

**OFFICIAL BID DOCUMENT  
FOR  
CASEY COUNTY MAINTENANCE GARAGE  
KENTUCKY TRANSPORTATION CABINET  
LIBERTY, KENTUCKY**

This Official Bid Document consisting of pages 1 through 15, shall be used in submitting a bid document for the work. Copies will be furnished upon request by the authority issuing the Contract Documents.

THIS BID DOCUMENT SUBMITTED BY \_\_\_\_\_

\_\_\_\_\_  
(Name and Address of Bidder)

DATE: \_\_\_\_\_ TELEPHONE: \_\_\_\_\_

GENTLEMEN:

This Bidder, in compliance with your Request for Bid No. RFB-137-21, and having carefully examined the Drawings and complete Contract Documents as defined in Article 1 of the General Conditions as well as the Specifications for the work as prepared by Omni Architects, Staggs & Fisher Consulting Engineers, Inc., Brown + Kubican; hereby proposes to furnish all labor, materials, supplies and services required to perform the specifics of the Contract Documents, within the time set forth therein and for the stated Lump Sum Bid Amount.

The Bidder hereby acknowledges receipt of the following Addenda:

ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____
ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____
ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____
ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____

**(IF NONE HAVE BEEN ISSUED AND RECEIVED, INSERT THE WORD NONE.)**

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**ALL BLANKS IN THE BID DOCUMENTS SHALL BE COMPLETED AND ALL REQUIRED SUPPORT DATA SHALL BE FURNISHED. IF INDICATED I N THE BIDDING DOCUMENTS, SUMS SHALL BE EXPRESSED IN BOTH WORDS AND FIGURES. IN THE CASE OF DESCREPANCY BETWEEN THE TWO, THE AMOUNT IN WORDS SHALL PREVAIL.**

**LUMP SUM BASE BID:**

The Bidder agrees to furnish all labor, materials, supplies and services required to complete this project defined as Casey County Maintenance Garage, Kentucky Transportation Cabinet, Liberty, Kentucky for the Department for Facilities and Support Services, Commonwealth of Kentucky, in accordance with the Drawings, Specifications, and Contract Documents, and any duly issued Addenda for the LUMP SUM BID AMOUNT set forth below:

**LUMP SUM BASE BID AMOUNT:**

\_\_\_\_\_ DOLLARS  
(USE WORDS)

\_\_\_\_\_ CENTS (\$ \_\_\_\_\_ )  
(USE WORDS) (USE FIGURES)

**ADDITIVE ALTERNATE #:** Additional Paving: Provide all labor and materials as required for additional earthwork, storm drainage and paving as identified in the Drawings and Specifications.

\_\_\_\_\_ DOLLARS  
(USE WORDS)

\_\_\_\_\_ CENTS (\$ \_\_\_\_\_ )  
(USE WORDS) (USE FIGURES)

**NOTE: THE AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST PAGE MUST BE PROPERLY EXECUTED FOR THE LUMP SUM BASE BID TO BE VALID.**



**OFFICIAL BID DOCUMENT**

**AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST**

**I, HEREBY CERTIFY:**

1. That I am the bidder (if the bidder is an individual), a partner in the bidder (if the bidder is a partnership), or an officer and employee of the bidding corporation having authority to sign on it's behalf (if the bidder is a corporation);
2. That the submitted bid or bids covering Division of Engineering and Contract Administration Request for Bid No. RFB-137-21 have been arrived at by the bidder independently and have been submitted without collusion with, and without any agreement, understanding or planned common course of action with any other contractor, vendor of materials, supplies, equipment or services described in the Request for Bid, designed to limit independent bidding or competition; as prohibited by provision KRS 45A.325;
3. That the contents of the bid or bids have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the bidder, its surety on any bond furnished with the bid or bids and will not be communicated to any such person prior to the official opening of the bid or bids.
4. That the bidder is legally entitled to enter into the contract with the Commonwealth of Kentucky and is not in violation of any prohibited conflict of interest, including those prohibited by the provisions of KRS 164.390; and 45A.330 to 45A.340 and 45A.455;
5. This offer is for thirty (30) calendar days from the date this bid is opened. In submitting the above it is expressly agreed that upon proper acceptance by the Division of Engineering and Contract Administration of any or all items bid above, a contract shall thereby be created with respect to the items accepted;
6. That I have fully informed myself regarding and affirm the accuracy of all statements made in this Official Bid Document including Bid Amount.
7. Unless otherwise exempted by KRS 45.590, the bidder intends to comply in full with all requirements of the Kentucky Civil Rights Act and to submit data required by the Kentucky Equal Employment Act upon being designated the successful bidder.
8. That the bidder, if awarded a contract, would not be in violation of the Executive Branch Code of Ethics established by KRS 11A.001 through KRS 11A.990.
9. That the bidder is not debarred from doing business with federal agencies and that, if debarred during the life of the contract, the bidder will notify the Commonwealth buyer of record within seventy-two (72) hours of the federal debarment.

READ CAREFULLY – SIGN IN SPACE BELOW – FAILURE TO SIGN INVALIDATES BID

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**SIGNED BY:** \_\_\_\_\_ **FIRM:** \_\_\_\_\_

**PRINT NAME:** \_\_\_\_\_ **ADDRESS:** \_\_\_\_\_

**TITLE:** \_\_\_\_\_

**DATE:** \_\_\_\_\_

**CITY** \_\_\_\_\_ **STATE** \_\_\_\_\_ **ZIP CODE** \_\_\_\_\_

**TELEPHONE NO:** \_\_\_\_\_

**FEDERAL ID. NO. OR SOCIAL SECURITY NO.** \_\_\_\_\_ **EMAIL:** \_\_\_\_\_

**\*Disadvantaged Contractors, check type of certification:**  
 WBE  MBE  DBE  SERVICE-DISABLED VETERAN

**\*Disadvantaged Contractors attach a copy of certification.**

**OFFICIAL BID DOCUMENT – SUBMITTAL DATA**

**THE FOLLOWING ITEMS ARE HERewith ENCLOSED AS REQUIRED:**

- Sworn Required Affidavit For Bidders, Offerors And Contractors
- Sworn Affidavit for Claiming Resident Bidder Status
- Vendor Report of Prior Violations of KRS Chapters, 136, 139, 141, 337, 338, 341 and 342.
- Bidder's Qualifications.
- Disadvantaged Business Enterprises (DBE) Participation

The utilization of minority/disadvantaged vendors and subcontractors is encouraged, whenever possible, on public projects. The bidder and contractor should make full efforts to locate disadvantaged business persons.

Bidders may use the following resources:

Commonwealth of Kentucky's SMALL BUSINESS CONNECTION website: <https://secure.kentucky.gov/sbc/default.aspx>

Kentucky Minority and Women Business Enterprise website: <https://mwbe.ky.gov/Pages/default.aspx>

Kentucky Service-Disabled Veteran-Owned Small Business website:

<https://finance.ky.gov/initiatives/sdvosb/Pages/default.aspx>

Kentucky Transportation Cabinet Disadvantaged Business Enterprise directories: <http://transportation.ky.gov/Civil-Rights-and-Small-Business-Development/Pages/Certified-DBE-Directory.aspx>

Finance and Administration Cabinet, Office of EEO/Contract Compliance: email [Finance.ContractCompliance@ky.gov](mailto:Finance.ContractCompliance@ky.gov) or call 502-564-2874

U.S. Small Business Administration, Dynamic Small Business Search website: [http://dsbs.sba.gov/dsbs/search/dsp\\_dsbs.cfm](http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm)

Louisville/ Jefferson County Metropolitan Sewer District website: <http://www.msdlouky.org/insidemsd/diverse/find.html>

A bidder must include a list of all disadvantaged vendors and/or subcontractors contacted in order to prepare a bid (ATTACH TO OFFICIAL BID DOCUMENT).

If the bidder fails to utilize any disadvantaged vendors and/or subcontractors, a statement must be included to describe actions to include disadvantaged vendors and/or subcontractors (ATTACH TO OFFICIAL BID DOCUMENT).

The Finance and Administration Cabinet will review all submissions by bidders to determine compliance with this provision.

- List of Unit Prices, if applicable
- List of Subcontractors, if applicable
- List of Materials and Equipment, if applicable
- Bid Guaranty in the amount of no less than five percent (5%) of the TOTAL BID AMOUNT.
- Roofing Certifications, if applicable.

**COMMONWEALTH OF KENTUCKY  
FINANCE AND ADMINISTRATION CABINET  
SWORN STATEMENT REGARDING CAMPAIGN FINANCE LAWS  
PURSUANT TO KRS 45A.110 AND KRS 45A.115**

The following form (page 5) relative to Campaign Finance Laws shall be completed in total, notarized and returned with your bid. Responsibility of a bidder or offeror for a contract award shall not be made until the bidder or offeror provides this sworn statement.

**ANNUAL REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS**

**Affidavit Effective Date:** \_\_\_\_\_  
**Affidavit Expiration Date:** \_\_\_\_\_  
**Maximum Length One-Year**

**FOR BIDS AND CONTRACTS IN GENERAL:**

- I. Each bidder or offeror swears and affirms under penalty of perjury, that to the best of their knowledge:
- a. In accordance with KRS 45A.110 and KRS 45A.115, neither the bidder or offeror as defined in KRS 45A.070(6), nor the entity which he/she represents, has knowingly violated any provisions of the campaign finance laws of the Commonwealth of Kentucky; and the award of a contract to the bidder or offeror or the entity which he/she represents will not violate any provisions of the campaign finance laws of the Commonwealth.
  - b. The bidder or offeror swears and affirms under penalty of perjury that, to the extent required by Kentucky law, the entity bidding, and all subcontractors therein, are aware of the requirements and penalties outlined in KRS 45A.485; have properly disclosed all information required by this statute; and will continue to comply with such requirements for the duration of any contract awarded.
  - c. The bidder or offeror swears and affirms under penalty of perjury that, to the extent required by Kentucky law, the entity bidding, and its affiliates, are duly registered with the Kentucky Department of Revenue to collect and remit the sales and use tax imposed by KRS Chapter 139, and will remain registered for the duration of any contract awarded.
  - d. The bidder or offeror swears and affirms under penalty of perjury that the entity bidding is not delinquent on any state taxes or fees owed to the Commonwealth of Kentucky and will remain in good standing for the duration of any contract awarded.
  - e. The bidder or offeror swears and affirms under penalty of perjury that the entity bidding, is not currently engaged in, and will not for the duration of the contract engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which Kentucky can enjoy open trade, as defined in KRS 45A.607.
  - f. The bidder or offeror swears and affirms that the entity bidding, and all subcontractors therein, have not violated any of the prohibitions set forth in KRS 11A.236 during the previous ten (10) years, and further pledge to abide by the restrictions set forth in such statute for the duration of the contract awarded.

**FOR "NON-BID" CONTRACTS (I.E. SOLE-SOURCE; NOT-PRACTICAL OR FEASIBLE TO BID; OR EMERGENCY CONTRACTS, ETC):**

- I. Each contractor further swears and affirms under penalty of perjury, that to the best of their knowledge:
- a. In accordance with KRS 121.056, and if this is a non-bid contract, neither the contractor, nor any member of his/her immediate family having an interest of 10% or more in any business entity involved in the performance of any contract awarded, have contributed more than the amount specified in KRS 121.150 to the campaign of the gubernatorial slate elected in the election last preceding the date of contract award.
  - b. In accordance with KRS 121.330(1) and (2), and if this is a non-bid contract, neither the contractor, nor officers or employees of the contractor or any entity affiliated with the contractor, nor the spouses of officers or employees of the contractor or any entity affiliated with the contractor, have knowingly contributed more than \$5,000 in aggregate to the campaign of a candidate elected in the election last preceding the date of contract award that has jurisdiction over this contract award.
  - c. In accordance with KRS 121.330(3) and (4), and if this is a non-bid contract, to the best of his/her knowledge, neither the contractor, nor any member of his/her immediate family, his/her employer, or his/her employees, or any entity affiliated with any of these entities or individuals, have directly solicited contributions in excess of \$30,000 in the aggregate for the campaign of a candidate elected in the election last preceding the date of contract award that has jurisdiction over this contract.

**ANNUAL REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS**

As a duly authorized representative for the bidder, offeror, or contractor, I have fully informed myself regarding the accuracy of all statements made in this affidavit, and acknowledge that the Commonwealth is reasonably relying upon these statements, in making a decision for contract award and any failure to accurately disclose such information may result in contract termination, repayment of funds and other available remedies under law. If the bidder, offeror, or contractor becomes non-compliant with any statements during the affidavit effective period, I will notify the Finance and Administration Cabinet, Office of Procurement Services immediately. I understand that the Commonwealth retains the right to request an updated affidavit at any time.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Date

Company Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Commonwealth of Kentucky Vendor Code (if known): \_\_\_\_\_

Subscribed and sworn to before me by \_\_\_\_\_  
(Affiant) (Title)

of \_\_\_\_\_ this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.  
(Company Name)

\_\_\_\_\_  
Notary Public

[seal of notary]

My commission expires: \_\_\_\_\_

**REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS CLAIMING RESIDENT BIDDER STATUS**

**FOR BIDS AND CONTRACTS IN GENERAL:**

The bidder or offeror hereby swears and affirms under penalty of perjury that, in accordance with KRS 45A.494(2), the entity bidding is an individual, partnership, association, corporation, or other business entity that, on the date the contract is first advertised or announced as available for bidding:

1. Is authorized to transact business in the Commonwealth;
2. Has for one year prior to and through the date of advertisement
  - a. Filed Kentucky income taxes;
  - b. Made payments to the Kentucky unemployment insurance fund established in KRS 341.49; and
  - c. Maintained a Kentucky workers' compensation policy in effect.

The BIDDING AGENCY reserves the right to request documentation supporting a bidder's claim of resident bidder status. Failure to provide such documentation upon request shall result in disqualification of the bidder or contract termination.

Signature	Printed Name
Title	Date
Company Name	
Address	

Subscribed and sworn to before me by \_\_\_\_\_  
(Affiant) (Title)

of \_\_\_\_\_ this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.  
(Company Name)

\_\_\_\_\_  
Notary Public

[seal of notary] My commission expires: \_\_\_\_\_



### BIDDER'S QUALIFICATIONS

The Bidder's Qualifications are required by the owner to be submitted as set forth herewith:

1. This firm is a Corp.\_\_\_\_\_, Partnership\_\_\_\_\_, or Proprietorship\_\_\_\_\_.
2. A permanent place of business is maintained at:

\_\_\_\_\_

STREET	CITY	STATE	ZIP CODE
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\_\_\_\_\_  
TELEPHONE NUMBER

3. The following construction plant and equipment will be made available for use on this contract:

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

4. In the event the contract is awarded the undersigned, surety bonds will be furnished by:

\_\_\_\_\_

5. Experience of Contractor on other similar work:

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

6. We now have the following jobs under contract and bonded:

JOB	TOTAL CONTRACT	PERCENT COMPLETED
_____	\$ _____	_____ %
_____	\$ _____	_____ %
_____	\$ _____	_____ %
_____	\$ _____	_____ %
_____	\$ _____	_____ %

P-2

**DISADVANTAGED BUSINESS ENTERPRISE (DBE) PARTICIPATION**

- 1.01 **CERTIFICATION OF DBE:** Any DBE utilized pursuant to this Section shall be certified as a DBE by one of the following: Kentucky Finance and Administration Cabinet, Kentucky Transportation Cabinet or other state Transportation agencies, the Louisville/Jefferson County Metropolitan Sewer District, the Tri-State Minority Supplier Development Council or other state Minority Supplier Development Councils, the Ohio River Valley Women's Business Council, the Women's Business Enterprise National Council, the National Women Business Owners Council, or the Small Business Administration.
- 1.02 **OBLIGATION OF BIDDER/CONTRACTOR:** Bidder/Contractor shall make a good faith effort to meet the DBE contract goal set by the Commonwealth by including DBE's as subcontractors and/or material suppliers on 10% of the total estimated cost of the Contract. The failure to meet the foregoing goal shall not result in disqualification from bidding or being awarded a contract. However, Bidders/Contractors not meeting the DBE goal shall be expected to provide written proof of their good faith efforts. Award of the contract shall be conditioned upon satisfaction of the requirements established by this section. The Bidder/Contractor shall attempt to divide the work in the contract to facilitate use of DBE's (however, there is no requirement that the work be artificially divided or divided in a way that raises the bid price of the Bidder/Contractor).
- 1.03 **PROOF REQUIRED:** Each bidder shall furnish written proof in their bid package that they reached the DBE participation goal for this Contract, or of their good faith efforts to meet the DBE participation goal. A copy of each participating DBE's certification shall accompany the required forms. All submissions shall be subject to verification of the Commonwealth.
- A. Proof that the apparent successful bidder reached the DBE goal shall consist of the following and shall be made on form DB-2-A, attached hereto:
1. The names and addresses of DBE firms that will participate in the contract;
  2. A description of the work each named DBE firm will perform;
  3. The dollar amount of participation by each named DBE firm;
  4. The percentage amount of participation by each named DBE firm;
- B. Proof that the apparent successful bidder made a good faith efforts to meet the DBE participation goal may include the following:
1. Advertisement by the Bidder/Contractor of DBE contracting opportunities associated with this contract in at least one of each of the following periodicals: a periodical in general circulation throughout the Commonwealth, a trade periodical focused on DBE contractors/suppliers in general circulation throughout the Commonwealth, and a minority-focused periodical in general circulation throughout the Commonwealth. The Bidder/Contractor shall include copies of the dated advertisements in his bid package;
  2. Written notice of DBE opportunities in this contract to at least five pertinent DBE's at least seven days prior to the bid opening date. Copies of the written notices shall be included in the bid package;
  3. The Bidder/Contractor's response(s) to those DBE's who requested plans, specifications and/or contracting requirements. Copies of said responses shall be included in the bid package;
  4. Documentation on form DB-2-B of good faith negotiations with at least three DBE's, with no rejection of a qualified DBE without sound reason, including price quotes that are above other subcontractor's price quotes;
  5. Utilization of the Finance and Administration Cabinet's Office of Equal Employment Opportunity and Contract Compliance for referrals to organizations that assist in locating DBE's. Proof of use of such referrals and contacts made as a result thereof shall be included in the bid package.



DB-2-A

**DISADVANTAGED BUSINESS AVAILABILITY VERIFICATION**

\_\_\_\_\_ does commit itself that on the following project:  
NAME OF COMPANY

\_\_\_\_\_ PROJECT NAME REQUEST FOR BID NUMBER

The Bidder agrees to furnish information required by the Commonwealth of Kentucky to indicate the Disadvantaged Business which it intends to utilize. Breach of this commitment constitutes breach of the Bidder's contract if awarded.

NAME OF DISADVANTAGED BUSINESS	TELEPHONE	TYPE OF WORK

DOLLAR VALUE	PERCENT	DISADVANTAGED CLASSIFICATION

The undersigned shall enter into a formal agreement with the Disadvantaged business firms for work listed in this schedule conditioned upon execution of a contract with the Commonwealth of Kentucky.

Disadvantaged business firms listed above by the Bidder and accepted by the Owner and the Architect/Engineer shall be used on the work for which they were proposed and accepted and shall not be changed except with the written approval of the Owner and the Architect/Engineer. The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the Bidder to the commitment herein set forth.

Signature and title of authorized official of the company and the data shall be properly executed on this document or the bid will be deemed nonresponsive.

\_\_\_\_\_ NAME OF AUTHORIZED OFFICER TITLE

\_\_\_\_\_ SIGNATURE DATE

If you are bidding as a General Contractor on this project i.e. direct bidding and a Disadvantaged as defined herein, please provide a copy of your DBE Certification.

Submit with Bid. \_\_\_\_\_  
(Please copy additional Disadvantaged Business Availability Forms as necessary.)

DB-2-B

**DISADVANTAGED BUSINESS UNAVAILABILITY VERIFICATION**

I, \_\_\_\_\_, \_\_\_\_\_ (TITLE)

of \_\_\_\_\_ (PRIME BIDDER)

certify that on \_\_\_\_\_ I contacted the following Disadvantaged owned business by: (circle one) Certified Mail, Phone, In Person to obtain a bid for work items to be performed on the Contract.

<b>DISADVANTAGED CLASSIFICATION (IE. WBE, MBE, DBE, SDVOSB) CONTRACTOR</b>	<b>WORK ITEMS SOUGHT</b>	<b>FORM OF BID SUPPORT (I.E., UNIT PRICE, MATERIALS LABOR &amp; LABOR ONLY)</b>

To the best of my knowledge and belief, said Disadvantaged owned business was unavailable (exclusive of unavailability due to lack of agreement on price) for work on this project, or unable to prepare a bid, for the following reason(s):

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

SIGNATURE \_\_\_\_\_

DATE \_\_\_\_\_

\_\_\_\_\_ was offered an (NAME OF DISADVANTAGED BUSINESS)

opportunity to bid on the above-identified work on \_\_\_\_\_ by

(SOURCE)

The above statement is a true and accurate account of why I did not submit a bid on this project.

\_\_\_\_\_  
(SIGNATURE OF DISADVANTAGED BUSINESS)

\_\_\_\_\_  
(TITLE)

\_\_\_\_\_  
(DATE)

Submit with Bid if Applicable.  
(Please copy additional Disadvantaged Business Unavailability Forms as needed.)

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**LIST OF UNIT PRICES: (ALL BLANKS MUST BE FILLED IN)**

Unit prices shall include the furnishing of all labor, materials, suppliers, services and shall include all items of cost, overhead and profit for the Contractor and any Subcontractor involved, and shall be used uniformly without modification for either additions or deductions. The Unit Prices as established shall be used to determine the equitable adjustment of the Contract Price in connection with changes or extra work performed under the Contract. Failure to completely fill out all unit prices requested may result in bid rejection.

<b>DESCRIPTION OF WORK</b>		<b>UNIT PRICE</b>	<b>UNIT OF MEASURE</b>
1.	Mass earth cut (on-site disposal)	\$	CY
2.	Mass earth fill (on-site borrow)	\$	CY
3.	#57 crushed stone in place	\$	TON
4.	#2 crushed stone in place	\$	TON
5.	DGA in place	\$	CY
6.	Reinforced concrete foundations	\$	CY
7.	Structural excavation for foundations	\$	CY

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**LIST OF PROPOSED SUBCONTRACTORS:**  
**(Must be submitted with Bid)**

The following list of proposed subcontractors is required by the owner to be executed, completed, and submitted with the Bidder's Proposal. All subcontractors are subject to approval by the Division of Engineering and Contract Administration, Department of Facilities and Support Services, Frankfort, Kentucky. Failure to submit this list, completely filled out, may result in bid rejection.

If certain branches of work are to be done by the Prime Contractor, so state. Review/evaluation of subcontractors will occur on the bid opening day. If the Commonwealth requests replacement of a subcontractor, on bid opening day, then the apparent low bidder will provide a replacement subcontractor prior to close of the Commonwealth's business day on that day. Failure of the apparent low bidder to comply with the preceding sentence may result in bid rejection. If subcontractor review/evaluation is not completed on the bid opening day, then procedures for any replacement will be issued based on the uniqueness of each situation. The responsibility for selection, offering of qualified, competent subcontractors to accomplish the work intended is solely the responsibility of the bidder to the Commonwealth.

**ALL BLANKS MUST BE FILLED IN. IF PERFORMED BY THE BIDDER, STATE PRIME/GENERAL CONTRACTOR.**

	<b>BRANCH OF WORK</b>	<b>NAME OF SUBCONTRACTOR</b>
1.	Earthwork	
2.	Asphalt paving	
3.	Cast-in-place concrete (Base Bid)	
4.	Metal building insulation system	
5.	Metal building system	
6.	Plumbing	
7.	Plumbing Insulation	
8.	HVAC	
9.	HVAC Insulation	
10.	Sheet Metal (ductwork)	
11.	Electrical	
12.	Technology Wiring	

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**LIST OF MATERIALS AND EQUIPMENT (MUST BE COMPLETELY FILLED OUT WHEN BID IS SUBMITTED):**

Every item listed under the different phases of construction must be clearly identified so that the Owner will definitely know what the bidder proposes to furnish. Bidders be hereby advised that this list is required by the owner to be executed, completed, and submitted with the Bidder's Proposal.

The use of the manufacturer's dealer's name only, or stating "as per plans and specifications", will not be considered as sufficient identification.

Where more than one "Make or Brand" is listed for any one item, the Owner has the right to select the one to be used.

Failure to submit a proper list may result in rejection of Bidder's Proposal.

	<b>MATERIAL AND/OR EQUIPMENT:</b>	<b>MANUFACTURER AND BRAND NAME:</b>
1.	Cast-in-place concrete (Supplier)	
2.	Metal building insulation	
3.	Aluminum windows	
4.	Aluminum canopies	
5.	Metal building system	
6.	Gas fired unit heaters	
7.	Outdoor packaged HVAC units	
8.	Exhaust fans	
9.	Panelboards	
10.	Disconnect switches	

**FINANCE AND ADMINISTRATION  
DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES  
DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION**



**REQUEST FOR BID NO. RFB-137-21  
CASEY COUNTY MAINTENANCE GARAGE  
KENTUCKY TRANSPORTATION CABINET  
LIBERTY, KENTUCKY**

**Agency: 609  
Fund: C9NW**



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MOVEIT INSTRUCTIONS
OFFICIAL BID DOCUMENT
NOTICE TO CONTRACTORS
PART I ADVERTISEMENT FOR BIDS
PART II INSTRUCTIONS TO BIDDERS
PART III GENERAL CONDITIONS
PART IV PAYMENT BOND
PART V PERFORMANCE BOND
PART VI AGREEMENT BETWEEN OWNER AND CONTRACTOR
SPECIFICATIONS

**PLEASE NOTE THE FOLLOWING:**

THE VENDOR VIOLATION FORM IN THE BID DOCUMENTS IS BEING SENT TO THE LABOR CABINET FOR VERIFICATION. PLEASE MAKE SURE ALL YOUR VIOLATIONS ARE LISTED WITHIN THE LAST FIVE (5) YEARS. IF A BIDDER LISTS "NONE" AND HAS SOME, THEIR BID MAY BE REJECTED. FOR A LIST OF YOUR VENDOR VIOLATIONS, YOU CAN FAX OR EMAIL THE LABOR CABINET WITH YOUR REQUEST. FAX NUMBER IS (502) 696-1984 OR EMAIL: [wages@ky.gov](mailto:wages@ky.gov). CONTRACTORS MUST ALLOW THREE (3) DAYS IN ORDER TO GET INFORMATION FROM THE LABOR CABINET.

