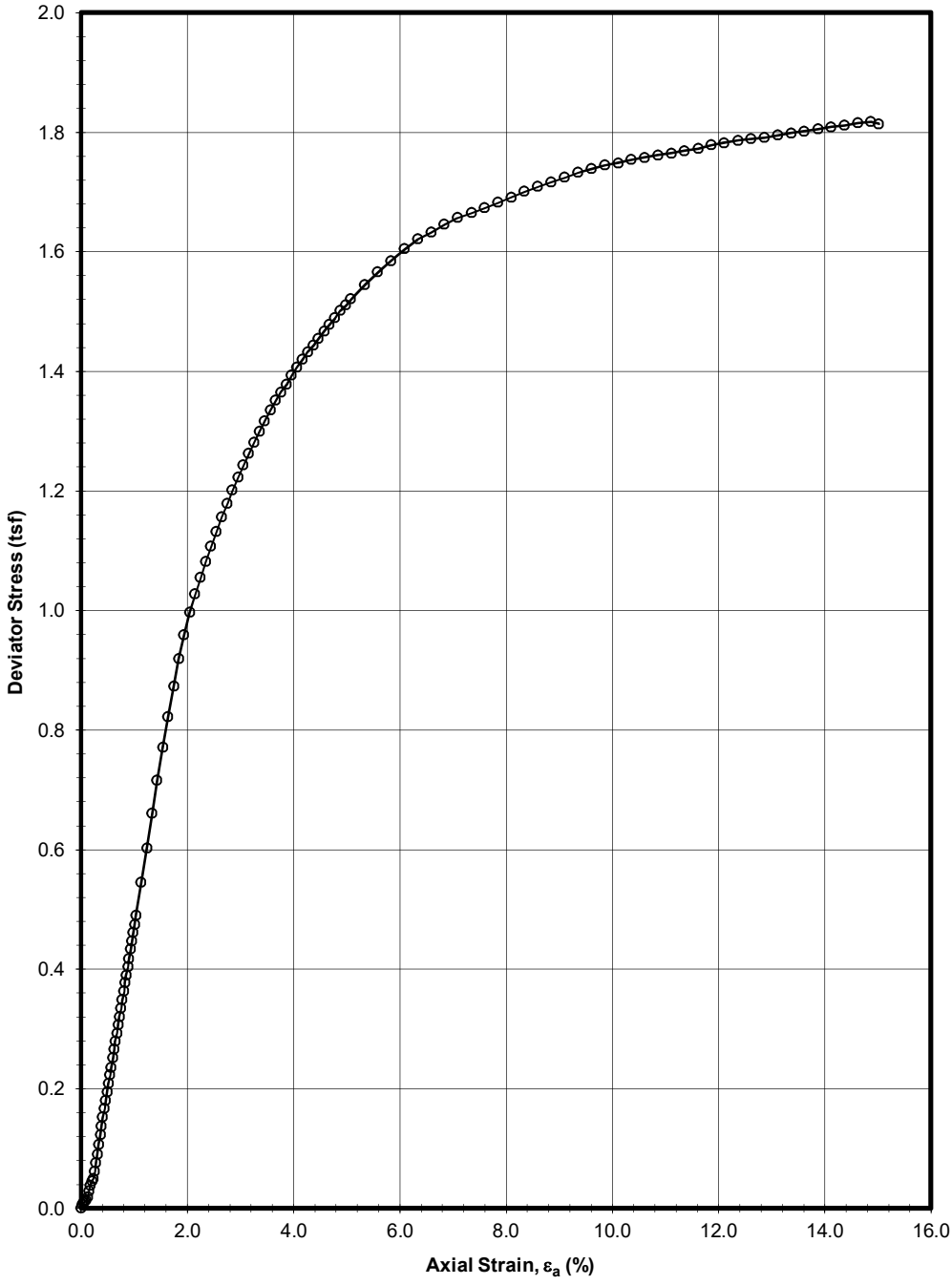
UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850

Project No.: J038221.01

Boring: B-1

Sample: ST-3 - Depth: 6 ft.



UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

ASTM D 2850

Project No.: J038221.01

Boring: B-5

Sample: ST-4 - Depth: 8 ft.