THERE IS A CHECKLIST ON PAGE 4 OF THE OFFICIAL BID DOCUMENT FOR CONTRACTORS TO MAKE SURE ALL OF BID DOCUMENT IS ENCLOSED WHEN SUBMITTING THEIR BID.

**IMPORTANT:** Be prepared for temperature checks at various state agency entry points. If you have a fever, you will be turned away. Face masks are also required by employees/contractors when working, traveling or meeting in groups or in common areas (breakrooms, hallways, etc.)

**Contractors must load their Bid Documents under the corresponding RFB in MOVEit in order for it to be received. IF BID IS NOT UPLOADED IN THE CORRECT FOLDER IN MOVEit, THE BID WILL BE DEEMED NON-RESPONSIVE. BID MUST BE LOADED COMBINED IN ONE PDF FILE WHICH SHALL INCLUDE YOUR BID BOND.**



## MOVEit TRANSFER

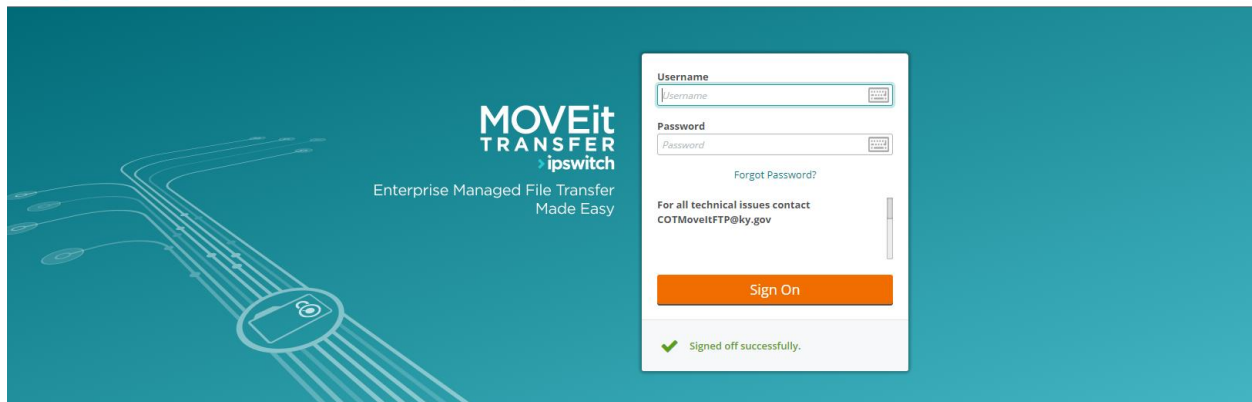
<https://ftp.ky.gov>

This application is used for

**Secure File Transfer:** upload/download files with the FTP application and share the secure location with other registered MOVEit users with no size limit. NOTE: the retention of files on all MOVEit applications is 90 days unless otherwise requested.



- Encrypted File Transfer and Messaging  
 - HTTPS, FTPS and SFTP (SSH), Optional Client Certs/Keys  
 - ISO 27001, HIPAA, PCI, ~~GDPR~~, SOX, BASEL (I/II), FIS, FISMA, GLBA, FFIEC, ITAR Compliant  
 Ky.gov An Official Website of the Commonwealth of Kentucky



**Login.** The log in is case sensitive.

Username: kyrfb  
 Password: Submitter2020

**Unable to login –**

Contact the [CommonwealthServiceDesk@ky.gov](mailto:CommonwealthServiceDesk@ky.gov) and they will notify the MOVEit team to assist you. You can also call 502-564-7576.

**Forgot Password - YOU CANNOT CHANGE THE PASSWORD ON THIS ACCOUNT. DO NOT ATTEMPT TO CHANGE IT.**

**NOTE:** You should not be prompted to change the password, if this occurs contact the Commonwealth buyer on the project.

### **IMPORTANT:**

**Please include company name and RFB# in the file name. ALL FILES (bid documents, equipment lists, bid bond, etc.) should be COMBINED into one PDF document before submission.**



After you login to the system, you will see this screen.

The screenshot shows the MOVEit interface. At the top, there are logos for the Commonwealth Office of Technology and MOVEit Progress. A navigation bar indicates the user is signed on as 'Kentucky RFB Submitter engineering (kyrfb)'. The main content area has a left sidebar with a 'HOME' link and a disclaimer about time stamps. The main area contains instructions: 'Files are retained for 90 days. No size restrictions are placed on attachments.' It also includes a 'TECH SUPPORT' link and a list of instructions for submitting a proposal. At the bottom, there is an 'Upload' button and a 'Home Folder' section.

Notice the instructions on the screen for submission.

Scroll down to find the RFB/RFP you are submitting on. Open the folder by clicking on the folder with the correct RFB/RFP. Do **NOT** check the box. **Click upload on the right side of the screen.** Upload your proposal to the correct RFB/RFP.

/Distribution/KyAgencies/KYFinance/Procurement/ENG-RFP

<input type="checkbox"/>	Name	<input checked="" type="checkbox"/>	Size/Contents	Creator	Created
<input type="checkbox"/>	RFB-168-20				3/18/2020 3:39:56 PM
<input type="checkbox"/>	RFB-174-20				3/18/2020 3:40:49 PM
<input type="checkbox"/>	RFB-176-20				3/18/2020 3:40:43 PM
<input type="checkbox"/>	RFB-177-20				3/18/2020 3:40:37 PM
<input type="checkbox"/>	RFB-178-20				3/18/2020 3:40:33 PM
<input type="checkbox"/>	RFB-181-20				3/18/2020 3:40:24 PM
<input type="checkbox"/>	RFB-183-20				3/18/2020 3:40:17 PM
<input type="checkbox"/>	RFB-189-20				3/18/2020 3:40:04 PM
<input type="checkbox"/>	RFB-191-20				3/18/2020 3:40:12 PM

**\*\* Highly Recommended \*\***

Before uploading your files, add your Company name to the front of all file names.

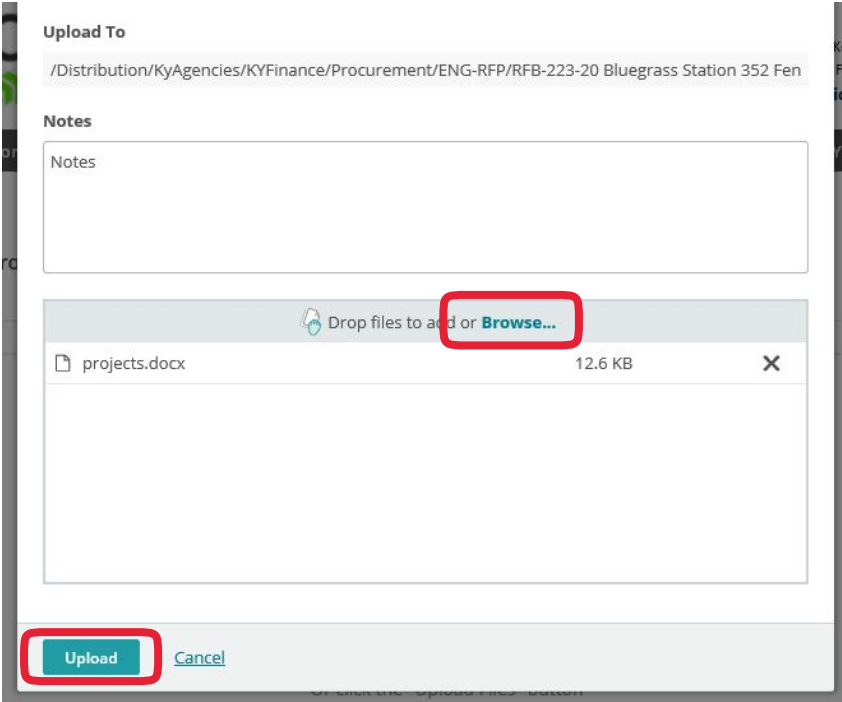
Example: AcmeCoyote\_Filename.pdf

**NOTES Section** – Use this section to input your contact information or make comments about the files being uploaded.

Browse to your files and select the files to upload - Do **NOT** use drag and drop.

Make sure to click Upload.

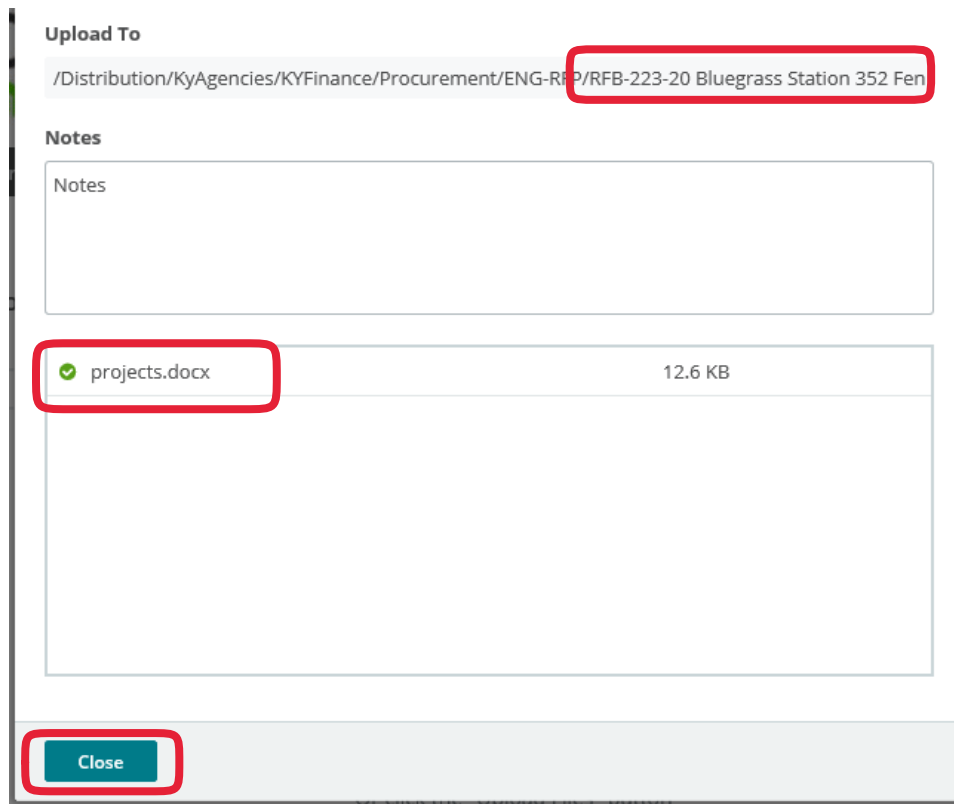
There is not a size limit for file uploads.



When the upload is complete a check mark will appear to the left of your files and the bottom of the window will show the close button.

**\*\* We highly recommend** that you print the screen as verification for your records that the file(s) were submitted. There is no other verification of receipt of files. If you feel that you need further verification, you can email COTMOVEitFTP@ky.gov or the buyer on the project.

Verify that the file was uploaded to the correct folder by reviewing the file path (see below). The last part of the path will show the folder it was uploaded to.



Click Close at the bottom of the window.  
Sign out.



The **Sign Out** Link will exit you from the application.

**Your files will automatically be transferred to our procurement staff**

The **Tech Support Link** will provide links to the User Guide under MOVEit Transfer Help, and Information on how to Contact the COT MOVEit Team.

#### FOR TECHNICAL ASSISTANCE WITH MOVEit/FTP

- Non-Commonwealth third parties should contact the Commonwealth Service Desk. Commonwealthservicedesk@ky.gov and cc: COTMOVEITFTP@ky.gov. Or call 502-564-7576.
  - In the request for assistance please include the following -- username, telephone number, RFP number, list of any files you are uploading, and a detailed description of any errors or messages received.

**OFFICIAL BID DOCUMENT  
FOR  
CASEY COUNTY MAINTENANCE GARAGE  
KENTUCKY TRANSPORTATION CABINET  
LIBERTY, KENTUCKY**

This Official Bid Document consisting of pages 1 through 15, shall be used in submitting a bid document for the work. Copies will be furnished upon request by the authority issuing the Contract Documents.

THIS BID DOCUMENT SUBMITTED BY \_\_\_\_\_

\_\_\_\_\_  
(Name and Address of Bidder)

DATE: \_\_\_\_\_ TELEPHONE: \_\_\_\_\_

GENTLEMEN:

This Bidder, in compliance with your Request for Bid No. RFB-137-21, after having carefully examined the Drawings and complete Contract Documents as defined in Article 1 of the General Conditions as well as the Specifications for the work as prepared by Omni Architects, Staggs & Fisher Consulting Engineers, Inc.; Brown + Kubican, hereby proposes to furnish all labor, materials, supplies and services required to perform the specifics of the Contract Documents within the time set forth therein and for the stated Lump Sum Bid Amount.

The Bidder hereby acknowledges receipt of the following Addenda:

ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____
ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____
ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____
ADDENDUM NO. _____	DATED _____	ADDENDUM NO. _____	DATED _____

**(IF NONE HAVE BEEN ISSUED AND RECEIVED, INSERT THE WORD NONE.)**

**OFFICIAL BID DOCUMENT  
FOR  
CASEY COUNTY MAINTENANCE GARAGE  
KENTUCKY TRANSPORTATION CABINET  
LIBERTY, KENTUCKY**

**ALL BLANKS IN THE BID DOCUMENTS SHALL BE COMPLETED AND ALL REQUIRED SUPPORT DATA SHALL BE FURNISHED. IF INDICATED I N THE BIDDING DOCUMENTS, SUMS SHALL BE EXPRESSED IN BOTH WORDS AND FIGURES. IN THE CASE OF DESCREPANCY BETWEEN THE TWO, THE AMOUNT IN WORDS SHALL PREVAIL.**

**LUMP SUM BASE BID:**

The Bidder agrees to furnish all labor, materials, supplies and services required to complete this project defined as Casey County Maintenance Garage, Kentucky Transportation Cabinet, Liberty, Kentucky for the Department for Facilities and Support Services, Commonwealth of Kentucky, in accordance with the Drawings, Specifications, and Contract Documents, and any duly issued Addenda for the LUMP SUM BID AMOUNT set forth below:

**LUMP SUM BASE BID AMOUNT:**

\_\_\_\_\_ DOLLARS  
(USE WORDS)

\_\_\_\_\_ CENTS \_\_\_\_\_ )  
(USE WORDS) (USE FIGURES)

**ADDITIVE ALTERNATE #:** Additional Paving: Provide all labor and materials as required for additional earthwork, storm drainage and paving as identified in the Drawings and Specifications.

\_\_\_\_\_ DOLLARS  
(USE WORDS)

\_\_\_\_\_ CENTS (\$) \_\_\_\_\_ )  
(USE WORDS) (USE FIGURES)

**NOTE: THE AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST PAGE MUST BE PROPERLY EXECUTED FOR THE LUMP SUM BASE BID TO BE VALID.**

**OFFICIAL BID DOCUMENT**

**AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST**

**I, HEREBY CERTIFY:**

1. That I am the bidder (if the bidder is an individual), a partner in the bidder (if the bidder is a partnership), or an officer and employee of the bidding corporation having authority to sign on it's behalf (if the bidder is a corporation);
2. That the submitted bid or bids covering Division of Engineering and Contract Administration Request for Bid No. RFB-137-21 have been arrived at by the bidder independently and have been submitted without collusion with, and without any agreement, understanding or planned common course of action with any other contractor, vendor of materials, supplies, equipment or services described in the Request for Bid, designed to limit independent bidding or competition; as prohibited by provision KRS 45A.325;
3. That the contents of the bid or bids have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the bidder, its surety on any bond furnished with the bid or bids and will not be communicated to any such person prior to the official opening of the bid or bids.
4. That the bidder is legally entitled to enter into the contract with the Commonwealth of Kentucky and is not in violation of any prohibited conflict of interest, including those prohibited by the provisions of KRS 164.390; and 45A.330 to 45A.340 and 45A.455;
5. This offer is for thirty (30) calendar days from the date this bid is opened. In submitting the above it is expressly agreed that upon proper acceptance by the Division of Engineering and Contract Administration of any or all items bid above, a contract shall thereby be created with respect to the items accepted.
6. That I have fully informed myself regarding and affirm the accuracy of all statements made in this Official Bid Document including Bid Amount.
7. Unless otherwise exempted by KRS 45.590, the bidder intends to comply in full with all requirements of the Kentucky Civil Rights Act and to submit data required by the Kentucky Equal Employment Act upon being designated the successful bidder.
8. That the bidder, if awarded a contract, would not be in violation of the Executive Branch Code of Ethics established by KRS 11A.001 through KRS 11A.990.
9. That the bidder is not debarred from doing business with federal agencies and that, if debarred during the life of the contract, the bidder will notify the Commonwealth buyer of record within seventy-two (72) hours of the federal debarment.

READ CAREFULLY – SIGN IN SPACE BELOW – FAILURE TO SIGN INVALIDATES BID

**SIGNED BY:** \_\_\_\_\_

**FIRM:** \_\_\_\_\_

**PRINT NAME:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**TITLE:** \_\_\_\_\_

**CITY**                      **STATE**                      **ZIP CODE**

**DATE:** \_\_\_\_\_

**TELEPHONE NO:** \_\_\_\_\_

**FEDERAL ID. NO. OR SOCIAL SECURITY NO.** \_\_\_\_\_

**EMAIL:** \_\_\_\_\_

<b>*Disadvantaged Contractors, check type of certification:</b>			
<input type="checkbox"/> WBE	<input type="checkbox"/> MBE	<input type="checkbox"/> DBE	<input type="checkbox"/> SERVICE-DISABLED VETERAN

**\*Disadvantaged Contractors attach a copy of certification.**

**OFFICIAL BID DOCUMENT – SUBMITTAL DATA**

**THE FOLLOWING ITEMS ARE HEREWITH ENCLOSED AS REQUIRED:**

- Sworn Required Affidavit For Bidders, Offerors And Contractors
- Sworn Affidavit for Claiming Resident Bidder Status
- Vendor Report of Prior Violations of KRS Chapters, 136, 139, 141, 337, 338, 341 and 342.
- Bidder's Qualifications.
- Disadvantaged Business Enterprises (DBE) Participation

The utilization of minority/disadvantaged vendors and subcontractors is encouraged, whenever possible, on public projects. The bidder and contractor should make full efforts to locate disadvantaged business persons.

Bidders may use the following resources:

Commonwealth of Kentucky's SMALL BUSINESS CONNECTION website: <https://secure.kentucky.gov/sbc/default.aspx>

Kentucky Minority and Women Business Enterprise website: <https://mwbe.ky.gov/Pages/default.aspx>

Kentucky Service-Disabled Veteran-Owned Small Business website:

<https://finance.ky.gov/initiatives/sdvosb/Pages/default.aspx>

Kentucky Transportation Cabinet Disadvantaged Business Enterprise directories: <http://transportation.ky.gov/Civil-Rights-and-Small-Business-Development/Pages/Certified-DBE-Directory.aspx>

Finance and Administration Cabinet, Office of EEO/Contract Compliance: email [Finance.ContractCompliance@ky.gov](mailto:Finance.ContractCompliance@ky.gov) or call 502-564-2874

U.S. Small Business Administration, Dynamic Small Business Search website: [http://dsbs.sba.gov/dsbs/search/dsp\\_dsbs.cfm](http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm)

Louisville/ Jefferson County Metropolitan Sewer District website: <http://www.msdbky.org/insidemsd/diverse/find.html>

A bidder must include a list of all disadvantaged vendors and/or subcontractors contacted in order to prepare a bid (ATTACH TO OFFICIAL BID DOCUMENT).

If the bidder fails to utilize any disadvantaged vendors and/or subcontractors, a statement must be included to describe actions to include disadvantaged vendors and/or subcontractors (ATTACH TO OFFICIAL BID DOCUMENT).

The Finance and Administration Cabinet will review all submissions by bidders to determine compliance with this provision.

- List of Unit Prices, if applicable
- List of Subcontractors, if applicable
- List of Materials and Equipment, if applicable
- Bid Guaranty in the amount of no less than five percent (5%) of the TOTAL BID AMOUNT.
- Roofing Certifications, if applicable

**COMMONWEALTH OF KENTUCKY  
FINANCE AND ADMINISTRATION CABINET  
SWORN STATEMENT REGARDING CAMPAIGN FINANCE LAWS  
PURSUANT TO KRS 45A.110 AND KRS 45A.115**

The following form (page 5) relative to Campaign Finance Laws shall be completed in total, notarized and returned with your bid. Responsibility of a bidder or offeror for a contract award shall not be made until the bidder or offeror provides this sworn statement.

**ANNUAL REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS**

**Affidavit Effective Date:** \_\_\_\_\_  
**Affidavit Expiration Date:** \_\_\_\_\_  
**Maximum Length One-Year**

**FOR BIDS AND CONTRACTS IN GENERAL:**

- I. Each bidder or offeror swears and affirms under penalty of perjury, that to the best of their knowledge:
- a. In accordance with KRS 45A.110 and KRS 45A.115, neither the bidder or offeror as defined in KRS 45A.070(6), nor the entity which he/she represents, has knowingly violated any provisions of the campaign finance laws of the Commonwealth of Kentucky; and the award of a contract to the bidder or offeror or the entity which he/she represents will not violate any provisions of the campaign finance laws of the Commonwealth.
  - b. The bidder or offeror swears and affirms under penalty of perjury that, to the extent required by Kentucky law, the entity bidding, and all subcontractors therein, are aware of the requirements and penalties outlined in KRS 45A.485; have properly disclosed all information required by this statute; and will continue to comply with such requirements for the duration of any contract awarded.
  - c. The bidder or offeror swears and affirms under penalty of perjury that, to the extent required by Kentucky law, the entity bidding, and its affiliates, are duly registered with the Kentucky Department of Revenue to collect and remit the sales and use tax imposed by KRS Chapter 139, and will remain registered for the duration of any contract awarded.
  - d. The bidder or offeror swears and affirms under penalty of perjury that the entity bidding is not delinquent on any state taxes or fees owed to the Commonwealth of Kentucky and will remain in good standing for the duration of any contract awarded.
  - e. The bidder or offeror swears and affirms under penalty of perjury that the entity bidding, is not currently engaged in, and will not for the duration of the contract engage in, the boycott of a person or an entity based in or doing business with a jurisdiction with which Kentucky can enjoy open trade, as defined in KRS 45A.607.
  - f. The bidder or offeror swears and affirms that the entity bidding, and all subcontractors therein, have not violated any of the prohibitions set forth in KRS 11A.236 during the previous ten (10) years, and further pledge to abide by the restrictions set forth in such statute for the duration of the contract awarded.

**FOR "NON-BID" CONTRACTS (I.E. SOLE-SOURCE, NOT PRACTICAL OR FEASIBLE TO BID; OR EMERGENCY CONTRACTS, ETC):**

- I. Each contractor further swears and affirms under penalty of perjury, that to the best of their knowledge:
- a. In accordance with KRS 121.056, and if this is a non-bid contract, neither the contractor, nor any member of his/her immediate family having an interest of 10% or more in any business entity involved in the performance of any contract awarded, have contributed more than the amount specified in KRS 121.150 to the campaign of the gubernatorial slate elected in the election last preceding the date of contract award.
  - b. In accordance with KRS 121.330(1) and (2), and if this is a non-bid contract, neither the contractor, nor officers or employees of the contractor or any entity affiliated with the contractor, nor the spouses of officers or employees of the contractor or any entity affiliated with the contractor, have knowingly contributed more than \$5,000 in aggregate to the campaign of a candidate elected in the election last preceding the date of contract award that has jurisdiction over this contract award.
  - c. In accordance with KRS 121.330(3) and (4), and if this is a non-bid contract, to the best of his/her knowledge, neither the contractor, nor any member of his/her immediate family, his/her employer, or his/her employees, or any entity affiliated with any of these entities or individuals, have directly solicited contributions in excess of \$30,000 in the aggregate for the campaign of a candidate elected in the election last preceding the date of contract award that has jurisdiction over this contract.



**ANNUAL REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS**

As a duly authorized representative for the bidder, offeror, or contractor, I have fully informed myself regarding the accuracy of all statements made in this affidavit, and acknowledge that the Commonwealth is reasonably relying upon these statements, in making a decision for contract award and any failure to accurately disclose such information may result in contract termination, repayment of funds and other available remedies under law. If the bidder, offeror, or contractor becomes non-compliant with any statements during the affidavit effective period, I will notify the Finance and Administration Cabinet, Office of Procurement Services immediately. I understand that the Commonwealth retains the right to request an updated affidavit at any time.

\_\_\_\_\_  
Signature Printed Name

\_\_\_\_\_  
Title Date

Company Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Commonwealth of Kentucky Vendor Code (if known): \_\_\_\_\_

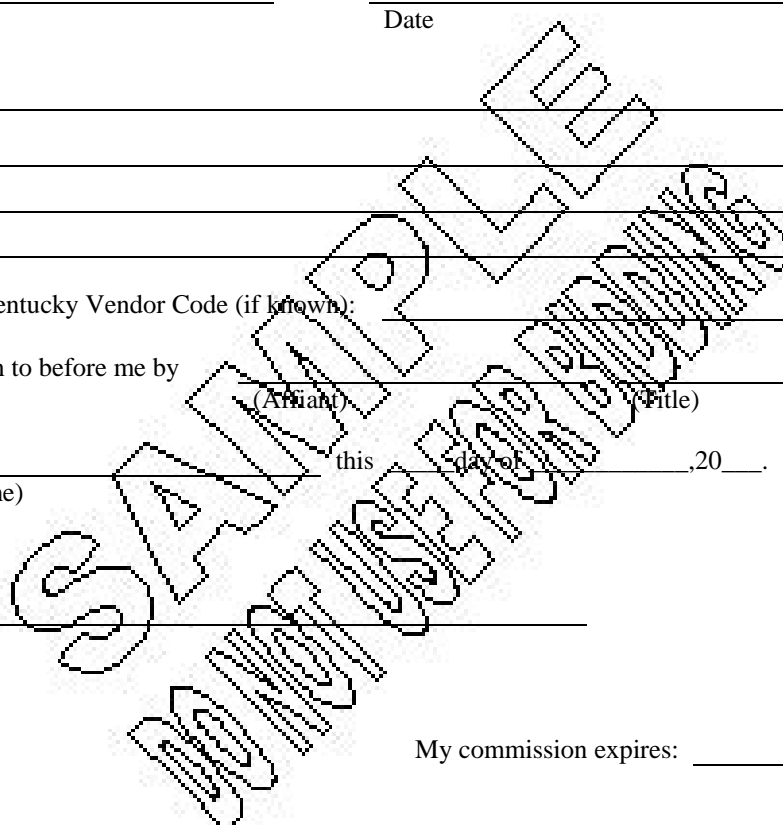
Subscribed and sworn to before me by \_\_\_\_\_  
(Affiant) (Title)

of \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.  
(Company Name)

\_\_\_\_\_  
Notary Public

[seal of notary]

My commission expires: \_\_\_\_\_



**REQUIRED AFFIDAVIT FOR BIDDERS, OFFERORS AND CONTRACTORS CLAIMING RESIDENT BIDDER STATUS**

**FOR BIDS AND CONTRACTS IN GENERAL:**

The bidder or offeror hereby swears and affirms under penalty of perjury that, in accordance with KRS 45A.494(2), the entity bidding is an individual, partnership, association, corporation, or other business entity that, on the date the contract is first advertised or announced as available for bidding:

1. Is authorized to transact business in the Commonwealth;
2. Has for one year prior to and through the date of advertisement
  - a. Filed Kentucky income taxes;
  - b. Made payments to the Kentucky unemployment insurance fund established in KRS 341.49; and
  - c. Maintained a Kentucky workers' compensation policy in effect.

The BIDDING AGENCY reserves the right to request documentation supporting a bidder's claim of resident bidder status. Failure to provide such documentation upon request shall result in disqualification of the bidder or contract termination.

\_\_\_\_\_  
Signature Printed Name

\_\_\_\_\_  
Title Date

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Address

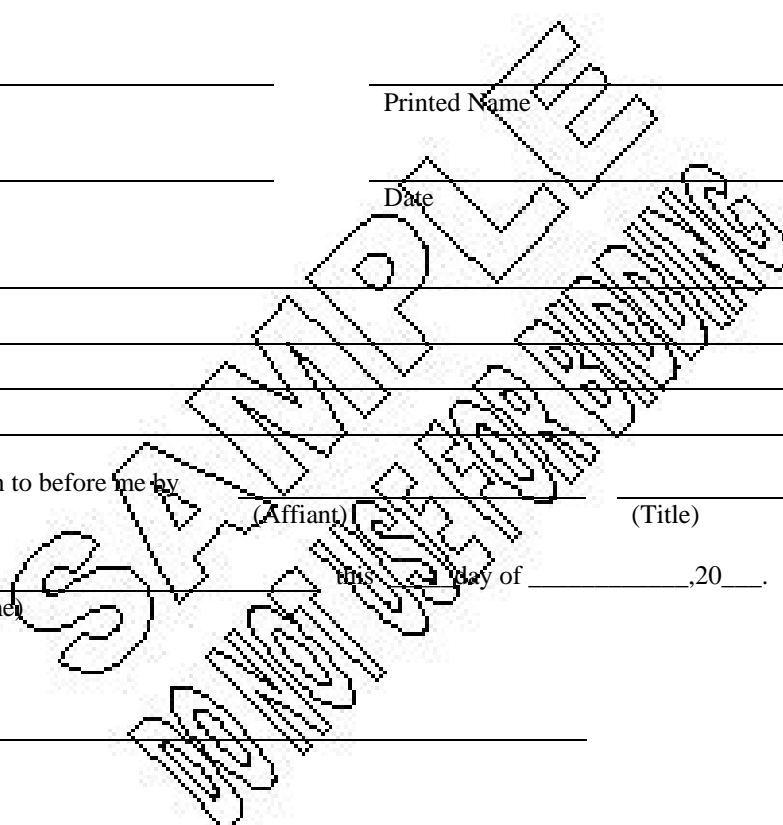
\_\_\_\_\_  
Subscribed and sworn to before me by (Affiant) (Title)

of \_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.  
(Company Name)

\_\_\_\_\_  
Notary Public

[seal of notary]

My commission expires: \_\_\_\_\_





**BIDDER'S QUALIFICATIONS**

The Bidder's Qualifications are required by the owner to be submitted as set forth herewith:

1. This firm is a Corp. \_\_\_\_\_, Partnership \_\_\_\_\_, or Proprietorship \_\_\_\_\_.
2. A permanent place of business is maintained at:

\_\_\_\_\_

STREET	CITY	STATE	ZIP CODE
--------	------	-------	----------

\_\_\_\_\_

TELEPHONE NUMBER

3. The following construction plant and equipment will be made available for use on this contract:

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

4. In the event the contract is awarded the undersigned, surety bonds will be furnished by:

\_\_\_\_\_

5. Experience of Contractor on other similar work:

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

6. We now have the following jobs under contract and bonded:

JOB	TOTAL CONTRACT	PERCENT COMPLETED
_____	\$ _____	_____ %
_____	\$ _____	_____ %
_____	\$ _____	_____ %
_____	\$ _____	_____ %
_____	\$ _____	_____ %

P-2

**DISADVANTAGED BUSINESS ENTERPRISE (DBE) PARTICIPATION**

- 1.01 **CERTIFICATION OF DBE:** Any DBE utilized pursuant to this Section shall be certified as a DBE by one of the following: Kentucky Finance and Administration Cabinet, Kentucky Transportation Cabinet or other state Transportation agencies, the Louisville/Jefferson County Metropolitan Sewer District, the Tri-State Minority Supplier Development Council or other state Minority Supplier Development Councils, the Ohio River Valley Women's Business Council, the Women's Business Enterprise National Council, the National Women Business Owners Council, or the Small Business Administration.
- 1.02 **OBLIGATION OF BIDDER/CONTRACTOR:** Bidder/Contractor shall make a good faith effort to meet the DBE contract goal set by the Commonwealth by including DBE's as subcontractors and/or material suppliers on 10% of the total estimated cost of the Contract. The failure to meet the foregoing goal shall not result in disqualification from bidding or being awarded a contract. However, Bidders/Contractors not meeting the DBE goal shall be expected to provide written proof of their good faith efforts. Award of the contract shall be conditioned upon satisfaction of the requirements established by this section. The Bidder/Contractor shall attempt to divide the work in the contract to facilitate use of DBE's (however, there is no requirement that the work be artificially divided or divided in a way that raises the bid price of the Bidder/Contractor).
- 1.03 **PROOF REQUIRED:** Each bidder shall furnish written proof in their bid package that they reached the DBE participation goal for this Contract, or of their good faith efforts to meet the DBE participation goal. A copy of each participating DBE's certification shall accompany the required forms. All submissions shall be subject to verification of the Commonwealth.
- A. Proof that the apparent successful bidder reached the DBE goal shall consist of the following and shall be made on form DB-2-A, attached hereto:
1. The names and addresses of DBE firms that will participate in the contract;
  2. A description of the work each named DBE firm will perform;
  3. The dollar amount of participation by each named DBE firm;
  4. The percentage amount of participation by each named DBE firm;
- B. Proof that the apparent successful bidder made a good faith efforts to meet the DBE participation goal may include the following:
1. Advertisement by the Bidder/Contractor of DBE contracting opportunities associated with this contract in at least one of each of the following periodicals: a periodical in general circulation throughout the Commonwealth, a trade periodical focused on DBE contractors/suppliers in general circulation throughout the Commonwealth, and a minority-focused periodical in general circulation throughout the Commonwealth. The Bidder/Contractor shall include copies of the dated advertisements in his bid package;
  2. Written notice of DBE opportunities in this contract to at least five pertinent DBE's at least seven days prior to the bid opening date. Copies of the written notices shall be included in the bid package;
  3. The Bidder/Contractor's response(s) to those DBE's who requested plans, specifications and/or contracting requirements. Copies of said responses shall be included in the bid package;
  4. Documentation on form DB-2-B of good faith negotiations with at least three DBE's, with no rejection of a qualified DBE without sound reason, including price quotes that are above other subcontractor's price quotes;
  5. Utilization of the Finance and Administration Cabinet's Office of Equal Employment Opportunity and Contract Compliance for referrals to organizations that assist in locating DBE's. Proof of use of such referrals and contacts made as a result thereof shall be included in the bid package.

DB-2-A

**DISADVANTAGED BUSINESS AVAILABILITY VERIFICATION**

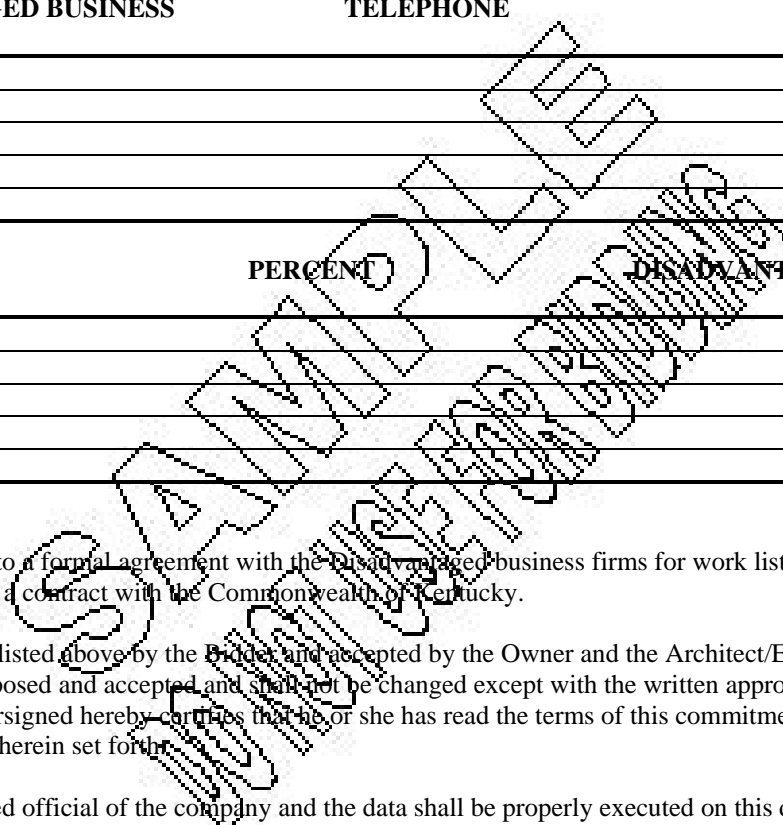
\_\_\_\_\_ does commit itself that on the following project:  
NAME OF COMPANY

\_\_\_\_\_ PROJECT NAME REQUEST FOR BID NUMBER

The Bidder agrees to furnish information required by the Commonwealth of Kentucky to indicate the Disadvantaged Business which it intends to utilize. Breach of this commitment constitutes breach of the Bidder's contract if awarded.

NAME OF DISADVANTAGED BUSINESS	TELEPHONE	TYPE OF WORK

DOLLAR VALUE	PERCENT	DISADVANTAGED CLASSIFICATION



The undersigned shall enter into a formal agreement with the Disadvantaged business firms for work listed in this schedule conditioned upon execution of a contract with the Commonwealth of Kentucky.

Disadvantaged business firms listed above by the Bidder and accepted by the Owner and the Architect/Engineer shall be used on the work for which they were proposed and accepted and shall not be changed except with the written approval of the Owner and the Architect/Engineer. The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the Bidder to the commitment herein set forth.

Signature and title of authorized official of the company and the data shall be properly executed on this document or the bid will be deemed nonresponsive.

\_\_\_\_\_  
NAME OF AUTHORIZED OFFICER

\_\_\_\_\_  
TITLE

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
DATE

If you are bidding as a General Contractor on this project i.e. direct bidding and a Disadvantaged as defined herein, please provide a copy of your DBE Certification.

Submit with Bid.  
(Please copy additional Disadvantaged Business Availability Forms as necessary.)

DB-2-B

**DISADVANTAGED BUSINESS UNAVAILABILITY VERIFICATION**

I, \_\_\_\_\_, \_\_\_\_\_ (TITLE)

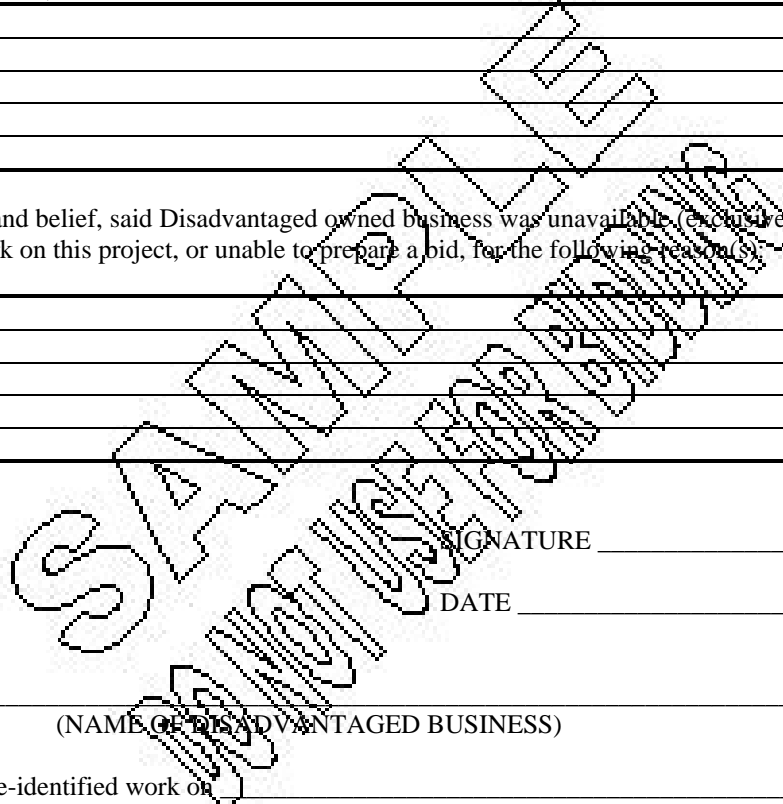
of \_\_\_\_\_ (PRIME BIDDER)

certify that on \_\_\_\_\_ I contacted the following Disadvantaged owned business by: (circle one) Certified Mail, Phone, In Person to obtain a bid for work items to be performed on the Contract.

DISADVANTAGED CLASSIFICATION (IE. WBE, MBE, DBE, SDVOB) CONTRACTOR	WORK ITEMS SOUGHT	FORM OF BID SUPPORT (IE., UNIT PRICE, MATERIALS LABOR & LABOR ONLY)

To the best of my knowledge and belief, said Disadvantaged owned business was unavailable (exclusive of unavailability due to lack of agreement on price) for work on this project, or unable to prepare a bid, for the following reason(s):

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



SIGNATURE \_\_\_\_\_

DATE \_\_\_\_\_

\_\_\_\_\_ was offered an (NAME OF DISADVANTAGED BUSINESS)

opportunity to bid on the above-identified work on \_\_\_\_\_ by \_\_\_\_\_

(SOURCE)

The above statement is a true and accurate account of why I did not submit a bid on this project.

\_\_\_\_\_  
(SIGNATURE OF DISADVANTAGED BUSINESS)

\_\_\_\_\_  
(TITLE)

\_\_\_\_\_  
(DATE)

Submit with Bid if Applicable.  
(Please copy additional Disadvantaged Business Unavailability Forms as needed.)

**OFFICIAL BID DOCUMENT  
 FOR  
 CASEY COUNTY MAINTENANCE GARAGE  
 KENTUCKY TRANSPORTATION CABINET  
 LIBERTY, KENTUCKY**

**LIST OF UNIT PRICES: (ALL BLANKS MUST BE FILLED IN)**

Unit prices shall include the furnishing of all labor, materials, suppliers, services and shall include all items of cost, overhead and profit for the Contractor and any Subcontractor involved, and shall be used uniformly without modification for either additions or deductions. The Unit Prices as established shall be used to determine the equitable adjustment of the Contract Price in connection with changes or extra work performed under the Contract. Failure to completely fill out all unit prices requested may result in bid rejection.

DESCRIPTION OF WORK		UNIT PRICE	UNIT OF MEASURE
1.	Mass earth cut (on-site disposal)	\$	CY
2.	Mass earth fill (on-site borrow)	\$	CY
3.	#57 crushed stone in place	\$	TON
4.	#2 crushed stone in place	\$	TON
5.	DGA in place	\$	CY
6.	Reinforced concrete foundations	\$	CY
7.	Structural excavation for foundations	\$	CY

**SAMPLE  
 DO NOT USE FOR BIDDING**



**OFFICIAL BID DOCUMENT  
FOR  
CASEY COUNTY MAINTENANCE GARAGE  
KENTUCKY TRANSPORTATION CABINET  
LIBERTY, KENTUCKY**

**LIST OF PROPOSED SUBCONTRACTORS:**  
**(Must be submitted with Bid)**

The following list of proposed subcontractors is required by the owner to be executed, completed, and submitted with the Bidder's Proposal. All subcontractors are subject to approval by the Division of Engineering and Contract Administration, Department of Facilities and Support Services, Frankfort, Kentucky. Failure to submit this list, completely filled out, may result in bid rejection.

If certain branches of work are to be done by the Prime Contractor, so state. Review/evaluation of subcontractors will occur on the bid opening day. If the Commonwealth requests replacement of a subcontractor, on bid opening day, then the apparent low bidder will provide a replacement subcontractor prior to close of the Commonwealth's business day on that day. Failure of the apparent low bidder to comply with the preceding sentence may result in bid rejection. If subcontractor review/evaluation is not completed on the bid opening day, then procedures for any replacement will be issued based on the uniqueness of each situation. The responsibility for selection, offering of qualified, competent subcontractors to accomplish the work intended is solely the responsibility of the bidder to the Commonwealth.

**ALL BLANKS MUST BE FILLED IN. IF PERFORMED BY THE BIDDER, STATE PRIME/GENRAL CONTRACTOR.**

	<b>BRANCH OF WORK</b>	<b>NAME OF SUBCONTRACTOR</b>
1.	Earthwork	
2.	Asphalt paving	
3.	Cast-in-place concrete (Base Brd)	
4.	Metal building insulation system	
5.	Metal building system	
6.	Plumbing	
7.	Plumbing Insulation	
8.	HVAC	
9.	HVAC Insulation	
10.	Sheet Metal (ductwork)	
11.	Electrical	
12.	Technology Wiring	

**OFFICIAL BID DOCUMENT  
 FOR  
 CASEY COUNTY MAINTENANCE GARAGE  
 KENTUCKY TRANSPORTATION CABINET  
 LIBERTY, KENTUCKY**

**LIST OF MATERIALS AND EQUIPMENT (MUST BE COMPLETELY FILLED OUT WHEN BID IS SUBMITTED):**

Every item listed under the different phases of construction must be clearly identified so that the Owner will definitely know what the bidder proposes to furnish. Bidders be hereby advised that this list is required by the owner to be executed, completed, and submitted with the Bidder's Proposal.

The use of the manufacturer's dealer's name only, or stating "as per plans and specifications", will not be considered as sufficient identification.

Where more than one "Make or Brand" is listed for any one item, the Owner has the right to select the one to be used.

Failure to submit a proper list may result in rejection of Bidder's Proposal.

	<b>MATERIAL AND/OR EQUIPMENT:</b>	<b>MANUFACTURER AND BRAND NAME:</b>
1.	Cast-in-place concrete (Supplier)	
2.	Metal building insulation	
3.	Aluminum windows	
4.	Aluminum canopies	
5.	Metal building system	
6.	Gas fired unit heaters	
7.	Outdoor packaged HVAC units	
8.	Exhaust fans	
9.	Panelboards	
10.	Disconnect switches	



**Andy Beshear**  
Governor

Commonwealth of Kentucky  
Finance and Administration Cabinet  
DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES  
**DIVISION OF ENGINEERING & CONTRACT  
ADMINISTRATION**

Bush Building, 403 Wapping Street, 2<sup>nd</sup> Floor  
Frankfort, KY 40601  
(502) 564-3155  
Fax (502) 564-3649

**Holly M. Johnson**  
Secretary

**Sam Ruth**  
Commissioner

**Jennifer Linton**  
Executive Director

**NOTICE TO CONTRACTORS  
FOR  
CASEY COUNTY MAINTENANCE GARAGE  
KENTUCKY TRANSPORTATION CABINET  
LIBERTY, KENTUCKY**

Attached hereto is a copy of the "Advertisement for Bids" for furnishing all labor, equipment, appliances and materials necessary for Casey County Maintenance Garage, Kentucky Transportation Cabinet, Liberty, Kentucky.

**SAME IS DESIGNATED AS:**

<b>REQUEST NO.</b>	Request for Bid No. RFB-137-21
<b>BID ON:</b>	CASEY COUNTY MAINTENANCE GARAGE KENTUCKY TRANSPORTATION CABINET LIBERTY, KENTUCKY
<b>BID DATE:</b>	February 3, 2021 2:00 P.M., Eastern Time

Responsible Contractors who have proper experience, equipment and qualifications are invited to bid on this work. These factors will be considered in the Award of Contract and all work will be performed under the standard regulations for construction of the Commonwealth of Kentucky.

**PRE-BID MEETING/SITE VISITS:** The Virtual Pre-bid is January 20, 2021 at 9:00 AM.

There will be a virtual pre-bid on the above referenced project. Contractors must email Scott Jackson with Clotfelter-Samokar to be invited to a Team's Meeting for this virtual pre-bid. Email is [sjackson@clotfelter-samokar.com](mailto:sjackson@clotfelter-samokar.com). Interested contractors must contact Scott Price with the Transportation Cabinet (606) 706-9404, to schedule a site visit. Contractors must make an appointment to visit the site. Please limit to one representative per company. Be prepared for temperature checks at various state agency entry points. If you have a fever, you will be turned away. Face masks are also required by employees/contractors when working, traveling or meeting in groups or in common areas (breakrooms, hallways, etc.) Anything said at the site visit is not valid unless it is in the addendum.

**PART I  
ADVERTISEMENT FOR BIDS**

1. **INVITATION:**

Sealed bid documents for the following work will be received by the Division of Engineering and Contract Administration, 2nd Floor Bush Building, 403 Wapping Street, Commonwealth of Kentucky, Frankfort, KY 40601, in the manner and on the date hereinafter specified for the furnishing of all labor, materials, supplies, tools, appliances, equipment, services, etc., necessary for Casey County Maintenance Garage, Kentucky Transportation Cabinet, Liberty, Kentucky, as set forth in the specifications and as shown on the drawings prepared by Scott Jackson and Ben Boggs, Omni Architects, Wayne Thomas, Staggs & Fisher Consulting Engineers, Inc., Jay Wang, Brown + Kubican; and approved by the Department for Facilities and Support Services of the Commonwealth of Kentucky and under the terms and conditions to this Request for Bid.

2. **PROJECT DESCRIPTION:**

The project is to be a new maintenance garage for the Kentucky Transportation Cabinet, District 8. The building will be an 8,000 square feet pre-engineered metal building with metal wall and roof panels and a thermal insulation/liner system. The structural system consists of a pre-engineered steel frame skeleton with conventional poured in place concrete shallow foundations, piers, grade beams and concrete floor slabs. The building layout consists of a 6,000 sf vehicle area with two vehicle bays, and a 2,000 sf support area containing offices, toilets, shower, break room and storage. Interior partitions will be light gauge steel framing with gypsum board surface and sound batt insulation. Occupied support spaces will have exposed concrete flooring and acoustic panel ceilings. Pedestrian doors will be hollow metal, windows will be aluminum framed with insulating glass. Vehicle doors will be by Owner. Site work consists of excavation and engineered fill for the building pad, minimal sidewalks, and parking and asphalt paving. Site furnishings include signage and flagpole. Water service shall be from municipal system, sanitary will gravity flow to municipal system. The building will utilize natural gas for heat. HVAC for occupied support spaces will be a packaged horizontal HVAC unit. Vehicle bays will be heated with gas unit heaters and ventilated with exhaust fans. Electrical work includes a 120/240V power distribution system and LED lighting. Communications systems will include telephone and data wiring and devices.

3. **METHOD OF BIDDING:**

Bids will be received from Prime Contractors on a Lump Sum Bid Basis for the total project. All phases of work shall be bid to and through the Prime Contracting Firms. Bids shall be submitted in the manner herein described and on the official bid document form included with the conditions and specifications and shall be subject to all the conditions as set forth and described in the Bid Documents.

**SPECIAL NOTE:**

**Bids shall be submitted on the Official Form supplied by the Division of Engineering and Contract Administration. Failure to comply with the foregoing requirements will be cause for invalidation of bid.**

4. **METHOD OF AWARD:**

Award shall be issued on the lowest responsive bid by a responsible bidder. The Bid Document shall contain all qualifying requirements and forms. It is the intent of the Commonwealth of Kentucky to use all available funds. Alternates will be taken in the order listed as funds permit.

**Bid is subject to Reciprocal preference for Kentucky resident bidders and Preferences for a Qualified Bidder or the Department of Corrections, Division of Prison Industries (KAR 200 5:410).**

**KRS 45A.490 Definitions for KRS 45A.490 to 45A.494.**

As used in KRS 45A.490 to 45A.494:

- (1) "Contract" means any agreement of a public agency, including grants and orders, for the purchase or disposal of supplies, services, construction, or any other item; and
- (2) "Public agency" has the same meaning as in KRS 61.805.

**KRS 45A.492 Legislative declarations.**

The General Assembly declares:

- (1) A public purpose of the Commonwealth is served by providing preference to Kentucky residents in contracts by public agencies; and
- (2) Providing preference to Kentucky residents equalizes the competition with other states that provide preference to their residents.

**KRS 45A.494 Reciprocal preference to be given by public agencies to resident bidders -- List of states -- Administrative regulations.**

- (1) Prior to a contract being awarded to the lowest responsible and responsive bidder on a contract by a public agency, a resident bidder of the Commonwealth shall be given a preference against a nonresident bidder registered in any state that gives or requires a preference to bidders from that state. The preference shall be equal to the preference given or required by the state of the nonresident bidder.
- (2) A resident bidder is an individual, partnership, association, corporation, or other business entity that, on the date the contract is first advertised or announced as available for bidding:
  - (a) Is authorized to transact business in the Commonwealth; and
  - (b) Has for one (1) year prior to and through the date of the advertisement, filed Kentucky corporate income taxes, made payments to the Kentucky unemployment insurance fund established in KRS 341.490, and maintained a Kentucky workers' compensation policy in effect.
- (3) A nonresident bidder is an individual, partnership, association, corporation, or other business entity that does not meet the requirements of subsection (2) of this section.
- (4) If a procurement determination results in a tie between a resident bidder and a nonresident bidder, preference shall be given to the resident bidder.
- (5) This section shall apply to all contracts funded or controlled in whole or in part by a public agency.
- (6) The Finance and Administration Cabinet shall maintain a list of states that give to or require a preference for their own resident bidders, including details of the preference given to such bidders, to be used by public agencies in determining resident bidder preferences. The cabinet shall also promulgate administrative regulations in accordance with KRS Chapter 13A establishing the procedure by which the preferences required by this section shall be given.
- (7) The preference for resident bidders shall not be given if the preference conflicts with federal law.
- (8) Any public agency soliciting or advertising for bids for contracts shall make KRS 45A.490 to 45A.494 part of the solicitation or advertisement for bids.

The reciprocal preference as described in KRS 45A.490-494 above shall be applied in accordance with 200 KAR 5:400.

**Determining the residency of a bidder for purposes of applying a reciprocal preference**

Any individual, partnership, association, corporation, or other business entity claiming resident bidder status shall submit along with its response the attached Required Affidavit for Bidders, Offerors, and Contractors Claiming Resident Bidder Status. The BIDDING AGENCY reserves the right to request documentation supporting a bidder's claim of resident bidder status. Failure to provide such documentation upon request shall result in disqualification of the bidder or contract termination.

A nonresident bidder shall submit, along with its response, its certificate of authority to transact business in the Commonwealth as filed with the Commonwealth of Kentucky, Secretary of State. The location of the principal office identified therein shall be deemed the state of residency for that bidder. If the bidder is not required by law to obtain said certificate, the state of residency for that bidder shall be deemed to be that which is identified in its mailing address as provided in its bid.

5. **PROJECT CONTACTS:**

1. Architect: Scott Jackson and Ben Boggs, Omni Architects, (859) 273-3700, [sjackson@clotfelter-samokar.com](mailto:sjackson@clotfelter-samokar.com) ; [bboggs@clotfelter-samokar.com](mailto:bboggs@clotfelter-samokar.com)
2. Consultant: Wayne Thomas, Staggs & Fisher Consulting Engineers, Inc., (859) 271-3246, [wthomas@sfengineering.com](mailto:wthomas@sfengineering.com)
3. Consultant: Jay Wang, Brown + Kubican, (859) 543-0933, [jwang@bkse.net](mailto:jwang@bkse.net)
4. Project Manager: Bill Novak, Division of Engineering and Contract Administration, (502) 564-8110, [Bill.Novak@ky.gov](mailto:Bill.Novak@ky.gov)
5. Agency: Terry Denny, KY Transportation Cabinet, (502) 221-1970, [terry.denny@ky.gov](mailto:terry.denny@ky.gov)
6. Site: , Casey County Maintenance Garage, ,
7. Purchasing Agent: Margaret MacDonald, Division of Engineering and Contract Administration, (502) 564-5182, [Margaret.MacDonald@ky.gov](mailto:Margaret.MacDonald@ky.gov)

6. **BID SUBMITTAL:**

Due to the COVID-19 virus, the Bush Building is closed until further notice. Bids will no longer be accepted via postal carrier (USPS, UPS, FED EX, etc.) nor can bids be delivered to the Bush Building. All forms in your bid document shall be completely filled out when your bid is submitted. **Bids must be submitted electronically through MOVEit in order to be accepted.** Instructions are attached. **Contractors must load their Bid Documents COMBINED into one PDF document under the corresponding RFB in MOVEit in order for it to be received. IF BID IS NOT UPLOADED IN THE CORRECT FOLDER IN MOVEit, THE BID WILL BE DEEMED NON-RESPONSIVE.** *Bidders are encouraged to take a screen shot verifying bid submittal.* This is a secure website, no one can see these bids but the buyers. They are date and time stamped when submitted.

Please note that the instructions for MOVEit state that contractors will be notified when their bid is received. Buyers will NOT be notifying contractors.

All results will be posted to Lynn Imaging planroom after the bid opening and review. If additional information is needed from the successful bidder the buyer will be in contact.

**NOTE: Your bid must be sent in time to arrive prior to the bid closing date and time.**

Bidder assumes full responsibility for timely delivery of the bid in compliance with the above described procedures and conditions.

**There will be a public bid reading by conference call on the bid opening date at 2:30 PM ET.  
The dial in number is 502-782-2663 or 844-603-5060.  
Participant code is 45182#**

7. **BID WITHDRAWAL:**

No bidder may withdraw his bid for a period of thirty (30) days after the date set for the opening of bids.

8. **BONDING:**

All bids shall be accompanied by a bid guarantee (in the form of a bid bond or certified check) of not less than five (5%) percent of the amount of the lump sum base bid. A 100% Performance Bond and a separate 100% Payment Bond shall be furnished by the successful bidder. All bonding and insurance requirements are contained in the Instructions to Bidders and/or General Conditions. Bonds should be executed by a surety company authorized to do business in the Commonwealth of Kentucky.

9. **RIGHT TO REJECT:**

The Division of Engineering and Contract Administration, Commonwealth of Kentucky, reserves the right to reject any and all bids and to waive all informalities and/or technicalities where the best interest of the Commonwealth may be served.

10. **GENERAL INFORMATION:**

- A. Bidder's Qualifications, Unit Prices, Proposed Subcontractors, and List of Materials are required to be submitted with the bid.
- B. All documents related to this project shall be submitted, transmitted, transferred, reviewed, approved or rejected, and/or otherwise processed using the Owner's Document Collaboration System (eCommunications) which is the Owner's web-based document collaboration system that shall be used by all project participants. No submission, transmittal, transfer, review, approval or processing shall be deemed Official without the use of this system.
- C. KRS 337.550 (1) Provides that if any contractor or subcontractor is found to be in violation of any provisions of KRS 337.505 to 337.550 by the Department of Labor and upon notification to the Commissioner of the Department for Facilities and Support Services, the Commissioner of the Department for Facilities and Support Services shall hold such contractor or subcontractor ineligible to bid

on public works until such a time as that contractor or subcontractor is in substantial compliance as determined by the Commissioner of Labor.

- D. Each demolition/renovation project must comply with Kentucky Division of Air Pollution Control Regulation 401 KAR 57:011. This includes notification, in writing, to the Division of Air Pollution Control, ten (10) days before start of the project.
- E. **Tobacco-Free:** Pursuant to Executive Order, use of any tobacco products (including e-cigarettes) is prohibited in all Executive Branch buildings and parking lots and on the grounds. Please refer to Executive Order # 2014-747 for complete details.  
For FAQ's go to: <http://tobacco-free.ky.gov/Pages/FAQs.aspx>

F. **REGISTRATION WITH SECRETARY OF STATE:**

Domestic and foreign corporations shall be registered with the Kentucky Secretary of State and declared to be in "good standing" prior to award of contract. Offeror should verify status at the following website: <http://www.sos.ky.gov> and click on "Business Services". Failure to comply with this requirement within (5) days after notification may render your bid non-responsive.

G. **REGISTRATION WITH SECRETARY OF STATE BY A FOREIGN ENTITY:**

Pursuant to KRS 45A.480(1)(b), an agency, department, office, or political subdivision of the Commonwealth of Kentucky shall not award a state contract to a person that is a foreign entity required by [KRS 14A.9-010](#) to obtain a certificate of authority to transact business in the Commonwealth ("certificate") from the Secretary of State under [KRS 14A.9-030](#) unless the person produces the certificate within fourteen (14) days of the bid or proposal opening. Therefore, foreign entities should submit a copy of their certificate with their solicitation response. If the foreign entity is not required to obtain a certificate as provided in [KRS 14A.9-010](#), the foreign entity should identify the applicable exception in its solicitation response. Foreign entity is defined within [KRS 14A.1-070](#).

**For all foreign entities required to obtain a certificate of authority to transact business in the Commonwealth, if a copy of the certificate is not received by the contracting agency within the time frame identified above, the foreign entity's solicitation response shall be deemed non-responsive or the awarded contract shall be cancelled.**

Businesses can register with the Secretary of State at <https://secure.kentucky.gov/sos/ftbr/welcome.aspx>.

H. **REGISTRATION with eMars (eProcurement):**

In order to receive a contract in the State's electronic procurement system (eMars/eProcurement), a vendor/contractor shall be registered to conduct business therein. Business entities not already registered may register by visiting the eProcurement website at ([www.eprocurement.ky.gov](http://www.eprocurement.ky.gov)) and complete the registration information. The website has phone numbers and email addresses to facilitate answering any questions you may have with the registration or update process. Failure to comply with this requirement within (5) days after notification may render your bid non-responsive.

I. **PRE-BID MEETING:**

There will be a virtual pre-bid on the above referenced project. Contractors must email Scott Jackson with Clotfelter-Samokar to be invited to a Team's Meeting for this virtual pre-bid. Email is [sjackson@clotfelter-samokar.com](mailto:sjackson@clotfelter-samokar.com). Interested contractors must contact Scott Price with the Transportation Cabinet (606) 706-9404, to schedule a site visit. Contractors must make an appointment to visit the site. Please limit to one representative per company. Be prepared for temperature checks at various state agency entry points. If you have a fever, you will be turned away. Face masks are also required by employees/contractors when working, traveling or meeting in groups or in common areas (breakrooms, hallways, etc.) Anything said at the site visit is not valid unless it is in the addendum.

The Virtual Pre-bid is January 20, 2021 at 9:00 AM.

## Section 1: Definitions

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1. "Addendum" means a written or graphic instrument issued by the purchasing agency prior to the execution of the contract that modifies or interprets the Bidding Documents by addition, deletion, clarification or correction.
  2. "Alternate" means an optional item stated in the bid the amount of which is to be added to or deducted from the amount of the base bid.
  3. "Architect" or "Engineer" means a firm that provides professional design services and is engaged by the Division of Engineering and Contract Administration for Capital Construction Projects, and identified as such in the Contract Documents. The term refers to the design team, consisting of the prime architect/engineer and all Sub-Consultants (if used) or consultant identified by the owner.
  4. "Bid" means the sum stated in the Bid Response for which the bidder offers to perform the work described in the specifications and detailed on the plans.
  5. "Bidder" means one who submits a bid directly to the owner for the work described in the bidding documents.
  6. "Bidding Documents" means the Solicitation, including Instructions to Bidders, General Conditions, Special and Supplemental Conditions, Forms for Response, plans, specifications and Addenda issued prior to receipt of bids.
  7. "Bid Response" means a complete and properly signed document, offering to do the work or designated portion thereof, supported by data called for by the bidding documents.
  8. "Chief Purchasing Officer" means the secretary of the Finance and Administration Cabinet, who shall be responsible for all procurement of the Commonwealth except as provided by KRS Chapters 175, 176, 177, and 180. KRS 45A.030(3).
  9. "Commonwealth" means the Commonwealth of Kentucky.
  10. "Construction" means the process of building, altering, repairing, improving or demolishing any public structures or buildings, or other public improvements of any kind to any public real property. It does not include the routine maintenance of existing structures, buildings or real property. KRS 45A.030(4).
  11. "Contract (CT/CT2)" means a document established to purchase a specific quantity or amount of goods or non-professional services at a specific price. KRS 45A.030(8).
  12. "Contract Modification" means any written alteration in the specifications, delivery point, rate of delivery, contract period, price, quantity or other contract provisions of any existing contract, whether accomplished by unilateral action in accordance with a contract provision or by mutual action of the parties to the contract. It includes bilateral actions, such as supplemental agreements, and unilateral actions, such as change orders, administrative changes, notices of termination and notices of the exercise of a contract option. KRS 45A.030(9).
  13. "DECA" means the Division of Engineering and Contract Administration within the Department for Facilities and Support Services, Finance and Administration Cabinet.
  14. "Delivery Order (DO/DO2)" means a document established by a state agency to purchase a specific quantity at a specific price referencing a Master Agreement. DO documents are generally used for commodities and DO2 documents are used for services.
  15. "DFSS" means the Department for Facilities and Support Services within the Finance and Administration Cabinet.
  16. "DRP" means the Division of Real Properties within the Department for Facilities and Support Services, Finance and Administration Cabinet.
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17. "Electronic Offer" means an online bid through the state's eProcurement system, an offer submitted by electronic mail, or an offer submitted by facsimile.
18. "FAC" means the Finance and Administration Cabinet.
19. "Government Body" means any department, commission, council, board, bureau, committee, institution, legislative body, agency, government, corporation or other establishment of the executive or legislative branch of the state government. KRS 45A.030(17).
20. "Master Agreement (MA)" means a document that establishes a price agreement for use by state agencies with a vendor for supplying specific goods and services at specific unit prices during a specified time period. It does not place an order for goods and services.
21. "Offer" means a bid, proposal, Solicitation response or quotation.
22. "OPS" means the Office of Procurement Services within the Finance and Administration Cabinet.
23. "Owner" means the Commonwealth of Kentucky.
24. "Person" means any business, individual, organization or group of individuals. KRS 45A.030(20).
25. "Planholder" means any entity, supplier and/or subcontractor that has purchased plans and specifications from the Division of Engineering and Contract Administration's reprographics vendor in order to submit a bid with the Commonwealth of Kentucky.
26. "Procurement" means the purchasing, buying, renting, leasing or otherwise obtaining of any supplies, services or construction. It includes all functions that pertain to the procurement of any supply, service or construction item, including description of requirements, selection and solicitation of sources, preparation and award of contract, and all phases of contract administration. KRS 45A.030(21).
27. "Proof of Necessity Agreement (PON2)" means a type of contract established by a state agency to purchase professional services (i.e. personal service contracts, grants and memoranda of agreements).
28. "Purchase Order (PO/PO2)" means a type of contract established by a state agency to purchase a specific quantity or amount of goods or non-professional services at a specific price and is generally for a one-time purchase. A PO2 for non-professional services may contain an option to renew for an additional time period.
29. "Purchasing Agency" means any governmental body that is authorized by this code or its implementing administrative regulations or by way of delegation from the chief purchasing officer to contract on its own behalf rather than through the central contracting authority of the chief purchasing officer. KRS 45A.030(23).
30. "Purchasing Officer" means any person authorized by a governmental body in accordance with procedures prescribed by administrative regulations to enter into and administer contracts and make written determinations and findings with respect thereto. The term includes an authorized representative acting within the limits of authority. KRS 45A.030(24).
31. "Quote" or "Quotation Response" means a complete offer to perform the work specified in the Request for Quotation.
32. "RFB" means a Request for Bids.
33. "RFI" means a Request for Information.
34. "RFP" means a Request for Proposals. KRS 45A.070(5).
35. "RFQ" means a Request for Quotations.

36. "SAS" means the Office of Statewide Accounting Services within the Finance and Administration Cabinet.
37. "Secretary" means the secretary of the Finance and Administration Cabinet.
38. "Solicitation" means an RFB, RFI, RFP or RFQ.
39. "Sub-bidder" or "Subcontractor" means one who submits a bid to a prime bidder for materials or labor for a portion of the work described in the bidding documents.
40. "Tiered Pricing" means a determination of price based on volume, where the larger the volume, the larger the discount offered.
41. "Time" means calendar days.
42. "Unit Price" means an amount stated in the bid as a price per unit of measurement for materials or services as described in the bidding documents.
43. "Using Agency" means the state government entity that utilizes the work being contracted.

**FAP 220-05-00****BIDDER INSTRUCTIONS FOR COMPETITIVELY SEALED BID CONSTRUCTION SOLICITATIONS**

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- 1. Bidder's Representations:** Each bidder, by submitting a bid, swears or affirms, under penalty of law, that:
    - a. The bidder has read and understands the bidding documents and the bid is made in accordance with the bidding documents.
    - b. The bidder has carefully examined the site of the proposed work and is familiar with the local conditions under which the work is to be performed.
    - c. The bid is premised upon furnishing the work required by the bidding documents.
    - d. The bid amount has been arrived at by the bidder independently and has been submitted without collusion with, and without any agreement, understanding or planned common course of action with any other contractor, vendor of materials, supplies, equipment or services described in the Solicitation, that is designed to limit independent bidding or competition.
    - e. The contents of the bid have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the bidder, or its surety on any bond furnished with the bid and will not be communicated to any such person prior to the bid opening.
    - f. The bidder is legally entitled to enter into a contract with the Commonwealth and the award of a contract shall not create any conflict of interest, including those set out in KRS 45A.330 – KRS 45A.340; KRS 45A.455 and KRS 164.390.
  
  - 2. Bidding Documents:**
    - a. A bidder, sub-bidder, sub-contractor and others may obtain bidding documents in the manner and for the charge, if any, stated in the Solicitation.
    - b. A complete set of bidding documents shall be used in preparing bids. The Commonwealth assumes no responsibility for misinterpretations resulting from the use of incomplete sets of bidding documents. The bidder shall supply all information called for in the Solicitation. Failure to supply the specified information may be cause for determining the bid nonresponsive.
    - c. The Commonwealth, in providing bidding documents, does so only for the purpose of obtaining bids on the work and does not confer a license or grant for any other use.
    - d. A bidder shall promptly notify the purchasing officer of any ambiguity, inconsistency or error, which it may discover upon examination of the bidding documents or of the site and local conditions.
    - e. All questions regarding the meaning or interpretation of the bidding documents shall be directed in writing to the purchasing officer. Unless otherwise specified in the Solicitation, questions received less than ten (10) calendar days prior to the date for receipt of bids may not be answered.
    - f. Any interpretation, correction or change of the bidding documents shall be made by an addendum issued by the purchasing agency. Interpretations, corrections or changes of the bidding documents made in any other manner shall not be binding and bidders shall not rely upon such interpretations, corrections or changes.
    - g. Unless otherwise indicated in the bidding documents, the materials, products and equipment described or referenced by manufacturers' or vendors' names, trade names and catalog numbers are intended to establish a standard of required function, dimension, appearance and quality. Unless otherwise stated, equal items may be furnished or used if approved by the purchasing officer in consultation with the architect or the director of DECA.
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- h. Addenda shall be published on the Commonwealth's eProcurement web site, and shall be issued to all who are registered planholders with the contracted reprographics company or other distribution authorized by the director of DECA.
- i. Copies of addenda shall be made available for inspection wherever bidding documents are on file.
- j. No addenda of a material nature shall be issued later than seven (7) calendar days prior to the date for receipt of bids, except for addenda postponing the date for receipt of bids or withdrawing the Solicitation.
- k. The bidder shall ascertain prior to submitting a bid that the bidder has received all addenda issued by the purchasing officer for the particular solicitation. The bidder shall acknowledge receipt of all addenda on the Bid Response or by a separate letter to the purchasing officer, which shall be received at or prior to the hour and date specified for receipt of bids.

### 3. Bidding Procedure:

- a. Bids shall be submitted on the Bid Documents provided by the purchasing officer.
  - b. All blanks in the Bid Documents shall be completed and all required support data shall be furnished.
  - c. If required in the bidding documents, sums shall be expressed in both words and numerical figures. In the case of discrepancy between the two, the amount in words shall prevail.
  - d. The authorized representative of the bidder, who signed the Bid Response, shall initial any alteration or erasure in ink.
  - e. The bid shall be firm in offer and conform substantially to the advertised terms, plans and specifications. Any qualifications or reservation imposed by a bidder in the bid retaining the option of accepting, modifying or rejecting an offered contract shall be cause to render the bid not firm and ineligible for consideration of award. Any offer in response to the Solicitation that includes terms contrary or in addition to those in the Solicitation may be considered non-responsive and may be rejected by the Commonwealth.
  - f. All alternates specifically called for by the Commonwealth shall be bid. Voluntary alternate bids or an alternate to a lump sum bid shall not be considered.
  - g. The bidder shall make no stipulations on the Bid Response nor qualify the bid in any manner.
  - h. A person legally authorized to bind the bidder to a contract shall sign the Bid Response. The Bid Response shall also include the legal name of the bidder and a statement indicating whether the bidder is a sole proprietorship, a partnership, a corporation or other legal entity. A bid by a corporation shall also identify the state of incorporation and federal employer identification number.
  - i. The purchasing officer shall retain the bid security of bidders until:
    - 1. The contract has been executed and performance and payment bonds have been furnished;
    - 2. The specified time has elapsed so that bids may be withdrawn; or
    - 3. All bids have been rejected.
  - j. The completed Bid Response, bid security, and required support data shall be enclosed in a sealed envelope. The envelope shall be addressed to the bid receipt clerk stated in the Solicitation and shall identify the bidder's name and address, the invitation number stated in the bidding documents, closing date and hour. If the bid is sent by mail, the sealed envelope shall contain the notation "BID ENCLOSED" on the face thereof.
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- k. Bids shall be received at the designated location prior to the closing time and date for receipt of bids indicated in the Solicitation or any extension thereof made by addendum. Bids received after the closing time and date for receipt of bids may be considered for evaluation and award only if:
  - 1. No other bids were received within the advertisement period;
  - 2. The readvertisement time delay would seriously affect the operations of the using agency; and
  - 3. In the reasonable judgment of the purchasing officer, the bid was finalized prior to the official closing time and date for the receipt of bids.
- l. A bidder shall assume full responsibility for timely delivery at the location designated for receipt of bids.
- m. Oral, telephonic, facsimile or telegraphic bids or changes in bids by such methods are not permitted and shall not be considered.
- n. A competitively solicited contract shall be awarded from a bid evaluation in the state's eProcurement system or all bidders shall be notified of the award in writing.

#### **4. Modification or Withdrawal of a Bid:**

- a. A bid may be withdrawn prior to the closing time and date for receipt of bids by written request from an authorized representative of the bidder. The modification or withdrawal of a bid shall be received by the receipt clerk stated in the Solicitation prior to bid closing time to be considered valid.
- b. A withdrawn bid may be resubmitted up to the closing time designated for the receipt of bids.
- c. No bidder may withdraw, modify or cancel its bid for a period of thirty (30) calendar days following closing time and date for receipt of bids without the bid security being subject to forfeiture.

#### **5. Legal Requirements:**

- a. A foreign corporation submitting a bid shall be registered with the Kentucky Secretary of State and be declared in good standing prior to the issuance or receipt of a contract.
- b. A domestic corporation submitting a bid shall be in good standing in accordance with the requirements of the Kentucky Secretary of State.

#### **6. Taxes:**

- a. The winning bidder shall be liable for payment of Kentucky sales and use tax.
- b. The winning bidder is deemed the end user of all building materials used in construction projects for the Commonwealth.
- c. The winning bidder may not separately state Kentucky sales or use tax payable by the Commonwealth.

#### **7. Planholder's List:** The published planholder and addenda listing is for general information purposes and the exclusion or inclusion of any firm in no way expresses or implies Commonwealth approval or disapproval of the qualifications of any listed bidder, subcontractor, or material or equipment supplier.

#### **8. Bid Bonds:** Pursuant to KRS 45A.185, DECA or the using agency may require a bid bond as surety that a bidder will hold its offer firm for a specified period of time. If the Solicitation requires a bid bond, a bidder shall file with the requesting agency a bid bond or certified check in the amount and form specified by the Solicitation with the requesting agency. The bond shall be received either with the bid or prior to the bid closing to be considered.

- a. The bond shall be in an amount equal to at least five percent (5%) of the amount of the bid or as stated in the Solicitation.
- b. In addition to signing the bid bond as principal, the bidder shall have the bond signed by a surety company authorized to do business in the Commonwealth. A list of surety companies may be obtained from the Kentucky Department of Insurance. If the surety on a bond has its authority to do business in Kentucky revoked or, if for any reason it ceases to do business in the Commonwealth, the bidder shall promptly obtain another surety on the bond.
- c. The bond shall be conditioned on full performance of all obligations imposed on the bidder by the Solicitation, including the obligation to keep the price firm for as long a period as specified in the Solicitation, obligation to enter into a contract with the Commonwealth, and the obligation to file a performance payment bond if required by contract. The bid bond shall provide that upon failure to perform an obligation, the Commonwealth may recover from the bidder and the surety, or either of them, any and all damages suffered because of the failure.
- d. If a bidder elects to submit a certified check in lieu of a bid bond, it shall be security for full performance of all obligations referred to in subsection c. of this Section.
- e. If a bidder is not awarded a contract, the certified check shall be returned to that bidder promptly after the award is made. The successful bidder's check shall be returned after the contract is awarded or as soon as the bidder has filed a performance bond, if required. Checks may be returned by certified mail, return receipt requested. The return receipts shall be electronically attached or hard copies attached to each bidder's bid and filed in the bid folder.

#### **9. Consideration of Bids:**

- a. Unless the bidding documents indicate otherwise, all properly identified, timely bids shall be publicly opened, read aloud, and listed on the official bid tabulation. Tabulations shall be made available to bidders upon written request to the FAC's Open Records Custodian.
- b. The Commonwealth retains the right to cancel the Solicitation, to reject any and all bids, and to waive technicalities and minor irregularities in bids, if such action is determined to be in the best interest of the Commonwealth.
- c. Grounds for the disqualification of bids are stated in 200 KAR 5:306(4)(2).
- d. Minor or technical deficiencies or irregularities in a bid may be waived by the purchasing officer on behalf of the Commonwealth, if:
  1. The purchasing officer determines that it is in the Commonwealth's best interest to do so;
  2. The technicalities or irregularities are mere matters of form not affecting the material substance of a bid, represent an immaterial deviation from or variation in the precise requirements of the Solicitation, and have no more than a trivial or negligible effect on price, quality, quantity or delivery of supplies or performance of services being procured; and
  3. The correction or waiver of the technicality or irregularity does not affect the relative standing of, or prejudice other bidders.
- e. If the Commonwealth does not waive the deficiency, the deficient bid shall be rejected.

#### **10. Acceptance of Bid:**

- a. A contract shall be awarded, after a reasonable bid evaluation period, in accordance with the Solicitation, if the acceptable bid is within the amount budgeted by the agency.

- b. The Commonwealth reserves the right to accept or reject any alternate bid. If alternates designated by the Commonwealth are considered in the award, the alternates shall be accepted in the sequence in which they are listed on the Bid Documents and the lowest bid sum shall be computed on the basis of the sum of the base bid plus any alternates accepted.

#### **11. Qualification of Contractors:**

- a. A bidder shall submit a statement of the bidder's qualifications as part of the Bid Response. The purchasing officer shall have the right to make such inquiry as deemed necessary to determine the ability of the bidder to perform the work in a prompt and efficient manner in accordance with the contract documents. The failure of a bidder to promptly supply information in connection with the purchasing officer's inquiry may be grounds for a determination that such bidder is nonresponsive.
- b. In determining the qualifications and responsibility of a bidder, the purchasing officer shall consider the bidder's experience, facility, previous work standing, financial standing, skill, quality and efficiency of construction plant, and equipment proposed to be utilized on the project.
- c. The Commonwealth may reject any bid if an investigation and evaluation of the bidder's qualifications give reasonable doubt that the bidder can perform the work in a prompt and efficient manner in accordance with the contract documents.

#### **12. Unit Prices:**

- a. If requested in the Solicitation, a bidder shall submit a list of unit prices in accordance with the Bid Document instructions, which shall include labor, materials, equipment, appliances, supplies, overhead and profit, as applicable.
- b. Unit prices shall be used for the pricing of changes in the quantity of work from that indicated by the contract drawings and specifications, if the Commonwealth has authorized such changes in writing.
- c. Only one (1) unit price shall be quoted for each designated item of work. The unit price shall be used to calculate price adjustments based on deductive as well as additive changes.
- d. Unit prices shall apply to all phases of the work whether the work is performed by the bidder or by the bidder's subcontractor.
- e. For unit prices of a lump sum bid contract, the Commonwealth reserves the right, prior to an award of contract, to evaluate the unit prices and adjust or reject any unit price that is determined by the purchasing officer to be unreasonable in amount.
- f. If a total sum bid is made by line item, and unit prices are quoted for estimated quantities of units of work, such unit prices are not subject to change. However, the purchasing officer reserves the right to correct mathematical errors in extensions and additions by the bidder. In the latter case, the purchasing officer's corrected bid sum total shall supersede the bidder's incorrect computed bid sum total.

#### **13. Subcontractor Listing:**

- a. If requested, a bidder shall list the names of subcontractors proposed for each of the principal portions of the work, including those persons or entities who are to furnish material or equipment fabricated to a special design, in the designated place on the Bid Documents.
- b. When a listed subcontractor is proposed for a principal portion of the work as required in subsection a. above, and that subcontractor is not self-performing the work, but is subcontracting the work to lower tier subcontractor, each lower tier subcontractor shall be listed in parenthesis after the name of the main subcontractor. Without such listing of lower tier contractors, the main subcontractor must perform the work of that principal portion of the work with its own forces in its entirety.

- c. A bidder shall establish, to the satisfaction of the purchasing officer, the reliability and responsibility of the listed subcontractors. The bidder may be required by the purchasing officer to provide additional information regarding listed subcontractors, including listed lower tier subcontractors.
- d. If, after due investigation, there is reasonable objection to the qualifications of a listed subcontractor or a listed lower tier subcontractor, the bidder shall, upon written direction of the purchasing officer, submit the name of an acceptable substitute subcontractor or lower tier subcontractor with no change in bid price. The failure of the bidder to promptly comply with this requirement may be grounds for rejection of the bid.
- e. Any listed subcontractor or listed lower tier subcontractor to whom the purchasing officer does not make written objection prior to the award of the contract shall be deemed acceptable to the Commonwealth.
- f. A bidder shall make no other substitution for any listed subcontractor or listed lower tier subcontractor without first receiving the approval of the purchasing officer in writing of the intended substitution and the specific reason for the substitution. A substitution may be disapproved if the purchasing officer has reasonable objection. The purchasing officer may require a written agreement from the subcontractor being released.
- g. Any work performed by a lower tier subcontractor that is not listed on the form of proposal in the manner described above, where required by the purchasing officer, shall be deemed to have been installed at the risk of the general contractor and the Commonwealth reserves the right, at its sole discretion, to reject that portion of the work and require that the work be removed and installed by a listed subcontractor or that the Commonwealth otherwise be compensated by a credit change order for an amount determined by the Commonwealth as reasonable for acceptance of such work installed by a non-listed lower tier subcontractor.
- h. Nothing contained in the bidding documents shall be deemed to create a contractual relationship between the Commonwealth and any subcontractor.

#### **14. Materials and Contractor Listing:**

- a. If requested, a bidder shall submit a listing of primary materials and equipment, including manufacturer's name, brand and catalog number. The materials and equipment listing shall be bound with the Bid Response or completed in the time period designated in Section 15.b. of this FAP.
- b. Prior to the final acceptance of a bid, the purchasing officer shall make a preliminary review of the bidder's list of materials and equipment. The purchasing officer shall advise the bidder of the tentative acceptability of such materials and equipment, subject to satisfactory completion and approval of shop drawings, or direct such other action as may be necessary in order to meet the requirements of the contract documents. If any of the listed material or equipment is determined not to meet the requirements of the contract documents, the bidder shall be required to furnish other material or equipment meeting those requirements at no change in bid price. Preliminary review and acceptance of the above list shall not relieve the bidder, as the contractor, of the obligation to furnishing equipment and materials in accordance with the contract documents.

#### **15. Post-Bid Review:**

- a. A bidder may have an authorized representative at the bid opening for the submittal of the material and equipment listing and the post-bid review of the apparent winning bid.
- b. Unless otherwise provided in the bidding documents or authorized by the purchasing officer, the apparent winning bidder shall submit the material and equipment listing no later than one (1) hour after the close of the reading of the bids. The materials and equipment listing shall be that listing bound with the Bid Documents.
- c. After opening, the scope of work bid by each bidder shall be reviewed by representatives of the purchasing agency, the using agency, the architect or engineer, and the apparent winning bidder. Review shall be directed toward subcontractors, material listing, unit prices and qualifications of the bidder.



- d. The bidder's representative shall have the authority and ability to respond to questions that arise during the review.

**16. Equal Employment and Nondiscrimination:**

- a. The Commonwealth is committed to a policy of providing equal job opportunities on public contracts and prohibiting discrimination based on race, creed, color, sex, age, religion, national origin or disability in employment. KRS 45.560 – KRS 45.640.
- b. The utilization of minority vendors and subcontractors is encouraged, whenever possible, on public works contracts. The bidder and contractor should make full efforts to locate minority business persons. KRS 45A.610.
- c. Unless exempted in accordance with KRS 45.590, the provisions of KRS 45.560 – KRS 45.640 shall be binding upon the declared successful bidder and the resulting contract shall contain the provisions set forth in KRS 45.570(2).
- d. Unless a bidder is exempt under KRS 45.560 – KRS 45.640, the apparent successful bidder shall submit to the purchasing agency in the manner described and on the form(s) required, the information required by KRS 45.600 within five (5) calendar days of being declared the apparent low bidder. The form(s) shall be reviewed by the FAC Office of Equal Employment Opportunity and Contract Compliance.

**17. Performance and Payment Bonds:**

- a. Pursuant to KRS 45A.190 and KRS 45A.195, a bidder shall deliver the required performance and payment bonds to the purchasing agency upon notification of intent to award, or, with the approval of the purchasing officer, within fourteen (14) calendar days after that date. Otherwise, the Commonwealth may determine that the proposed awardee has abandoned the Bid Response and the bid shall become null and void.
- b. Unless otherwise specified in the bidding documents, the bonds shall be written on the form bound in the bidding document in the number of copies to be specified by the purchasing officer.
- c. A bidder shall require the attorney-in-fact, who executes required bonds on behalf of the surety, to affix thereto a certified and current copy of his/her Power of Attorney. The date of the Power of Attorney shall not precede the date of the bonds. The bonds shall be executed with a licensed resident or non-resident agent, who represents insurance companies authorized to do business in Kentucky.

**18. Award of Contract:**

- a. The issuance of an award of a contract is contingent upon securing an acceptable bid that is within the amount of budgeted funds and determining that the award of contract is in the best interest of the Commonwealth.
- b. Unless otherwise provided in the bidding documents, the Agreement between the Commonwealth and the contractor shall be written on the standard form of agreement bound within the Solicitation. The Commonwealth shall not be required to enter into or sign further agreements, leases, company orders or other documents to complete the Agreement.
- c. The Commonwealth's acceptance of the bidder's offer in response to the Solicitation, indicated by the issuance of a contract award, shall create a binding agreement between the parties consisting of the documents listed below. In the event of a conflict between the provisions contained in the contract, the order of precedence shall be in the same listing order as below.
  1. Solicitation including any addenda;
  2. Specifications;

3. Special Conditions;
4. General Conditions;
5. Technical provisions of the specifications;
6. Drawings/plans; and
7. Bid Response to the Solicitation.

**19. Award of Construction and Construction-Related Contracts:** Capital construction funded contracts require properly authorized Appropriation, Allotment, Revenue Budget, Project Management Master and Journal Voucher Transfer documents (SAS-5, SAS-14) for award of contract and allocation of construction funds. The issuing agency shall execute a construction contract using agency or general fund accounts on the basis of a duly signed agency Purchase Request.



**FINANCE AND ADMINISTRATION CABINET  
DEPARTMENT FOR FACILITIES MANAGEMENT  
DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION**

**GENERAL CONDITIONS of the Contract for Construction**  
**- General Contractor**

These **General Conditions of the Contract for Construction – General Contractor** have been implemented by the Kentucky Division of Engineering and Contract Administration for the purpose of delineating the provisions of the Contract for Construction when the Commonwealth has entered into a Contract with a General Contractor to accomplish a Capital Construction Project. The Document as a whole outlines the primary obligations and basic expectations for each entity involved in the Project.

These General Conditions apply to each section of the specifications and to the Contract Documents as a whole and are binding upon the Contractor and all Subcontractors as each are subject to the provisions contained herein.

These General Conditions are intended to define and establish certain definitions, procedures, rules and provisions of the Contract governing the operation so that the Work may be continued and be completed in an orderly, expeditious and workmanlike manner.

These General Conditions, together with the specifications and Contract Documents, shall further establish the standards of material and workmanship for the Work.

Specific Project requirements may alter the provisions indicated herein where strict adherence to the provisions of this document are not warranted or applicable. The Special Conditions and Supplemental Conditions contained in the Contract Documents, if present, modify and take precedence over the provisions of these General Conditions for this specific Project.

These General Conditions are based on and are consistent with the specific Kentucky Revised Statutes passed by the Kentucky Legislature and signed into effect by the Governor; specific Kentucky Administrative Regulations promulgated by State Agencies to enhance and clarify procedures that are authorized by a specific statute; specific Finance Cabinet Administrative Regulations; and the DECA Procedures Manual.

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# Articles

## **1. Definitions of Terms**

Wherever used in these General Conditions or in other Contract Documents, the following terms have the meaning indicated which are applicable to both the singular and plural thereof:

**‘1.1 Addenda** Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bidding Requirements or the Contract Documents. An Addendum supersedes related provisions of the Contract Documents which are clarified, corrected or changed by the addenda.

**‘1.2 Agency or Using Agency**, defined by KRS 45a.030, and is the state government entity which utilizes the Work being contracted. The Agency is a “client” of the Owner and advises the Owner of the needs, requirements and desires of the Agency related to the project. The Owner consults with the Agency on matters related to the Project. The Agency does not possess the legal authority of the Owner (see KRS 45a.045).

**‘1.3 Architect, Engineer or Consultant (A-E)** is the person or entity, either a registered Architect, Registered Engineer, or Consultant, who is identified as such in the Contract Documents and on the drawings or any replacement Registered Architect, Registered Engineer, or consultant identified by the Owner. The A-E is a separate contractor and not an agent of the Owner. The term includes any associates or consultants employed by the A-E to assist in providing the required professional services to the Owner.

**‘1.4 Certification of Payment** is the Owner’s Progress Payment Forms, DOA-24 and DOA-25. All Payments made to the Contractor under this contract shall be on the appropriate Owner’s Progress Payment Form.

**‘1.5 Change Order** means a written order to the Contractor executed by the Owner and the A-E after execution of the Contract, directing a change in the Work and may include a change in the Contract Price or the Contract Time, or any combination thereof. There shall be no authorized changes in the Work, which affect either Contract Price or Contract Time, without a fully executed Change Order, except as provided elsewhere herein.

**‘1.6 Contract** is the legal relationship, duties and obligations between the Owner and Contractor as evidenced by the Contract Documents for the Project.

**‘1.7 Contract Time** is the number of calendar days between the Date of Commencement and the dates set for Substantial Completion and Final Completion of the Work, including any adjustments thereto, all as established in the Contract between Owner and Contractor

**‘1.8 Contract Documents** include the Invitation for Bids, the Instructions to Bidders, the Payment and Performance Bonds, the General Conditions, the Special or Supplemental Conditions, the drawings, specifications, solicitation addenda, the contractors response to the solicitation, any written clarification of the response, the award document containing the Agreement between Owner and Contractor, and modifications issued after execution of the Contract. Modifications include (1) Change Orders issued as provided in Article 14, and (2) Field Orders for minor changes in the work issued by the A-E as provided in Article 14. Documents not included or expressly contemplated in this Paragraph, 1.8, do not, and shall not, form any part of the Contract between the Owner and the Contractor.

**‘1.9 Contract Sum** means the sum stated in the Contract including any authorized adjustments thereto and is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents.

**‘1.10 Contractor or General Contractor** means the person or entity with whom the Owner has executed the Contract for construction. The Contractor may also be referred to as General Contractor. The Contractor shall hold his subcontractors, suppliers and others under his employ or contract to the terms and conditions of the Contract Documents.

**‘1.11 Damages for untimely performance** means a calculated monetary amount to be paid to the Owner, based on real costs which the Commonwealth incurs, due to the Contractor's failure to complete the Work within the allowable time identified in the Contract Documents. This term may also be referred to as "Liquidated Damages" where the actual cost of damages for untimely performance cannot be readily calculated and a definite sum is predetermined to be paid to the Owner. The amount of Liquidated Damages shall be defined in the Special Conditions of this Project.

**‘1.12 Date of Commencement** is the date specified in the Contract as the date upon which the Contractor is authorized to begin work. The Contract Time as set forth in paragraph 1.7 is determined using this Date of Commencement as the starting date.

**‘1.13 DECA Project Manager** means the person(s) delegated authority to act on behalf of the Owner. Such person(s) is employed by the Owner, DECA's Project Manager(s) will be designated at the Pre-Construction Meeting. DECA reserves the right to change its designated Project Manager(s) at any stage of the Work, for the sole purpose or benefit of the Commonwealth.

**‘1.14 Delay** means an event that causes an increase in the duration of the Project, or that changes the sequence of the Work or individual Work activities, thereby preventing completion of the Project within the time period specified in the Contract Documents. An event that does not cause an increase in the duration of the Project or prevents the completion of the Project within the time period specified in the Contract Documents, such as an event that is not on the critical path of the project schedule, is not a delay under this Contract.

**‘1.15 Direct Expenses** is defined as "All items of expenses directly incurred by or attributable to a specific project, assignment or task" and "Direct costs consist of direct materials, direct labor, subcontract costs, and other miscellaneous direct costs such as bonding and equipment rentals, that are directly related to and can be specifically attributed to an individual contract."

**‘1.16 Drawings** are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams. Where it is obvious that a drawing illustrates only a part of the given work or of a number of items, the remainder shall be deemed repetitious and so construed.

**‘1.17 Document Collaboration** is the Owner's web-based document collaboration system that shall be used by all project participants for the submission, transmittal, transfer, review, approval, processing of all documents related to this project. Where the General Conditions, the technical specifications, or the Contract for Construction indicates that a submission of documents is required, this submission shall be through the Owner's Document Collaboration System.

**‘1.18 Extra Work** as used in Article 14 is defined as Work not part of the existing Contract Documents which is being added to the Contract by a fully executed Change Order.

**‘1.19 A Field Order** is a written order issued by the A-E which clarifies or interprets the Contract Documents, or orders minor changes in the Work which does not require a change under Article 14. Field Orders are issued to the Contractor through the Owner's Document Collaboration System. Field Orders are also called A-E's Supplemental Instructions (ASIs).

**‘1.20 Final Completion** is defined as the Work being acceptable under the Contract Documents and the Contract fully performed in accordance with the terms and conditions of the Contract Documents and the entire payment balance due the Contractor is due and payable.

**'1.20.1 Final Completion Date** shall have the meaning as described to it in Article '19.5.

**'1.21 Notice of Intent to Award** is a written letter issued to the apparent successful contractor after acceptance of bid price, unit prices, subcontractors and equipment and materials to inform them of such acceptance and request the required additional documentation to initiate the Contract. **This is NOT an authorization to proceed.**

**'1.22 Owner** means the Commonwealth of Kentucky, acting through the Finance and Administration Cabinet and its Administrative Agent, the Department for Facilities and Support Services, Division of Engineering and Contract Administration. The Owner is represented solely by the Division of Engineering and Contract Administration. The Owner is represented by the DECA Project Manager for the specific Project.

**'1.23 The Project** is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by other Contractors, working under separate Contract with the Owner.

**'1.24 Resident Observer** means an individual who has a direct contract with the A-E to observe and report on activities at the work site. A Resident Observer employed by the A-E is not authorized to serve as the Owners Representative, unless so designated by the Owner in writing.

**'1.25 Retainage** means money earned by a contractor for work accepted by the Owner, but withheld to ensure proper performance by the contractor. Retainage is further defined in Article '18.

**'1.26 Shop Drawings** means drawings, completion diagrams, schedules, and other data specially prepared for the Work by the Contractor or any Subcontractor, lower tier subcontractors, manufacturer, supplier, or distributor to illustrate some portion of the Work. Shop Drawings and other submittals from the Contractor to the A-E shall be transmitted through the Owner's Document Collaboration System. Unless other requirements are indicated in the Special Conditions for this project or unless otherwise permitted by the A-E in writing, all shop drawings required by the Contract Documents shall to be submitted to the A-E for review and acceptance within the time indicated below:

**'1.26.1 For Projects of less than 180 calendar day duration:** thirty (30) calendar days of the Date of Commencement.

**'1.26.2 For Projects of more than 181 calendar days and less than 360 calendar days duration:** less than sixty (60) calendar days of the Date of Commencement.

**'1.26.3 For Projects of more than 361 calendar days duration:** less than ninety (90) calendar days of the Date of Commencement.

**'1.26.4 In circumstances where a specific shop drawing required by the Contract Documents cannot reasonably be submitted** to the A-E for review and acceptance, the Contractor shall notify the A-E in writing within the time periods indicated above for submission, and if the A-E finds it reasonable to waive this submission time period requirement, the A-E may do so in writing.

**'1.26.5 In circumstances where a specific shop drawing required by the Contract Documents cannot be reasonably reviewed by the A-E within the time prescribed elsewhere in the Contract Documents,** the A-E shall notify the Contractor in writing prior to the date required for the review of the reasons for the time needed for reviewing the Shop Drawing.

**'1.27 Specifications** are the descriptive and written portions of the Contract Documents, wherever located and whenever issued, that describe the quality and performance of building materials and systems, using code citations and published standards. The drawings and specifications are complementary, together providing the information required for a complete facility. However, the specifications overrule the drawings where there is a conflict or contradiction. However, the Contractor shall inquire of the A-E for a determination of the resolution of the conflict or contradiction.

**'1.28 Subcontractor** means the person or entity having a direct contract with the Contractor for the performance of a part of the Work. The Owner has no direct contractual relationship with the subcontractor.

**'1.29 Substantial Completion** is the point at which, as certified in writing by the A-E and accepted by the Owner that the Project is: 1) at a level of completion in strict compliance with the Contract (see article '19.4 for a complete listing of requirements for compliance); 2) all necessary approvals by public authorities has been given; and, 3) that the Owner or the Agency can enjoy beneficial use or occupancy and can use, operate and maintain (the Owner has received all required warranties and documentation) it in all respects, for its intended purpose. Partial use or occupancy of the Project shall not result in the Project being deemed substantially complete and such partial use or occupancy shall not be evidence of Substantial Completion.

**'1.29.1 Substantial Completion Date** shall have the meaning as described to it in Article 19.

**'1.30 Warranty, General.** The Contractor shall warrant all equipment, materials, products, and workmanship provided by the Contractor under these Contract Documents for a period of twelve (12) months after the Date of Final Completion. This period of time is called the One-Year Warranty Period and is further defined in Article 9.2.

**'1.31 The Work** includes the construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, supervision, materials, equipment, services, and things provided or to be provided by the Contractor to fulfill the Contractor's obligations.

## **'2. Intent and Interpretation**

**The A-E shall be the authority of the Contract Documents as to their intent or interpretation,** except as defined below and/or as provided in paragraph 3.4.

**'2.1** Anything that may be required, implied or inferred by the documents which make up the Contract, or any one or more of them, shall be provided by the Contractor for the Contract Sum;

**'2.2** Nothing contained in the Contract Documents shall create, nor be interpreted to create, privity or any other relationship whatsoever between the Owner and any person except the Contractor;

**'2.3** When a word, term, or phrase is used in the Contract Documents, it shall be interpreted or construed first, as defined herein; second, if not defined, according to its generally accepted meaning in the construction industry; and third, if there is no generally accepted meaning in the construction industry, according to its common and customary usage;

**'2.4** The words "include", "includes", or "including", shall be deemed to be followed by the phrase, "without limitation".

**'2.5** The specification herein of any act, failure, refusal, omission, event, occurrence or condition as constituting a material breach of the resulting Contract shall not imply that any



other, non-specified act, failure, refusal, omission, event, occurrence or condition shall be deemed not to constitute a material breach of the resulting Contract;

**'2.6** In the event of any conflict, discrepancy, or inconsistency, the following shall control:

**'2.6.1** As between figures given on plans and scaled measurements, the figures shall govern; When two or more figures given on the plans are in conflict, the Contractor shall inform the A-E of such conflict immediately and the A-E shall clarify the correct figure to be used. The Contractor shall not proceed with any work related to the figures in conflict until the A-E has provided this clarification.

**'2.6.2** As between large scale plans and small scale plans, the large scale plans shall govern;

**'2.6.3** As between plans and specifications, the requirements of the specifications shall govern; When there is a conflict between the plans and specifications, the Contractor shall inform the A-E of such conflict immediately and the A-E shall clarify the correct interpretation to be used. The Contractor shall not proceed with any work related to the conflict until the A-E has provided this clarification.

**'2.6.4** When any conflict, discrepancy, or inconsistency exists as described in Article '2.6, and when there is a necessary determination by the A-E, with agreement by the Owner, that the provisions indicated above do not result in the proper interpretation and resolution of the conflict, the A-E may provide written directive as to how the conflict is to be resolved.

**'2.6.4.1** When such written directive, as indicated in '2.6.4 results in a cost difference to properly resolve the conflict, discrepancy, or inconsistency, a cost adjustment may be determined by the A-E to be appropriate.

**'2.6.4.2** The Contractor shall notify the A-E/ Owner of his proposed necessity of a cost difference result within fourteen (14) calendar days of the receipt of the directive to resolve the conflict.. However, should the Contractor proceed with the work related to the conflict resolution without written notice of the proposed cost difference to the A-E within the prescribed time, no cost adjustment will be granted.

**'2.7 Meaning of Execution.** Execution of the Contract Documents by the Contractor is a representation that the Contractor has thoroughly examined the site of the Work, become familiar with the local conditions under which the Work is to be performed, and correlated personal observations with the requirements of the Contract Documents.

**'2.7.1** Execution of the Contract Documents is a further representation that Contractor has received, reviewed and carefully examined all of the Contract Documents, and has found them in all respects to be complete, accurate, adequate, consistent, coordinated and sufficient for construction, the Contractor is fully qualified to act as the contractor for the Project and has, and shall maintain, any and all licenses, permits or other authorizations necessary to act as the contractor for, and to construct the Project.

**'2.8 Prior Agreements.** The Contract Documents supersede any and all prior discussions, communications, representations, understandings, negotiations or agreements between the Owner and the Contractor and the Agency and the Contractor.

**'2.9 Contractor's Performance.** The Contractor shall perform all of the Work required, implied or reasonably inferable from the Contract including, but not limited to, the following:

**'2.9.1** Construction of the Project;

**'2.9.2** The furnishing of any required surety bonds and insurance;

**'2.9.3** The provision or furnishing, and prompt payment therefor, of labor, supervision, services, materials, supplies, equipment, fixtures, appliances, facilities, tools, transportation, storage, power, fuel, heat, light, cooling, or other utilities, required for construction and all necessary building permits and other permits required for the construction of the Project;

**'2.9.4** The creation and submission to the A-E of detailed and comprehensive record drawings and specifications, depicting all as-built construction. Said as-built drawings shall be submitted to the Owner by the A-E upon Final Completion of the Project and receipt of same by the Owner shall be a condition precedent to final payment to the Contractor and to the A-E.

**'2.10 Time.** All limitations of time set forth in the Contract Documents are material and are of the essence of the Contract. The Contractor shall execute the work in such a manner as consistent with the limitations of time set forth. The Contractor shall make reasonable progress on the completion of the Work on a continual and consistent basis. Any failure of the Contractor to execute the Work in a timely manner consistent with the limitations of time set forth in the Contract Documents may be deemed at a Material Breach of Contract.

**'2.11 Intent of Contract Documents.** The intent of the Contract Documents is to include all items necessary for the proper completion of the Work by the Contractor. Labor or materials which are evidently necessary to produce the desired results, even though not specifically mentioned in the Contract Documents, shall be included in the Work. The A-E is the interpreter of the Contract Documents and where any clarification regarding interpretation of the Documents is required the A-E shall be notified in writing pursuant to paragraph 2.13 below.

**'2.12 Contract Documents Complementary, etc.** The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. In case of conflicts between the various Contract Documents, the order of precedence shall be as follows: (1) Addenda, (2) Special Conditions, (3) General Conditions, (4) Division 1 - General Requirements of the Specifications; (5) Technical provisions of the Specifications; (6) Drawings.

**'2.13 Questions to A-E.** In the event a question arises regarding the meaning or intent of the drawings and specifications, the Contractor shall report it at once to the A-E by the submission of a Request for Information through the Owner's Document Collaboration System. The A-E shall furnish, with reasonable promptness, as defined by the Contract between the Owner and the A-E, additional instructions, by means of drawings or otherwise, necessary for the proper execution of the work, consistent with the requirements of Article 3.

**'2.14** Paragraph, titles, headings, and drawing numbers are for convenience only and form no operative part of the Contract. The General Contractor, and by the "flow down" provisions of these General Conditions, every subcontractor, shall provide all Work defined, identified, enumerated, specified or otherwise indicated to be provided by the Contract Documents.

### **'3. The Architect, Engineer, Consultant (A-E)**

**Unless otherwise directed by the Owner in writing, the A-E shall perform those duties and discharge those responsibilities allocated to the A-E in the Contract Documents.** The duties, obligations and responsibilities of the A-E shall include, but are not limited to, the following:

**'3.1 Owner's Representative.** The A-E will be the Owner's Agent during construction, through issuance of final payment, and during the contractor's One Year Warranty period. The A-E will advise and consult with the Owner. In the event the Owner should find it necessary or

convenient to replace the A-E, the Owner shall retain a replacement A-E and the role of the replacement A-E shall be the same as the role of the A-E.

**'3.2 Communication through A-E.** Except as otherwise provided in the Contract Documents, the Owner's instructions to the Contractor shall be through the A-E and the Contractor's communications with the Owner shall be through the A-E. Should the contractor act on communications from any other entity, other than through the A-E, he is acting at his own risk and may be required to reverse the actions taken as his own expense.

**'3.2.1 All documents related to this project shall be submitted, transmitted, transferred, reviewed, approved or rejected, and/or otherwise processed using the Owner's Document Collaboration System** which is the Owner's web-based document collaboration system that shall be used by all project participants. No submission, transmittal, transfer, review, approval or processing shall be deemed Official without the use of this system.

**'3.2.1.1 All documents transmitted for purposes of administration of the Contract** are to be in electronic (PDF) format and transmitted via the Commonwealth's Document Collaboration System that receives, logs and store documents, processes documents through workflows and notifies addressees via email.

**3.2.1.2 The A-E/ Engineer and the Contractor are required** to become familiar with this system, to use this for all official transmittal of information pertaining to this project, and to respond to the requirements of this system within a reasonable time as defined elsewhere herein and/or by the terms of their Contract with the Owner.

**3.2.1.2.1 Training:** The Owner has an agreement with the service provider of the Document Collaboration System to provide training, support and assistance to users of the system via a web-based training session which can be arranged upon request. Further training as may be required by a specific user of the system is the responsibility of the user of the system.

**'3.3 Review of Work.** The A-E shall approve, or respond otherwise, in a timely manner, as defined by the Contract between the Owner and the A-E, as necessary concerning shop drawings or other submittals received from the Contractor. Should the A-E have reasonable cause to be unable to approve, or respond otherwise to submissions from the Contractor, the A-E shall provide written explanation of the reasonable cause within the timely manner, as defined by the Contract between the Owner and the A-E.

**'3.3.1 The A-E shall be authorized to refuse to accept work** which is defective or otherwise fails to comply with the requirements of the Contract. The A-E shall refuse the work in writing when he deems it necessary to refuse the work. If the A-E deems it appropriate, the A-E shall be authorized to call for extra inspection or testing of the work for compliance with requirements of the Contract.

**'3.3.1.1 The costs of the extra inspection or testing** shall be paid by the Contractor, unless the results of the extra inspection or testing find that the work was originally in conformance with the Contract requirements and that the extra inspection or testing was not necessary. A reduction in the Contract Sum shall be provided by Change Order to reimburse the Owner for the costs of the extra inspection or testing.

**'3.3.1.2 In cases where the Contractor covers up work** that is required by the Contract Documents to be inspected or tested prior to the inspection or testing, the cost of uncovering the work and performing the inspection or testing shall be at the

Contractor's expense even if the work is found to have been originally in conformance with the Contract Documents. A reduction in the Contract Sum shall be provided by Change Order to reimburse the Owner for the costs of the extra inspection or testing.

**'3.3.2 The A-E shall review the Contractor's Payment Requests** and shall approve in writing those amounts which, in the opinion of the A-E, are properly owing to the Contractor as provided in the Contract. The A-E shall perform this review, approval and submission of his recommendation to the Owner, within ten (10) business days of receipt of the Payment Request from the General Contractor.

**'3.3.3** The A-E shall perform those inspections required by the Owner.

**3.4 Interpretation of Contract Documents.** The A-E shall be the interpreter of the requirements of the Contract Documents and the judge of the performance thereunder by the Contractor, subject to the provisions of Article 26.

**'3.4.1 Claims, disputes, and other matters in question** that arise relating to the execution or progress of the Work shall be referred initially to the A-E for decision, which he will render in writing within a reasonable time, as defined by the Contract between the Owner and the A-E.

**'3.4.2 Should the Contractor find disagreement with the A-E** as to the proper interpretation of the Contract Documents or other decision of the A-E, he must refer the A-E's decision to the Director of the Division of Engineering in writing within seven (7) days. The Director of the Division of Engineering will then discuss and negotiate the A-E's decision with the A-E to seek reasonable resolution of the matter. Following these discussions and negotiations, the A-E's initial decision or revised decision shall be binding, unless the Contractor appeals the A-E's initial or revised decision to the Secretary of the Finance and Administration Cabinet in accordance with the provisions of Article 26.

**'3.4.3 Should the Director of the Division of Engineering find disagreement with the A-E** as to the proper interpretation of the Contract Documents or any other decision of the A-E, the Director of the Division of Engineering may appeal the A-E's initial or revised decision to the Secretary of the Finance and Administration Cabinet in accordance with the provisions of Article 26.

**'3.4.4 The A-E shall have authority to reject Work** which does not conform to the Contract Documents. In the event of rejection, the A-E may recommend in writing withholding payment to the Contractor for the rejected Work, and such recommendation shall give the Owner the authority to withhold payment for such Work.

**'3.5 Review of Shop Drawings, etc.** The A-E shall review and approve, or take other appropriate action upon Contractor's submittals (such as Shop Drawings, product data, and samples) for conformance with the design concept and the information given in the Contract Documents. Such action shall be taken with reasonable promptness, as defined by the Contract between the Owner and the A-E, so as to cause no delay. The A-E may determine concurrently with the Contractor the timing and scheduling of the A-E's Review, with the understanding that some submittals are more critical to the Critical Path of the Completion of the project than others.

**'3.5.1 The A-E's approval** of a specific item shall not indicate approval of an assembly of which the item is a component. The A-E's approval of Shop Drawings or samples shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the A-E's attention to such deviation at the time of submission and the A-E has given written approval to the specific deviation, nor shall any approval by the A-E relieve the Contractor from responsibility for errors or omissions in the Shop Drawings.

**‘3.5.2 If, for any reason, any item specified and approved by the A-E as a shop drawing submittal, will not be available when needed** in the course of the work, and Contractor can show he has made a reasonable, persistent effort to obtain item in question, the Contractor is to notify the A-E in writing, immediately, and the A-E will either determine the source of the supply or arrange with the Owner for appropriate substitution, within the terms of the Contract. Otherwise, the Contractor will not be excused for delays in securing materials or products specified, and will be held accountable if completion of the project is thereby delayed.

**‘3.6 Preparation of Change Orders.** The A-E, in consultation with the Owner, shall prepare Change Orders. The A-E shall also have authority to order minor changes in the Work as provided in Article 14.2.

**‘3.7 Final Inspections, Certification.** The A-E, in consultation with the Owner, shall conduct inspections to determine the dates of Substantial Completion and Final Completion. The A-E shall also receive and forward to the Owner, for the Owner’s review, written warranties and related documents required by the Contract and assembled by the Contractor.

**‘3.8 The A-E shall review the Contractor’s Payment Requests** and shall approve in writing those amounts which, in the opinion of the A-E, are properly owing to the Contractor as provided in the Contract. The A-E will perform this review, approval and submission of his recommendation to the Owner, within ten (10) business days of receipt of the Payment Request from the Contractor.

**3.8.1 When there is reasonable justification that causes the A-E to be unable to perform this review, approval and submission of his recommendation to the Owner within the time prescribed in paragraph 3.8 above,** the A-E will notify the Contractor in writing as to the justification and as to the time that will be required for this review, approval and submission of his recommendation to the Owner.

**‘3.8.2 The Contractor may submit no more than one (1) payment request** each thirty (30) calendar day period, except where specifically agreed by the Owner that additional payment requests may be submitted within the thirty (30) calendar day period for reasons consistent with the Contractor’s performance of the Contract.

**‘3.9 The A-E, in consultation with the Owner, shall be authorized to require the Contractor to make changes or deviations in the work** which do not involve a change in the Contract Sum or in the Contract Time for the Contractor’s performance consistent with the intent of the Contract. The A-E shall make such changes or deviations in the work by written Field Order.

**‘3.10 The duties, obligations and responsibilities of the Contractor under the Contract** shall in no manner whatsoever be changed, altered, discharged, released, or satisfied by any duty, obligation or responsibility of the A-E. The Contractor is not a third-party beneficiary of any Contract by and between the Owner and the A-E. It is expressly acknowledged and agreed that the duties of Contractor to the Owner are independent of, and are not diminished by, any duties of the A-E to the Owner.

**‘3.11 The duties, obligations and responsibilities of both the A-E and the Contractor,** under their respective Contracts, shall in no manner whatsoever be changed, altered, discharged, released, or satisfied by any duty, obligation or responsibility of the Resident Observer. It is expressly acknowledged and agreed that the duties of Contractor and/or A-E to the Owner are independent of, and are not diminished by, any duties of the Resident Observer to the A-E/Owner. A copy of the Resident Observers Duties, Responsibilities and Limitations



are enumerated in the DECA Procedures Manual, are to be discussed at the Pre-Construction Meeting and are by reference made a part of these General Conditions.

#### **4. Construction Schedule**

**The Contractor, within fifteen (15) days of the Date of Commencement shall prepare and submit for the Owner and A-E's approval a construction schedule for completing the Work.** This submission shall be transmitted through the Owner's Document Collaboration System. The schedule shall indicate the starting and completion dates of the various stages of the Work, shall not exceed time limits established by the Contract Documents for the various stages of Work, shall be updated monthly and furnished to the Owner and A-E, shall be related to the Work of any other contractors on the Project to the extent required by the circumstances, and shall provide for expeditious and practicable execution of the Work. *Progress Payments to the Contractor are contingent upon receipt of the updated monthly project schedule and schedule of submittals.*

**4.1 Time Frame of Schedule:** *Extend schedule form date established for commencement of the Work (the Notice of Award or Notice to Proceed) to **Substantial Completion**, to **Final Completion**, and indicating all critical milestones along the time of the schedule.*

**4.1.1 Work by Owner:** *Include a separate activity for each portion of the Work to be performed by the Owner or by others working under separate contract with the Owner.*

**4.1.2 Products Ordered in Advance:** *Include a separate activity for each product pre-ordered by the Owner. Include the delivery date indicated in the Special Conditions or as relayed to the Contractor from the Owner.*

**4.1.3 Work Restrictions and "blackout dates":** *Show the effect of specified work restrictions and "blackout dates" as defined in the Special Conditions.*

**4.1.4 Commissioning:** *Show separate activities for each building system to receive commissioning by others working under separate contract with the Owner, allowing sufficient time for functional startup, commissioning, correction of commissioning issues and final commissioning. Note: Commissioning must be accomplished in its entirety by the Date of Substantial Completion.*

**4.1.5 Testing and Balancing:** *Show separate activity for testing and balancing by others working under separate contract with the Owner. Note: Testing and Balancing must be accomplished in its entirety by the Date of Substantial Completion.*

**4.2 The original schedule** shall be accompanied by a proposed schedule of values as described in Article 18.1. The original Project Schedule, Schedule of Submittals and the Schedule of Values are to be submitted to the A-E, reviewed and accepted by the A-E and the Owner, prior to submittal of the first Progress Payment. No payment will be made to the Contractor without an approved Schedule of Values and a Project Schedule.

**4.2.1 The original schedule** shall show the project being completed on the established Date of Substantial Completion. To do this, the Contractor shall include in the flow of work any existing "float" which may be identified during the layout of the project schedule.

**4.2.2 The Contractor acknowledges that all float** (including Total Float, Free Float, and Sequestered Float) is a shared commodity available to the Project and is not for the exclusive benefit of any party; float is an expiring resource available to accommodate changes in the Work, however originated, or to mitigate the effect of events that may delay performance or completion of all or part of the Work.

**'4.3 The Contractor shall promptly notify the A-E and Owner** if the Contractor is materially ahead of, or behind the updated construction schedule. Failure to so notify the A-E and Owner shall relieve the Owner from liability for damages caused by delay or impact. Strict compliance with the requirements of this article shall be a condition precedent to payment to the Contractor, and failure by the Contractor to strictly comply with said requirements shall constitute a material breach of the Contract.

**'4.3.1 On projects where a CPM schedule is required, the Contractor shall report on the status of any "float"**, including the addition of "float", the use of "float", and the anticipation of the use of "float" at each project Progress Meeting.

**'4.4 For projects with a Contract Sum of \$1,000,000 or greater** the schedule shall be in critical path method (CPM) format. The schedules shall include all activities necessary for performance of the work showing logic (sequences, dependencies, etc.) duration of each activity with the critical path highlighted. The schedules shall include, but not be limited to, submittal processing and review time required by the A-E, fabrication and delivery of materials, construction, testing clean-up, work and/or materials to be provided by the Owner, dates and durations for major utility outages requiring coordination with the Owner and the Owner's operations, and significant milestones related to the completion of the Project.

**'4.4.1 For projects where the CPM format is required for schedules**, any subsequent adjustment, modification or change in the schedule shall include an indication of the original Critical Path and the adjustment, modification, or change shall clearly delineate the adjustment, modification or change in the schedule and shall be accompanied by a written statement of the cause and reason for the adjustment, modification or change.

**'4.4.2 For projects where the CPM format is required for schedules and subsequent adjustment, modification or change in the schedule** does not include the information required by paragraph 4.3.1 above, the revised schedule shall be rejected and payment of the Contractor's General Conditions costs suspended until this provision is complied with satisfactorily.

**'4.5 Work Hours on site shall be coordinated with the A-E, Owner and Using Agency and shall be initially defined and scheduled at the Pre-Construction Conference**, adjusted by notification to the A-E, Owner and Using Agency during each monthly Progress Meeting, and shall comply with the following criteria:

**'4.5.1 Generally, work hours on site shall be** from 7am to 4pm, weekdays, unless otherwise defined in the Special Conditions. However, unless restricted or modified by the Special Conditions, the Contractor may propose a different work hour schedule up to 24/7/365 with acceptance by the Owner.

**'4.5.2 The Contractor shall have job site supervision on site** during any work hours scheduled and/or any extended work hours accepted by the Owner.

## **'5. Shop Drawings; Submittals**

**'5.1 Schedule for Submittals.** Prior to submission of the first application for payment and in sufficient time to allow the A-E reasonable time for review, the Contractor shall submit to the A-E a schedule of submittals which shall be coordinated with the construction schedule. This submission shall be transmitted through the Owner's Document Collaboration System. The Contractor shall keep the schedule of submittals current and present an updated schedule of submittals at each project progress meeting. This schedule of submittals shall contain anticipated and actual dates of the submittal of shop drawings and shall be consistent with the requirements for scheduling submittals defined in Article 1.26 of these General Conditions.

**'5.2 Submittals of Shop Drawings, Samples, etc.** The Contractor shall review, approve, and submit Shop Drawings, samples, and product data in accordance with the approved schedule as herein detailed.

**'5.2.1 The Contractor's stamp of approval** on any Shop Drawing or sample shall constitute a representation to Owner and A-E that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Documents.

**'5.2.2 The A-E shall review and approve, with reasonable promptness** as defined by the Contract between the Owner and A-E, the Shop Drawings, or return for corrections as required. The review and approval shall be for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The approval of a separate item will not indicate approval of the assembly in which the item functions.

**'5.2.3 The Contractor shall make any corrections required** by the A-E for compliance to the Contract and shall return the required number of corrected copies of Shop Drawings and resubmit new samples until approved. The Contractor shall direct specific attention, in writing, or on resubmitted Shop Drawings, to revisions other than the corrections called for by the A-E on previous submissions.

**'5.2.4 Where a Shop Drawing or sample submission is required** by the specifications, no related work shall be commenced until the submission has been approved by the A-E. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the A-E, Owner and Resident Observer.

**'5.2.5 The A-E's approval of Shop Drawings or samples** shall not relieve the Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless the Contractor has in writing called the A-E's attention to such deviation at the time of submission and the A-E has given written approval to the specific deviation, nor shall any approval by the A-E relieve the Contractor from responsibility for errors or omissions in the Shop Drawings.

**'5.2.5.1 Conflicting Requirements:** If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the A-E for decision before proceeding with the work.

**'5.2.6 The Contractor shall maintain a submittal log** which shall include, at a minimum, the date of each submittal, the date of any resubmittal, the date of any approval or rejection, and the reason for any approval or rejection. The Contractor shall provide copies of this submittal log with the current status of submittals clearly indicated therein to the A-E and the Owner at each progress meeting until such time as all submittals are complete and accepted.

**'5.3 Photographic Documentation:** Provide Pre-Construction Photographs, Construction Progress Photographs and Substantial Completion construction photographs. Submit photographs in the Owner's Document Collaboration System with a key plan or description of the location of the photograph taken.



**'5.3.1 Pre-Construction Photographs:** Take a minimum of 20 photographs to show existing conditions of the project site and adjacent property prior to the start of construction activities. Take additional photographs as necessary to adequately document the existing physical conditions of all improvements to the project site or adjacent property that might be affected by the activities of construction.

**'5.3.2 Construction Progress Photographs:** Take a minimum of 10 photographs DAILY to document the progress of construction. Take additional photographs as necessary to adequately document the progress of construction indicating all key elements of the construction and any significant progress.

**'5.3.3 Substantial Construction Photographs:** Take a minimum of 20 photographs to show conditions of the project site and adjacent property at the time of substantial completion of the work at the conclusion of construction activities. Take additional photographs as necessary to adequately document the current physical conditions of all improvements to the project site or adjacent property that might have been affected by the activities of construction.

## **'6. Documents and Samples at the Site**

**Unless otherwise provided in the Contract Documents, the General Contractor shall print and copy any drawings and specifications as are reasonably necessary for the execution of the Work.** Each Subcontractor shall have the ability to download the entire set of drawings and specifications at its option, however, every Subcontractor shall be responsible for the scope of their work indicated in any location throughout the drawings and specifications. There is NO GUARANTEE of the division of the scope of work to specific specifications sections or specific drawings.

**'6.1 The Contractor shall maintain at the site** one record copy of the drawings, specifications, addenda, Change Orders and other modifications, in good order and marked currently to record changes and selections made during construction. Unless otherwise directed, the Contractor shall also keep approved Shop Drawings, product data, samples and similar required submittals on hand. These shall be available to the A-E, Owner, and Resident Observer as requested.

**'6.1.1 When the Contractor fails to maintain the record copies indicated in paragraph 6.1 above,** payment of the Contractor's General Conditions costs may be suspended until this provision is complied with satisfactorily.

**'6.2 Upon completion of the Work,** the record documents described above shall be delivered to the A-E for submittal to the Owner along with the as-built drawings.

## **'7. Contract Documents Property of Owner**

**The Contract Documents, and each of them, as well as any other documents furnished by the Owner, shall remain the property of the Owner.** The Contractor shall have the right to keep one (1) copy of the Contract Documents upon completion of the Project; provided, however, that in no event shall the Contractor use, or permit to be used, any portion or all of such Contract Documents on other projects without the Owner's prior written authorization.

## **'8. Supervision and Construction Procedures**

**'8.1 Supervision of the Work.** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention so as to ensure expeditious, workmanlike performance in accordance with the requirements of the Contract Documents. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences

and procedures. He shall be responsible for the acts and omissions of persons directly employed by him, as he is for Subcontractors and others under Article 17. He shall be responsible for coordinating all portions of the Work under the Contract unless the Contract Documents give other specific instructions concerning these matters.

**'8.2 Obligation to Follow Contract Requirements.** The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents by the activities or duties of the A-E in the A-E's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

**'8.3 The Contractor shall not perform Work without adequate plans and specifications,** or, as appropriate, approved Shop Drawings, or other submittals. If the Contractor performs Work knowing or believing it involves an error, inconsistency or omission without first providing written notice to the A-E and Owner, the Contractor shall be responsible for such Work and pay the cost of correcting same.

**'8.4 All Work shall strictly conform** to the requirements of the Contract Documents. The Contractor shall not commence or continue any portion of the Work where there is not a complete understanding of the requirements of the Contract Documents. When the Contractor believes that he does not have a complete understanding of the requirements of the Contract Documents, he shall immediately notify the A-E of this fact and shall issue a Request for Information to obtain this complete understanding of the requirements.

**'8.4.1 All branches of work shown on the plans or specified,** whether specifically mentioned or not, shall be executed in strict compliance with all local, state or federal regulations and codes, where the same have jurisdiction. Where the Contractor may be in doubt as the application of a state regulation or code on a specific branch of work, the Contractor shall ask for an interpretation from the A-E prior to proceeding with the work.

**'8.5 The Work shall be continually supervised,** the Contractor bearing full responsibility for any and all acts or omissions of those engaged in the Work on behalf of the Contractor

**'8.5.1 The Contractor shall prepare Daily Construction Reports** and submit these reports through the Owner's Document Collaboration System a minimum of weekly. Failure to submit these Daily Construction Reports in a timely manner shall be reason for withholding of General Conditions amounts from the Contractor's payment requests until such submittal is completed.

**8.5.2 The Contractor's Daily Construction Report shall contain as a minimum** the following information in enough detail as to provide an accounting of the construction site conditions, activities and issues:

- Contractor's Name
- Job Superintendent's Name
- Date of Report
- Weather Conditions – precipitation, temperature, etc.
- Manpower – by trade including number of workmen.
- Brief description of work performed that day.
- Conditions which delay progress of the work.
- Issues that arose needing resolution.
- Resolution of prior issues that were implemented.
- Project Photographs, where appropriate.

**'8.6 The Contractor shall at all times enforce strict discipline and good order** among his employees and Subcontractors and shall not employ on the Work any person not skilled in the Work assigned to him. Strict discipline shall include a prohibition of the use of drugs, alcohol or

any other controlled substance; prohibition of firearms or other weapons; prohibition of unnecessary contact with building occupants; and other objectives of good discipline.

**'8.7** The Contractor shall employ and maintain at the Project site only competent supervisory personnel. Failure to provide proper job site supervision AT ALL TIMES THAT WORK IS IN PROGRESS shall be reason for a change order deduction of a portion of the General Conditions amounts from the Contractor's payment requests for the period of time that job site supervision is not provided.

**'8.8 The Contractor shall have a continuing duty** to read, examine, review, compare and contrast each of the Contract Documents, Shop Drawings, and other submittals and shall give written notice to the Owner and the A-E of any potential conflict, ambiguity, error or omission which the Contractor may find with respect to these documents and their adequacy and sufficiency for construction as required by the Contract before proceeding with the affected Work. The express or implied approval by the Owner or the A-E of any Shop Drawings or other submittals shall not relieve the Contractor of the continuing duties imposed hereby, nor shall any such approval be evidence of the Contractor's compliance with the resulting Contract.

**'8.8.1 The Owner has relied upon the A-E to prepare** documents for the Project, including the plans and specifications for the Project, which are accurate, adequate, consistent, coordinated and sufficient for construction, and in issuing the Contract to the Contractor, the Owner's established legal duties to the Contractor notwithstanding, the Owner has relied upon the A-E's professional expertise in fulfilling its legal duty to the Owner in addition to the Contractor's full and good faith compliance with its duties set forth above.

**'8.9 Superintendent.** The Contractor shall employ a qualified, competent full-time superintendent and any necessary assistants. This superintendent shall be present on site at all times that Work of this contract is underway except with prior written consent of the A-E. It shall be the responsibility of the superintendent to coordinate the work of all the Subcontractors.

**'8.9.1 The Owner reserves the right to accept the Superintendent** selected by the Contractor. This full-time Project Superintendent shall be qualified and experienced to supervise the work of this Contract. The Contractor shall notify the A-E and Owner in writing for acceptance prior to any change in supervisory personnel. This change shall be for reasons outlined below.

**'8.9.1.1 The Contactor shall immediately replace a Superintendent upon written notice from the Owner that the current Superintendent is unsatisfactory.** The Owner has the right to require replacement of a Superintendent at any time that the Owner loses confidence in the Superintendent: to adequately perform the duties required of the Contract Documents: to complete the Work in strict adherence to the Contract Documents; to maintain the project schedule; or to be present at the project site at all times Work is in progress, except as authorized by the A-E. The Owner also has the right to require the replacement of the Superintendent for inappropriate or unprofessional conduct either on the project site or directed toward the A-E/ Engineer, the Owner's Representatives (DECA personnel), the Using Agency Representatives, or the general public.

**'8.9.2 This Superintendent shall have full and complete authority** to act on behalf of the Contractor in all matters related to this project, except as defined in written form by the Contractor and accepted in writing by the Owner. All instructions given to the superintendent shall be considered as given to the Contractor.

**'8.9.3 The superintendent shall not be changed** except under the following circumstances:

**'8.9.3.1** where the superintendent proves to be unsatisfactory to the Contractor or ceases to be in his employ, in which case the Contractor shall give timely prior written notice to the Owner of the impending change in superintendent and a reasonable explanation for the change; or

**'8.9.3.2** where the Owner has reasonable grounds for dissatisfaction with the performance of the superintendent and gives written notice to the Contractor of these grounds. The Contractor, upon receiving such written notice, shall replace the existing superintendent with a successor, to whom the Owner has no objection.

**'8.9.4 Should the Contractor not provide the superintendent as required by the Contract Documents to oversee all work being performed on this Contract,** the Owner has the right to deduct by Change Order the amount of General Conditions costs from the Contract Sum for the period in which proper Superintendence of the Work is not provided. This amount is determined by dividing the complete amount of General Conditions indicated in the approved Schedule of Values by the number of months of project duration according to the approved Project Schedule.

**'8.10 Contractor's Project Manager.** In addition to the Superintendent required in article '8.9, the Contractor may employ a qualified, competent Project Manager. In the absence of an assigned Project Manager, the principal owner of the Contractor's Company shall be considered as the Project Manager. This Project Manager is not required be present on site at all times that Work of this contract is underway, but shall be intimately familiar with the status of the Work of the Project at all times. It shall be the responsibility of the Project Manager to supervise the Superintendent and represent the Contractor in all matters.

**'8.10.1 The Owner reserves the right to accept the Project Manager** selected by the Contractor. This Project Manager shall be qualified and experienced to manage the work of this Contract and represent the Contractor in all matters. The Contractor shall notify the A-E and Owner in writing for acceptance prior to any change in project management personnel. This change shall be for reasons outlined below.

**'8.10.1.1 The Contactor shall immediately replace a Project Manager upon written notice from the Owner that the current Project Manager is unsatisfactory.** The Owner has the right to require replacement of a Project Manager at any time that the Owner loses confidence in the Project Manager to adequately perform the duties required of the Contract Documents: to manage the Work in strict adherence to the Contract Documents; to maintain the project schedule; or to supervise the Superintendent. The Owner also has the right to require the replacement of the Project Manager for inappropriate or unprofessional conduct either on the project site or directed toward the A-E/ Engineer, the Owner's Representatives (DECA personnel), the Using Agency Representatives, or the general public.

**'8.10.2 This Project Manager shall have full and complete authority** to act on behalf of the Contractor in all matters related to this project. All instructions given to the Project Manager shall be considered as given to the Contractor.

**'8.10.3 The Project Manager shall not be changed** except under the following circumstances:

**'8.10.3.1** where the Project Manager proves to be unsatisfactory to the Contractor or ceases to be in his employ, in which case the Contractor shall give timely prior written notice to the Owner of the impending change in Project Manager and a reasonable explanation for the change; or

**'8.10.3.2** where the Owner has reasonable grounds for dissatisfaction with the performance of the Project Manager and gives written notice to the Contractor of these grounds. The Contractor, upon receiving such written notice, shall replace the existing Project Manager with a successor, to whom the Owner has no objection.

**'8.10.4 Should the Contractor fail to replace an unsatisfactory Project Manager as required by written notice of the Owner,** the Owner has the right to deduct by Change Order the amount of General Conditions costs from the Contract Sum for the period in which there is a refusal to make the required replacement. This amount is determined by dividing the complete amount of General Conditions indicated in the approved Schedule of Values by the number of months of project duration according to the approved Project Schedule.

**'8.11 Temporary Support Facilities Required:** The Contractor shall provide temporary job offices for use by the Job Superintendent, A-E, Resident Observer (if applicable) and the Owner during the course of construction from the time of commencement of the Work until Substantial Completion. Provide electric, water, HVAC internet access and telephone for all areas of the temporary job office. This job office shall be large enough to accommodate project meetings and to provide for construction management operations. Where a Resident Observer is utilized on the project, a separate office shall be provided for the Resident Observer's use with electric, water, HVAC, telephone and internet access.

## **'9. Labor, Material, and General Contractor Warranty**

**'9.1 Contractor Provisions.** Unless otherwise stipulated, the Contractor shall provide and pay for all materials, supervision, labor, water, tools, equipment, light, power, temporary heat, hoist, supplies, appliances, transportation, and other facilities and things necessary for the execution and completion of the Work.

**'9.1.1 In the event the Owner elects to make available the electric power or domestic water, at no cost, to the Contractor for construction purposes,** the election to do so will be spelled out in the Special Conditions for this project. Available electric power provided by the Owner, at his election, shall not be utilized as a means for temporary heat without specific approval from the Owner in writing.

**'9.1.2 Additionally, the Owner reserves the right to cease to provide this available electric power and/or domestic water, at no cost to the Contractor,** should it be found that the electric power and/or domestic water is not reasonably used economically.

**'9.2 General Contractor Warranty.** The Contractor warrants to the Owner and A-E that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will strictly conform with the requirements of the Contract Documents.

**'9.2.1** The Contractor shall warrant all equipment, materials, products, and workmanship provided by the Contractor under these Contract Documents not only during the Contract period but also for a period of twelve (12) months after the Date of Final Completion.

**'9.2.1.1 The One Year Warranty period for correction of Work shall be extended with respect to portions of the Work first performed after the Date of Substantial Completion** by the period of time between Substantial Completion and the actual completion of that portion of the Work.



**'9.2.2 Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective.** While, the Contractor's warranty excludes remedy for damage or defect caused by abuse by the Owner or building occupants, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage, if the Work is not conforming to the requirements of the Work and that has been determined to be defective, is not excluded from the Contractor's One Year Warranty.

**'9.2.3 If, during the Contract Period or during the One Year Warranty period** (a) any equipment, materials or products furnished and/or installed by the Contractor are found to be defective in service by reason of the Contractor's faulty process, structural and/or mechanical design or specification, or (b) any equipment, materials, or products furnished and/or installed by the Contractor are found to be defective by reason of defects in material or workmanship, the Contractor shall, promptly after receipt of written notice from the Owner or A-E, repair or cause to be repaired such defective equipment, materials or products, or replace such defective equipment, materials, or products.

**'9.2.3.1 During the One Year Warranty Period for correction of the Work, if the Owner fails to notify the Contractor** and give the Contractor the opportunity to make correction, the Owner waives the right to require correction by the Contractor and to claim a breach of Warranty. However, this inaction during the Warranty Period by the Owner does not imply any limitation of the Contractor's liability as indicated in paragraph '9.2.7.

**'9.2.3.2 During the One Year Warranty Period for correction of the Work, if the Owner notifies the Contractor** and gives the Contractor the opportunity to make correction, and the Contractor fails to correct the Work with reasonable promptness, the Owner has the right to claim a breach of Warranty.

**'9.2.4 The Contractor's warranty shall not exclude** remedy for damage or defect caused by abuse by the Contractor, his subcontractors, or others within his control during the construction period or during work related to Contractor warranty.

**'9.2.4.1 Any portion of the Work required by the Contract Documents shall not be waived as a requirement for Completion of the Work, except by specific written authorization from the Associate Director of the Division of Engineering and Contract Administration for reasons where, by no fault of the Contractor, could not be completed within the time established for Completion of the Work.**

**'9.2.5 If during the Contractor's warranty period, there is a question concerning the quality or kind of materials and equipment installed in this project,** and requested by the A-E, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

**'9.2.6 In the event of multiple failures of major consequence in similar equipment, products, components or systems, prior to the expiration of the one-year warranty** described above, the affected equipment, product, component or system shall be disassembled, inspected, and modified or replaced as necessary to prevent further occurrences. All related components which may have been damaged or rendered non-serviceable as a consequence of the equipment, product, component or system failure shall be replaced.

**'9.2.6.1 As used herein, multiple equipment, product, component or system failures shall be interpreted to mean two (2) or more successive failures of the same kind in the same item of equipment, product, component or system or**

failures of the same kind in two (2) or more items of equipment or product, or in a specific building system or component.

**'9.2.6.2 Major equipment failures may include**, but are not limited to, cracked or broken housings, piping, or vessels, excessive deflections, bent or broken shafts or structural members, broken or chipped gear teeth overheating, premature bearing failure, excessive wear, or excessive leakage around the seals.

**'9.2.6.2.1 Equipment failures which are directly and clearly traceable to operator abuse**, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over or under lubrication and using maintenance procedures not conforming with published maintenance instructions, shall be exempted from the scope of the one-year warranty.

**'9.2.6.3 Major product, component or system failures may include**, but are not limited to, failure of the item to perform as intended, excessive wear, discoloration due to defective finish application, leakage, or inadequacy of performance as specified.

**'9.2.6.3.1 Product, component, or system failures which are directly and clearly traceable to building user or operator abuse**, such as substitution of unauthorized replacement parts, use of incorrect lubricants or chemicals, flagrant over or under lubrication, using maintenance procedures not conforming with published maintenance instructions, and abuse or vandalism, shall be exempted from the scope of the one-year warranty.

**'9.2.6.4 Should multiple equipment, product, component or system failures occur** in a given item or type of equipment, product, component or system, all items of the same size and type shall be disassembled, inspected, modified or replaced, as necessary, and re-warranted for one year.

**'9.2.6.5 A new twelve (12) month warranty against defective or deficient design, workmanship, and materials** shall commence on the day that the item of equipment is reassembled and placed back into operation.

**'9.2.7 No specific provision of this Article nor any provision in the Contract Documents, nor any special guarantee time limit** implies any limitation of the Contractor's liability with the laws of the Commonwealth of Kentucky.

**'9.3 Substitution - Materials and Equipment.** Substitution of previously approved equipment and materials shall be submitted to the A-E for acceptance and will be considered only for the following reasons:

**'9.3.1** unavailability of the material or equipment due to conditions beyond the control of the Contractor

**'9.3.2** inability of the supplier to meet Contract schedule; or

**'9.3.3** technical and immaterial noncompliance to specifications.

Inclusion of a certain, make or type of materials or equipment by the Contractor shall not obligate the A-E or Owner to accept such material or equipment if it does not meet the requirements of the plans and specifications.

Substitutions not properly approved and authorized by the A-E and Owner may be considered defective work. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials and equipment.

**'9.4 Recycled Content:** KRS 45A.520 mandates that every state agency require a minimum recycled content for those materials it purchases. In accordance with 200 KAR 5:330, all listed products are to be offered by the awarded contractor ONLY as a recycled product. Except as provided in KRS 45A.510, construction related materials requiring a minimum recycled content include Building Insulation, Aluminum products, concrete, cement and steel products. For a complete listing of those items requiring minimum recycled content please refer to 200 KAR 5:330 <http://www.lrc.state.ky.us/kar/200/005/330.htm>

## **'10. Surveys, Permits, Fees, Notices, and Tests**

**'10.1 Owner-Furnished Surveys.** The Owner shall furnish whatever surveys are specifically required by the Contract Documents. Approvals, assessments, easements for permanent structures or permanent changes in existing facilities, and utility tap-on fees shall be secured and paid for by the Owner, unless otherwise provided in the Contract Documents.

**'10.1.1 Prior to start of Construction, the Owner will furnish all land and rights-of-way** necessary for the carrying out and completion of the Work to be performed under this Contract, except as outlined in the Special Conditions should any conditions exist at the start of construction which does not make this possible at the start of construction.

**'10.2 Permits.** Building, sewer, and water permits and similar kinds of permits required by local ordinances shall be obtained by the General Contractor. Note: no building permit fee shall be charged to or paid by the Contractor as the Commonwealth is exempt from such charges levied by Local Government Jurisdictions. The Contractor shall procure and pay for any necessary licenses to do business in the locale of the Work.

**'10.3 Notices.** The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.

**'10.4 Required Regulatory Tests and Inspections.** Regulatory agencies of the State and Federal governments having jurisdiction may require any Work to be inspected, tested or approved. The Contractor shall assume full responsibility therefore, including related costs, unless otherwise noted, and shall furnish the A-E the required certifications of inspection, testing or approval.

**'10.4.1 The Contractor shall pay the electrical inspection fees** directly to the Commonwealth of Kentucky, Department for Housing and Building Construction. The Electrical subcontractor is responsible for the payment of this fee. The Electrical subcontractor is responsible for coordination of the required electrical inspections as required by the Department for Housing and Building Construction.

**'10.5 Any delays by governmental agencies in obtaining Permits, Notices, Required Regulatory Tests and Inspections (10.2, 10.3, 10.4)** and not the fault of one of the parties shall be shared by the Contractor and Owner with appropriate time extensions only. Liquidated damages and Contractor compensation for such delays or impact are not applicable and shall not be payable.

**'10.6 Payment for Tests.** Tests of materials, products and equipment in place, required by the A-E or the Owner, to prove quality standards shall be paid by the Contractor. Should results of testing indicate that construction is not in compliance with Contract Documents, the Contractor shall bear the cost of any additional tests of the materials, products or equipment.



**'10.6.1 The Contractor shall give the A-E timely notice** of readiness of the Work for all inspections, tests or approvals. This timely notice of readiness shall be no less than 72 hours except by prior agreement between the A-E and the Contractor.

**'10.7 Local Building Permits and fees.** The Commonwealth's Construction projects are exempt from Building Permit requirements of Local Governments. The Contractor is not obligated to obtain a local building permit or to pay a building permit fee. However, this exemption does not waive the requirement for fees to make connection to utilities owned by a local municipality, Local Health Department Fees, or other such requirements.

## **'11. Protection of Work, Property, Employees and Public**

**'11.1 Safety Precautions and Programs.** The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Project. The Contractor shall be responsible for compliance with all State and Federal OSHA rules and regulations.

**'11.2 Safety of Persons and Property.** The Contractor shall continuously maintain adequate protection of all Work from damage and shall protect the Owner's property from injury or loss arising in connection with this Contract. He shall make good any such damage, injury, or loss, except such as may be directly due to errors in the Contract Documents or caused by agents or employees of the Owner. He shall adequately protect adjacent property as provided by law and the Contract Documents.

**'11.2.1 The Contractor shall take all necessary precautions** for the safety of his employees and the employees of his subcontractors on the Work site, and shall comply with all applicable provisions of federal, state, and municipal safety laws and building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where the Work is being performed.

**'11.2.2 The Contractor shall provide and maintain a Work environment** and procedures which will safeguard the public and State personnel and agents, property, material, supplies and equipment exposed to Contractor operations and activities; avoid interruptions of user agency operations; and avoid delays in Contract completion dates.

**'11.2.2.1 Utilities which serve occupied building(s) shall not be interrupted unless absolutely necessary.** When temporary utility interruptions are necessary, the Contractor shall provide the A-E and Owner a notice seven (7) calendar days prior to the temporary interruption. Where it is not practical to provide a seven (7) calendar day notice, the Contractor shall notify the A-E and Owner of the temporary interruption in advance and confirm the actual utility outage/ interruption a MINIMUM of seventy-two (72) hours ahead of the outage/ interruption.

**'11.2.2.2 When utilities are accidentally interrupted that serve occupied building(s),** the Contractor shall immediately notify the A-E, the Owner and the Building Operations Representative, and work consistently and persistently to restore the utilities immediately. The Contractor will be responsible for any costs or damages incurred by the Owner or adjacent property owners in the event of an accidental interruption.

**'11.2.3 For the purposes of protecting the safety of persons and property,** the Contractor shall provide appropriate safety barricades, signs and signal lights; Comply with any safety requirement published by any governmental authority with jurisdiction over the

site, including Federal, State or local jurisdictions; and ensure that any additional measures which are reasonably necessary for these purposes are taken.

**'11.2.4 The Contractor shall designate a responsible member** of his organization present on the Work site as safety officer whose duty shall be to enforce safety regulations. The name and position of the person so designated shall be reported to the A-E by the Contractor at the beginning of the project. Should the Contractor have reason to change the responsible member designated with this task, he shall immediately inform the A-E in writing.

**'11.2.5 In an emergency affecting the safety** of life, or of the Work, or of adjoining property, the Contractor, without special instruction or authorization from the A-E or Owner, shall act at his discretion to prevent such threatened loss or injury. Immediately following the emergency, the Contractor shall file a written report to the A-E and Owner detailing the incident and the actions taken to mitigate the condition.

**'11.2.6 If the A-E or the Owner becomes aware of any noncompliance** by the Contractor with the safety conditions of this Contract or of any condition caused by the Contractor, which poses a serious or imminent danger to the health or safety of the public or to State personnel, they shall notify the Contractor orally, with written confirmation, and direct immediate initiation of corrective action.

**'11.2.6.1 This provision of providing notice to Contractor** for noncompliance with safety issues does not in any way relieve the Contractor from his responsibilities, either in part or in full, to provide adequate precautions to insure the safety of persons and property.

**'11.2.6.2 This Notice**, when given to the Contractor or his representative at the Work site, shall be deemed sufficient notice of noncompliance and that corrective action is required.

**'11.2.6.3 After receiving the Notice**, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the A-E may issue an order stopping all or part of the Work until satisfactory corrective action has been taken.

**'11.2.6.3.1 The Contractor shall not be entitled** to an equitable adjustment of the Contract price or an extension of the performance schedule by reason of the issuance of any stop Work order under this Article.

**'11.3 Hazardous Materials.** In the event the Contractor unexpectedly encounters on the site material reasonably believed to be asbestos, lead based paint, polychlorinated biphenyl (PCB) or other classified hazardous substances/materials which have not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and A-E in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos, lead based paint, polychlorinated biphenyl (PCB), or other classified hazardous substances/materials which have not been rendered harmless. The Work in the affected area shall be resumed in the absence of any classified hazardous substances/materials or when it or they have been rendered harmless.

**'11.3.1 The Contractor shall at all times safely guard the Owner's property and adjacent property from injury and/or loss** resulting from the release of hazardous or toxic materials, or similar damage in connection with the Contract Documents or the performance of the Work hereunder. The Contractor shall replace or make good any damage, loss or injury caused as a result of failure to comply with Contract Documents.

## **'12. Inspection of Work / Defective or Incomplete Work / Special Inspections**

The Owner, the A-E, Special Inspector Agency and their representatives shall at all times have access to the Work whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection. This access shall include access to approved Construction Documents and Submittals. The Contractor shall be given timely notification in order to arrange for proper inspection of any Work performed outside of the normal working day or week.

**'12.1 If the specifications, the A-E's instructions, laws, ordinances, or any public authority require any Work to be specially tested or approved,** the Contractor shall give the A-E timely notice of its readiness for inspection. Inspections by the A-E shall be made promptly, as defined by the Contract between the Owner and the A-E.

**'12.2 In the event that the Contractor covers, conceals or obscures its Work in violation of the Contract** or in violation of a directive from the Owner or the A-E, such Work shall be uncovered and displayed for the Owner's or A-E's inspection upon request, and shall be reworked at no cost in time or money to the Owner.

**'12.2.1 If any of the Work is covered, concealed or obscured in a manner not covered by the above paragraph,** it shall, if directed by the Owner or the A-E be uncovered and displayed for the Owner's or A-E's inspection. If the uncovered Work conforms strictly to the Contract, the costs incurred by the Contractor to uncover and subsequently, replace such Work shall be borne by the Owner. Otherwise, such costs shall be borne by the Contractor.

**'12.3 The Contractor shall, at no cost in time or money to the Owner,** correct Work rejected by the Owner or by the A-E as defective or failing to conform to the Contract. Additionally, the Contractor shall reimburse the Owner for all testing, inspections and other expenses incurred as a result thereof.

**'12.4 The Owner may, but shall in no event be required to, choose to accept defective or nonconforming Work.** In such event, the Contract Price shall be reduced by the greater of (1) the reasonable costs of removing and correcting the defective or nonconforming Work, and (2) the difference between the fair market value of the Project as constructed and the fair market value of the Project had it not been constructed in such a manner as to include defective or nonconforming Work. If the remaining portion of the unpaid Contract Sum, if any, is insufficient to compensate the Owner for the acceptance of defective or nonconforming Work, the Contractor shall, upon written demand from the Owner, pay the Owner such remaining compensation for accepting defective or nonconforming Work.

**'12.5 When Special Inspections are required** by Section 1704 of the Kentucky Building Code for any portion of the work, the following provisions shall apply:

**'12.5.1 Special Inspector Agency or Special Inspector:** An independent agency/registered professional Contracted by the Owner, required by the Kentucky Building Code Chapter 17, and responsible for conducting special inspections and testing defined as such in the technical specifications for this project.

**'12.5.1.1 The costs of the initial special inspections and testing** shall be borne by the Owner by separate contract with the Special Inspection Firm.

**'12.5.1.2 The costs of re-inspections and/or re-testing, should discrepancies be found,** shall be paid by the Owner, but is recoverable by the Owner from the Contractor by a credit change order.

**'12.5.1.3 The costs of re-scheduling inspections and/or testing**, where the Contractor through his lack of reasonable control of scheduling causes the Special Inspector to spend time in preparation for an inspection and/or test that did not occur as scheduled, shall be paid by the Owner, but is recoverable by the Owner from the Contractor by a credit change order.

**'12.5.2 Contract Document Compliance:** Special Inspection and testing as defined in the technical specifications is for the purpose of verifying compliance with requirements specified or indicated. This does not relieve the Contractor of the responsibility for compliance with the Contract Document requirements.

**'12.5.2.1 Should the Special Inspector identify through inspection and testing that a portion of the Work is not in compliance with the technical specifications**, the Special inspector is to provide notice to the A-, Owner and Contractor concurrently that a deviation exists. The Special Inspection Firm does not possess the authority to modify the requirements of the technical specifications, but to inspect, test and notify of any non-compliance or deficiencies.

**'12.5.2.2 When a non-compliance or deficiency exists** as reported by the Special Inspection Firm, the A-E is to review the Special Inspection Report and, when necessary, issue a "Defective Work in Place Notice" to the contractor to require correction or modification.

**'12.5.2.3 Should the Special Inspector consider that there are a potential issue with the requirements of the technical specifications due to discovered existing field conditions**, the Special Inspector is to include such consideration in the Special Inspection Report for review and interpretation by the A-E. The decision of the A-E is final.

**'12.5.3 Notify the Special Inspector:** The Contractor shall be responsible for notifying the Special Inspector and/or Special Inspection Agency regarding individual inspections required by the Contract Documents and coordinating the schedule of inspections and testing with the Contractor's approved construction schedule. Adequate notice shall be provided so that the Special Inspector has time to become familiar with the project.

**'12.5.4 Deficiencies:** The Contractor shall be responsible to ensure that deficiencies are corrected and shall coordinate with the Special Inspector to ensure that the Special Inspector has observed the corrected deficiency prior to the work involved in the discrepancy being concealed or made inaccessible by subsequent work. Concealing or making inaccessible such deficiencies shall constitute another deficiency subject to removal to allow observation of the work involved in the initial discrepancy.

**'12.5.5 Reporting Requirements:** The Special Inspection Agency/ Special Inspector shall keep records of all inspections and testing, re-inspections and re-testing, and other related events. The Special Inspector shall furnish inspection and testing reports to the Owner, Contractor, and A-Eing concurrently and as construction progresses. Reports shall be submitted immediately following each site visit, inspection and when determinations of results of off-site testing are available.

**'12.5.5.1 Reports shall include** date of issue; project title and number; name/ address/ telephone number of testing agency; dates and locations of samples and tests or inspections; names of individuals making tests and inspections; description of the work being tested or inspected; test and inspection method; specification section related to work; complete test or inspection data; test and inspection results; interpretation of results; all non-conforming items/ discrepancies observed and corrective actions implemented by the Contractor; re-testing and re-inspection

performed; ambient conditions at time of sampling, testing or inspection; comments or professional opinion on whether tested or inspected work complies with the Contract Documents and name/ signature of inspector with registration number.

**'12.5.6 Notification of non-conforming or deficiency of the Work:** The Special Inspection Firm/ Special Inspector shall immediately bring non-conforming or discrepancy work to the attention of the Owner, A-E and Contractor. The A-E shall make a determination as to the need for correction.

**'12.5.6.1 If non-conforming or deficiency work is** not corrected in a timely manner or are about to be incorporated into the Work, the Special Inspector shall bring the non-conforming or discrepancy work to the immediate attention of the Authority Having Jurisdiction, Owner, Contractor, and the A-E, and that item shall be highlighted in the Special Inspector's written report.

**'12.5.6.2 Defective Work in Place Notice:** The A-E is to review the Special Inspector's report and when necessary shall issue a "Defective Work in Place Notice" and issue it through the Document Collaboration System. The Special Inspector shall cause the Notice to be posted at the Project Site regarding the noted discrepancies and which shall contain, at a minimum, the following information about the non-conforming item: 1) Description and exact location; 2) Reference to applicable detail of the approved Construction Documents (Drawings and Specifications); 3) name and title of each individual notified and method of notification; and, 4) Resolution or corrective action taken or to be taken.

### **'13. Royalties and Patents**

The Contractor shall pay all royalties and license fees and shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof.

### **'14. Changes in the Work/ Change Orders**

**'14.1 Change Orders.** One or more changes to the Work within the general scope of the Contract may be ordered by Change Order. The Contractor shall proceed with any such changes, (including additions, reductions, deletions, other revisions), and same shall be accomplished in strict accordance with the following:

**'14.1.1 Change Order means a written order to the Contractor** executed by the Owner and the A-E after execution of the Contract, directing a change in the Work and may include a change in the Contract Price, or the Contract Time, or any combination thereof. There shall be no authorized changes in the Work which affect either Contract Price or Contract Time without a fully executed Change Order.

**'14.1.1.1 In specific instances where the progress of the Work would be negatively affected** by a delay in the Work while a fully executed Change Order is being processed.. Upon approval by the Associate Director of the Division of Engineering, and with an agreed to Contract Sum/Contract Time adjustment, the A-E may issue a written authorization to proceed with the proposed change (with the change in Contract Sum/ Contract Time clearly indicated) prior to the issuance and execution of the formal Change Order. Following this written authorization to proceed with the proposed change, the A-E will prepare and process for execution the required Change Order.

**'14.1.1.2 In these specific instances where a written authorization to proceed is provided prior to execution of the required Change Order**, the action of the Contractor to proceed with the authorized work shall be deemed as agreement to the change for the Amount and Time extension indicated in the written notice to proceed with the change.

**'14.1.2 Any change in the Contract Sum or Contract Time resulting from a Change Order shall be determined by one of the following methods:**

(1) **by mutual agreement of a lump sum amount** and/or Time adjustment between the Owner and the Contractor as evidenced by (a) the Change in the Contract Sum or Contract Time being set forth in the Change Order, (b) such change in the Contract Sum or Contract Time, together with any conditions or requirements relating thereto, being initialed by both parties and (c) the Contractor's execution of the Change Order;

(2) **by unit prices stated in the Contract Documents** or subsequently agreed upon by the Owner and the Contractor

(3) **on a time and materials basis with a not to exceed price limitation**, when the scope of the Work is not readily determined prior to the execution of the Work. Prior to the use of a time and materials basis, approval of the Associate Director of the Division of Engineering is required. Additionally, the Contractor must provide detailed labor and materials documentation of the Work once performed for the reconciliation of the time and materials basis cost of the work. The A-E shall monitor the Work performed by this basis during the execution of the work; or

(4) **If no mutual agreement occurs** between the Owner and the Contractor, the Change in the Contract Sum, if any, shall be derived by determining the reasonable actual costs or savings achieved resulting from revisions in the Work. This determination shall be made by the A-E, who has the responsibility of interpretation of the Contract Documents.

**'14.1.2(4).1 When a determination by the A-E is required for a Change Order** due to no mutual agreement being reached between the Owner and the Contractor, the provisions of paragraph '14.1.3 and '14.1.4 shall apply. Additionally, the Contractor shall not refuse to perform the Work indicated by the Change Order and shall execute the Work in a timely manner, even if the Contractor intends to protest the determination as provided in paragraph '3.4

**'14.1.3 Items (1), (3), and (4) above shall include a component for all overhead, profit, indirect costs or other items not to exceed fifteen percent (15%).** Any such costs or savings shall be documented in the format and with such content and detail as the Owner or the A-E requires. The Contractor shall only receive one fifteen percent (15%) for the "jobsite overhead and profit" component whether such work be done by the Contractor or by his Subcontractor.

**'14.1.3.1 Contractor's Overhead and Profit percentages** shall be considered to include bonds and insurance, field and office supervisors and assistants (including Project Manager(s), Job Site Superintendent(s), Project Engineers and assistants, and Crew Foremen), Job Office and storage Trailers, sanitary facilities, communications (telephone and internet), temporary utilities, temporary facilities, testing, security, use of small tools, incidental job burdens, and general home office expenses and no separate allowance shall be made therefore.

**'14.1.3.2 Assistants to field and office supervisors include all clerical, stenographic and general office help.** Incidental job burdens include, but are not



necessarily limited to, office equipment and supplies, and conformance to OSHA requirements and no separate allowance shall be made therefore.

**'14.1.3.3** Items such as, but not necessarily limited to, review and coordination, estimating and expediting relative to contract changes are associated with field and office supervision and are considered to be included in the contractor's overhead and/or fee percentage.

**'14.1.4 For all charges relating to any Change Order, whether determined under subparagraph (2), (3) or (4) above, the following provisions shall apply:**

(1) **The Contractor shall keep and present in such form as the A-E may direct, a correct account of all items in such form comprising the net cost of such Work, together with vouchers.**

(2) **The determination of the A-E shall be final (except as provided in paragraph '3.4) upon all questions of the amount and cost of Changes in the Work, and it shall include in such cost, the cost to the Contractor of all materials used, of all labor, common and skilled, or foremen, trucks and teams, and the fair rental of all machinery used and for the period of such use.**

(3) **If said Work requires the use of machinery not already upon the work or to be otherwise used upon the Work, then the cost of transportation of such machinery to and from the Work shall be added to the fair rental, but said transportation shall not cover a distance exceeding one hundred (100) miles.**

(4) **The A-E shall not include in the net cost of Work any cost or rental or small tools, or any portion of time of the Contractor or his Superintendent, or any allowance for the use of capital, or any additional bond premium, insurance cost applicable to the Work or any actual or anticipated profit, or any job or office overhead not previously mentioned, these items being considered as being covered by the added fifteen (15%) percent for the jobsite overhead and profit component.**

(5) **In all cases where Changes in the Work are covered by unit prices set forth in the Contract, the value of such Work shall be determined only upon the basis of such unit prices.**

(6) **Pending final determination of value, payments on Changes in Work shall be made only upon the estimate of the A-E.**

**'14.1.5 If the Contractor claims that any instructions by the A-E involve additional cost and/or time extension, he shall give the A-E written notice thereof within a reasonable time after the receipt of such instructions and before proceeding to execute the change in Work.**

**'14.1.6 No work related to a Change Order shall be undertaken without a fully executed Change Order.** However, should the Owner and Contractor agree that time is of the essence for the execution of said work, the Owner will issue through the A-E in writing a notice to proceed with the said work prior to the full execution of the Change Order. This notice is to be upon acceptance by the Associate Director of the Division of Engineering. This notice to proceed with said work will include an acceptance of the proposed pricing of the work or will indicate that the pricing of the work is still being negotiated.

**'14.1.7 If the Owner and Contractor cannot agree on the effect of an ordered change on the adjustment to the Contract Sum or Contract Time**, this matter may also be referred to the A-E for determination.

**'14.1.7.1 If the Owner and/or Contractor do not agree with the A-E's determination regarding the valuation of a change**, the related adjustment to the Contract Sum or to the Contract Time, the matter shall be subject to the disputes procedure set out in Article 3.4 and Article 26.

**'14.1.8 The execution of a Change Order by the Contractor shall constitute conclusive evidence of the Contractor's agreement to the ordered changes in the Work, the resulting Contract as thus amended, the Contract Sum and the Contract Time for performance by the Contractor.** The Contractor, by executing the Change Order, waives and forever releases any claim against the Owner for additional time or compensation for matters relating to or arising out of or resulting from the Work included within or affected by the executed Change Order.

**'14.1.9 The Contractor shall notify and obtain the consent and approval of the Contractor's Payment and Performance Bond sureties with reference to all Change Orders** if such notice, consent or approval are required by the Owner, the A-E, the Contractor's sureties or by law. The Contractor's execution of the Change Order shall constitute the Contractor's warranty to the Owner that the sureties have been notified of, and consent to, such Change Order and the sureties shall be conclusively deemed to have been notified of such Change Order and to have expressly consented thereto.

**'14.2 Cash Allowance:** It is understood that the Contractor has included in the Contract Price all allowances (see Article '30 for more information) so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to A-E and the Owner. The Contractor agrees that:

**'14.2.1 The allowances include the cost to Contractor** (less any applicable trade in counts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes; and

**'14.2.2 The Contractor's cost for** unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances and no demand for additional payment on account of any of the foregoing will be valid; and

**'14.2.3 Prior to final payment of the full amount of the allowance** (on the schedule of values), an appropriate Change Order will be issued as recommended by A-E reflect actual amounts due the Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

**'14.3 Minor Changes.** The A-E may authorize minor changes in the Work which do not involve additional cost or extension of the Contract Time, and which are not inconsistent with the intent of the Contract Documents. Such changes shall be effected by a Field Order issued by the A-E to the Contractor and Owner concurrently, which shall be binding on the Owner and Contractor. The Contractor shall carry out such orders promptly.

**'14.3.1 However, if the Contractor claims that a Field Order involves additional cost or a delay to completion of the Work**, he shall give the A-E written notice thereof within a reasonable time after receipt of the Field Order. Otherwise, he shall be deemed to have waived any right to claim an adjustment to the Contract Sum or to the Contract Time.



## **'15 Project Records**

**'15.1 All documents relating in any manner whatsoever to the Project**, or any designated portion thereof, which are in the possession of the Contractor, or any Subcontractor of the Contractor, shall be made available to the Owner or the A-E for inspection and copying upon written request by the Owner.

Furthermore, said documents shall be made available, upon request by the Owner, to any state, federal or other regulatory authority and any such authority may review, inspect and copy such records.

Said records include, but are not limited to all drawings, plans, specifications, submittals, correspondence, minutes, memoranda, tape recordings, videos, or other writings or things which document the Project, its design, and its construction.

Said records expressly include those documents reflecting the cost of construction to the Contractor.

**'15.2** The Contractor shall maintain and protect these documents for no less than ten (10) years after final completion of the Project, or for any longer period of time as may be required by law or good construction practice.

## **'16. Delays and Extensions of Time**

**'16.1 It is agreed that time is of the essence for each and every portion of the resulting Contract** and where under the Contract an additional time is allowed for the completion of any Work, the new time limit fixed by such extension shall be of the essence of the Contract. Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to:

- (1) any preference, priority, or allocation order duly issued by the government;
- (2) unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather; or
- (3) any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (1) and (2) of this Article.

**16.1.1 Delay that is NOT caused by the Owner or Contractor**, that delays the critical path of the project schedule, may result in extension of Contract Time but not an increase in Contract Sum. Such delay includes: Acts of God; Labor disputes/ Strikes; Freight embargoes; Fire (when not attributable to act of Contractor); Unusual delays in deliveries (when not attributable to act of Contractor); Health epidemics that affect Contractor forces; and, Other causes beyond the control of the Contractor or Owner. Note: an increase of time caused by a delay that is NOT caused by the Owner or Contractor, does not constitute reason for an increase in Contract Sum.

**'16.1.1.1 The Contractor shall, within fifteen (15) calendar days of the occurrence** of the event that caused a delay not caused by the Owner or Contractor, notify the A-E and Owner in writing. The A-E shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order. Such a claim shall not result in an increase in Contract Sum.

**'16.1.1.1.1 Should the Contractor NOT provide written notification to the A-E and Owner** within the prescribed period of time indicated above, the Contractor, by his failure to properly notify, forfeits the right to seek a Contract Time Extension for said occurrence.

**'16.1.1.2 Should the Owner determine that it is in the Owner's best interest to avoid an extension of Contract time** due to a delay not caused by the Owner or Contractor, the Owner, through the A-E, may request the Contractor to provide a plan of action to mitigate the delay through changes in the sequence of operations or through an extended workday for specific trades that will mitigate the delay. In such instances, the Owner may elect to pay the Contractor reasonable and justified additional costs required to mitigate the delay in lieu of a contract time extension. This additional costs shall be limited to the overtime premium of the extended workday for specific trades or shall be limited to actual and proven costs of a change in sequence of operations.

**16.1.2 Delay due to adverse weather conditions:** The Contractor shall have incorporated into the Project Schedule at the time of execution of the Contract for Construction all anticipated delay caused by normally occurring adverse weather. Adverse weather is that which normally occurring (as defined as the average of the preceding ten (10) years) according to the records of the National Oceanic Atmospheric Administration (NOAA).

**'16.1.2.1 When adverse weather exceeds** that which is normally expected, as defined above, and the Contractor is making a claim for delay due to adverse weather, the Contractor shall submit to the A-E and Owner the following at the Project Progress Meeting immediately following the month in which the excessive adverse weather occurred:

- 1) Current weather data from NOAA for the project site which documents and proves that the adverse weather occurred at the project site on days in which work was scheduled to occur.
- 2) Historical weather data from NOAA for the project site which documents and proves that the adverse weather that occurred at the project site was more than anticipated.
- 3) Contractor's daily field reports showing that the adverse weather that was experienced at the project site caused delay in the work that was scheduled to be performed on during the period in which adverse weather was experienced.
- 4) Contractor's written detailed explanation of the delay in the work and how it was caused by the abnormal adverse weather that was experienced at the project site and was beyond the ability of the Contractor to control or mitigate the delay for each occurrence.

**'16.1.2.1.1 Should the Contractor NOT provide the information indicated above to the A-E and Owner,** within the prescribed period of time indicated above, the Contractor, by his failure to properly notify, forfeits the right to seek a Contract Time Extension for said occurrence.

**'16.1.2.1.2 When the Contractor is behind the critical path of the schedule,** it shall be the determination of the A-E as to whether the Contractor should be eligible for a time extension due to adverse weather delay. In making this determination, the A-E shall determine and conclude that the Contractor would have been delayed by adverse weather had the Contractor been on schedule of the critical path before determining that the Contractor is eligible for a time extension due to adverse weather delay. The Contractor shall provide evidence to the A-E for the A-E's use in making such determination.

**'16.1.2.2 When adverse weather is significantly less** than that which is normally expected, as defined above, the A-E will prepare for the Owner, at its request, a claim for a reduction in Contract Time by providing current and historical weather data from NOAA for the project site which documents and proves that the adverse weather was less than anticipated at the Project Progress Meeting immediately following the month in which the adverse weather that occurred was significantly less than anticipated. The number of days in the claim shall be added to the project float and is made available to the Contractor and/or Owner to mitigate other types of delay in the project completion. Generally, a reduction of time caused by less than anticipated adverse weather does not constitute reason for a decrease in Contract Sum.

**16.1.2.3 When the A-E determines that adverse weather has delayed** the project and that the claim of the Contractor for delay due to adverse weather is justified, the Contractor will provide an accounting of float held in the project (see Article 16.2.1.4.1) that may be applied to the weather delay. Should the amount of weather delay exceed the available amount of float held on the project, the A-E will issue a Change Order extending the Contract Time by the number of days in which the Contractor was actually delayed due to adverse weather. Generally, an extension of time for delays caused by adverse weather does not constitute reason for an increase in Contract Sum.

**'16.1.2.3.1 Should the Owner determine that it is in the Owner's best interest to avoid an extension of Contract time** due to a delay caused by adverse weather, the Owner, through the A-E, may request the Contractor to provide a plan of action to mitigate the delay through changes in the sequence of operations or through an extended workday for specific trades that will mitigate the delay. In such instances, the Owner may elect to pay the Contractor reasonable and justified additional costs required to mitigate the delay in lieu of a contract time extension. This additional costs shall be limited to the overtime premium of the extended workday for specific trades or shall be limited to actual and proven costs of a change in sequence of operations.

**'16.2.1 Delay that is caused by the Owner**, that delays the critical path of the project schedule, may result in extension of Contract Time and may result in an increase in Contract Sum. Generally, delays of this type which do not delay the critical path of the project schedule shall not result in extension of Contract Time nor result in an increase in Contract Sum.

**'16.2.1.1** The Contractor shall, within seven (7) calendar days of the occurrence of the event, notify the A-E in writing. The A-E shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order.

**'16.2.1.1.1 Should the Contractor NOT provide the information indicated above to the A-E and Owner**, within the prescribed period of time indicated above, the Contractor, by his failure to properly notify, forfeits the right to seek a Contract Time Extension for said occurrence.

**'16.2.1.2 An extension of time shall not be construed as cause for extra compensation under the Contract.** Extensions of time relating to concealed conditions as defined in Article 26 shall be governed by the provisions of that Article.

**'16.2.1.3 Should the Contractor claim that an extension of time is cause for extra compensation under the Contract**, he shall make such claim in writing to the A-E within fifteen (15) calendar days of the occurrence of the event. This claim shall be in sufficient detail to support the Contractor's claim. In instances where the final determination of the costs associated with such delay is not readily calculable, the Contractor shall provide an ESTIMATED cost of the delay per day of delay. If this estimated cost of delay per day is

accepted by the Owner, the actual amount compensable by the delay will be based on this estimate.

**16.2.1.3.1 A Contractor's claim for extra compensation under the Contract may include:** Job Office expenses (for a delay in access of sixteen (16) calendar days in any given month / each month considered separately), extended equipment-left-idle costs (rented or owned), increased labor and material costs (for extended delays), loss of efficiency (for extended delays), increased insurance premiums, excess storage costs, etc.

**16.2.1.3.2 A Contractor's claim for extra compensation under the Contract shall not include:** home office costs, equipment-not-left-idle costs (rented or owned), increased labor or material costs (for short delays), job site forces costs, loss of efficiency (for short delays), etc.

**16.2.1.4 When the Contractor experiences a delay caused by the Owner,** the Contractor shall work to mitigate the delay to be best of his ability and to make a claim for the delay must prove that he mitigated the delay to the greatest extent possible.

**16.2.1.4.1 Since the Owner and Contractor share as a commodity, all float (including Total Float, Free Float and Sequestered Float) (See Article '4.2),** this float is available to the Owner to mitigate the effect of events that may delay performance or completion of all or part of the Work that has been caused by the Owner.

**16.2.1.5 When the Contractor experiences a delay caused by the Owner,** the delay must result in a delay to the critical path of the project schedule which is not readily recoverable by the Contractor without actual damage. In making a claim for the delay the Contractor must prove that the delay was a delay to the critical path of the project schedule and that he was not readily able to recover without actual damage.

**16.2.1.6 When the Contractor experiences a delay caused by the Owner,** the Contractor may not be entitled to a claim for the delay if a concurrent delay is present that is caused by the actions or inaction of the Contractor. When a concurrent Contractor caused delay exists, both delays shall be reviewed together and the Contractor is only eligible to make a claim for a delay caused by the Owner that extends beyond the concurrent delay caused by the Contractor.

**16.2.1.7 When there is a delay caused by the Contractor that is concurrent with a delay caused by the Owner,** there may be an extension of Contract Time, if found warranted, but no compensation to the Contractor will be made.

**16.2.1.8 When the Contractor is behind the accepted Project Schedule (related to the Critical Path),** and there occurs a delay caused by the Owner (that would have affected the Critical Path had the Contractor been on schedule), no time extension or compensation will be due the Contractor during the period of time that he is behind schedule.

**16.2.1.9 When the Contractor fails to plan his work in a manner than permits him to ask questions of the A-E/Owner reasonable ahead of the time he requires to the answer to avoid a delay caused by the Owner,** the delay will be a considered a concurrent delay and while an extension of time may be found as reasonable to grant the Contractor, no compensation for the delay will be provided. This situation is considered a concurrent delay since the Contractor participated in creation of the delay by his failure to plan the work adequately to avoid or reduce the delay.

## **'17 Subcontractors**

**'17.1 Contractor Fully Responsible for Subcontractors.** The Contractor is fully responsible to the Owner for the acts and omissions of his Subcontractors and of persons and entities either directly or indirectly employed by them. Nothing contained in the Contract Documents shall create any contractual relationship between the Owner and a Subcontractor.

**'17.1.1 The Contractor has the contractual obligation to adjust differences** between his several Subcontractors. Attempts to have the A-E and/or Owner settle disputes between the Contractor and his Subcontractors or between Subcontractors will not be given consideration.

**'17.1.2 The Contractor shall not submit any claim from a Subcontractor** to the A-E and/or Owner. Should the Contractor receive a claim from a Subcontractor, it is his obligation to satisfy the claim with his subcontractor. Should the Contractor determine that a claim from a Subcontractor is valid and should be considered by the A-E and/or Owner, the Contractor shall make the claim as himself with the subcontractor's claim as supporting documentation. The Contractor shall also provide documentation and reason for supporting the claim to the A-E and/or Owner.

**'17.1.2.1 The A-E and/or Owner have no responsibility or obligation** to meet with a subcontractor to resolve a dispute or claim. Should the Contractor desire to have a subcontractor accompany the Contract in a meeting to resolve a dispute or claim, a request shall be made prior to the meeting requesting the Owner's acceptance of such accompaniment. Granting of this acceptance shall be solely at the discretion of the Owner and does not establish any contractual relationship of the Owner with the subcontractor in any respects.

**'17.1.3 The Contractor is responsible for the performance of his several subcontractors** including, but not necessarily limited to: any delay in completion of the work of a subcontractor; sequencing of work among his several subcontractors; covering up of work requiring inspection or observation; and/or the quality of workmanship in completing the Work.

**'17.1.4 The Contractor shall not submit to the A-E and/or Owner any document,** submittal, manual, or price proposal directly from his several Subcontractors without first having reviewed such and determined that it is reasonable, complete, and compliant with the Contract Documents.

**'17.2 Flow-down Requirement.** By contract, the Contractor shall require each Subcontractor:

(1) to be bound to the Contractor by the terms of the Contract Documents insofar as they apply to the Work to be performed by the Subcontractor; and

(2) to assume toward the Contractor all the obligations which the Contractor, by the Contract Documents, assumes toward the Owner.

**'17.3 Contracts with Subcontractors.** The Contractor shall contract with those Subcontractors listed in the Contractors Bid Response and deemed acceptable by the Owner in accordance with the procedure outlined in the Instruction to Bidders. All subcontracts shall afford the Contractor rights against the Subcontractor which correspond to those rights afforded to the Owner against the Contractor herein, including those rights of Contract termination as set forth herein.

**'17.4 Substitution of Subcontractors.** The Contractor shall not contract with any substitute Subcontractor or change a Subcontractor without providing timely written notice of the

proposed substitution to the A-E and Owner. The substitution shall not be made if the A-E and Owner object in writing to such change.

**17.4.1 Release required of original Subcontractor.** When the Contractor finds it necessary to propose a substitute Subcontractor or change a Subcontractor he shall provide to the Owner a written release from the Subcontractor being substituted or changed indicating that they are not able, or not willing to, provide the work in which they were originally contracted to provide.

**17.4.1.1 This written release shall be on the official letterhead of the Subcontractor,** when obtainable, stating that the Subcontractor is agreeable to being substituted on the project and that the Subcontractor waives all current and future claims resultant from the substitution.

**17.4.1.2 When the Contractor cannot obtain the release required of original Subcontractor** he shall provide in written form a statement, on the letterhead of the Contractor with proof that the Contractor has attempted to obtain such a release, that the Subcontractor is non-responsive in not only providing the release but is also non-responsive in providing the work being subcontracted, and that the Contractor fully accepts any future liability from the original subcontractor making a claim related to being substituted.

**17.4.1.3 Prior to the substitution being made,** the Contractor shall obtain written approval from the Purchasing Officer indicating that the Commonwealth has reviewed the documents provided as indicated above and has concluded that it is in the best interests of the Commonwealth that such a substitution is accepted.

## **'18. Payment**

The Owner shall make payments, less held retainage (defined in paragraph 18.5), to the Contractor on the amount of the Work performed or materials furnished for the Work in accordance with the following procedures:

**'18.1 Schedule of Values.** At the same time it submits a construction schedule, within fifteen (15) days of the Date of Commencement, as provided in Article 4, the Contractor shall submit a Schedule of Values apportioning the Contract Sum among the different elements of the Project for purposes of periodic and final payment, prepared in such form and supported by such data to substantiate its accuracy as the A-E may require. The Contractor shall not imbalance its Schedule of Values, nor artificially inflate any element thereof. The violation of this provision by the Contractor shall constitute a material breach of the Contract. Upon written approval by the A-E and the Owner, the Schedule of Values and construction schedule shall become the basis for the Contractor's Payment Requests during construction.

**'18.2 Application for Progress Payment.** Not more often than once a month (except as provided in paragraph 3.8), the Contractor shall submit to the A-E a signed application for payment (sometimes referred to as Payment Request), for the Work completed as of the date of the application and accompanied by such data and schedules as the A-E may reasonably require.

**'18.2.1 Therein, the Contractor may request payment less held retainage,** of that part of the Contract Sum allocable to Contract requirements properly provided, labor, materials and equipment properly incorporated in the Project.

**'18.2.2 If payment is requested on the basis of materials and equipment not incorporated in the Project,** but delivered and suitably stored at the Project site or at another location agreed to in writing by the Owner, the application for payments shall also



be accompanied by such data, satisfactory to Owner, as will establish the Owner's title to the material and equipment and protect his interest therein, including written documentation of full insurance against loss or damage and the bonding of the storage sites. Storage sites must be bonded.

**'18.2.3 Each subsequent application for payment** shall include an affidavit of the Contractor stating that all previous progress payments received on account of the Work have been applied to discharge in full all of the Contractor's obligations reflected in prior applications for payment.

**'18.2.4 Each Payment Request shall be signed by the Contractor** and shall constitute the Contractor's representation that the quantity of Work has reach the level for which payment is requested, that the Work has been properly installed or performed in strict compliance with this Contract, and that the Contractor knows of no reason why payment should not be made as requested.

**'18.3 Approval of Payments.** The A-E shall review the application for payment and shall review the work at the Project site or elsewhere to determine whether the quantity and quality of the Work is as represented in the application for payment and is as required by this Contract.

**'18.3.1 The A-E shall, within ten (10) business days** after receipt of each application for payment, approve in writing the amount which, in the opinion of the A-E, is properly owing to the Contractor.

**'18.3.1.1 When there is reasonable justification that causes the A-E to be unable to perform this review, approval and submission of his recommendation to the Owner within the time prescribed in paragraph 18.3.1 above,** the A-E will notify the Contractor in writing as to the justification and as to the time that will be required for this review, approval and submission of his recommendation to the Owner.

**'18.3.2 The Owner shall make payment to the Contractor within twenty (20) business days following the A-E's written approval** of each application for payment. A reasonable delay on the part of the Owner in making payment to the Contractor for any given payment shall not be a breach of contract.

**'18.3.2.1 When there is reasonable justification that causes the Owner to be unable to make payment within the time prescribed in paragraph 18.3.2 above,** the Owner will notify the Contractor in writing as to the justification as to why this payment cannot be made.

**'18.3.2.2 The Owner will not be required to make payment to the Contractor within the time prescribed in paragraph 18.3.2 above,** when the Owner has justification for the holding of this payment such as when the Owner's payment is conditional on submission of required documents from the Contractor.

**'18.3.3 The amount of each such payment shall be the amount approved for payment by the A-E less such amounts,** if any, otherwise owing by the Contractor to the Owner or which the Owner shall have the right to withhold as authorized by this Contract. The A-E's approval of the Contractor's application for payment shall not preclude the Owner from the exercise of any of its rights as set forth herein. The Contractor warrants and represents that, upon payment of the application for payment, title to all Work included in such payment shall be vested in the Owner.

**'18.4 Contractor's Warranty of Title.** The Contractor warrants and guarantees that title to all Work, materials and equipment covered by any application for payment, whether incorporated

in the project or not, will pass to Owner at the time of payment free and clear of all encumbrance.

**'18.5 Held Retainage/ Retainage Reduction.** Until fifty percent (50%) of the construction work has been completed in accordance with the contract, the Owner may withhold no more than ten percent (10%) retainage from the amount of any undisputed payment due, and retainage held after fifty-one percent (51%) of the construction project has been completed shall not be more than five percent (5%) of the total Contract Sum.

**'18.5.1 Subsequently, the Contractor shall withhold no more than ten percent (10%) retainage from the amount of any undisputed payment due to a subcontractor, and retainage held after fifty-one percent (51%) of the construction project has been completed shall not be more than five percent (5%) of the total amount contracted with a subcontractor.**

**'18.6 Completion, Acceptance and Final Payment.** Upon certification by the A-E of Substantial Completion of the Work, the Contractor shall continue to make normal pay requests as defined within this document.

**'18.6.1 Within thirty (30) calendar days after substantial completion or within twenty (20) calendar days after receipt of the A-E's recommendation for payment (whichever comes last), the Owner shall release the retainage less an amount equal to two hundred percent (200%) of the Owner's reasonably estimated cost of the balance of any contractor's contractually obligated, yet uncompleted, work remaining plus the following:**

**'18.6.1.1 Should the Contractor not fulfill the requirements for Substantial Completion by the date established by the Contract Documents for Substantial Completion, the Owner may withhold an additional amount of retainage to cover the anticipated application of "Liquidated Damages" or "Damages for Untimely Performance".**

**'18.6.2 Final payment shall be made by the Owner to the Contractor when the Contract has been fully performed by the Contractor in accordance with the Contract Documents and a final Certificate of Payment is submitted by the A-E to the Owner.** Such final payment shall be made by the Owner not more than twenty (20) calendar days after the submittal by the A-E of the final Certificate of Payment, except:

**'18.6.2.1** when the Owner is anticipating applying "Liquidated Damages" or "Damages for Untimely Performance", the amount of this anticipated application of damages may be withheld from Final Payment until such damages are resolved between the Owner and the Contractor.

**'18.6.3 The Contractor shall submit with the application for final payment an affidavit that all payrolls, bills for materials, supplies and equipment, and other indebtedness connected with the Work have been paid or otherwise satisfied, along with such supporting evidence of payment as the A-E requires. Final payment is conditioned on satisfactory compliance with this requirement.**

**'18.7 Waiver of Claims.** The making of final payment shall constitute a waiver of all claims by the Owner except those arising from:

**'18.7.1** unsettled liens;

**'18.7.2** faulty or defective Work appearing after Substantial Completion;

**'18.7.3** failure of the Work to comply with the requirements of the Contract Documents; or

**'18.7.4** terms of any special warranties required by the Contract Documents.



The acceptance of final payment by the Contractor shall constitute a waiver of all claims except those previously made in writing and identified by the Contractor as unsettled at the time of the final application for payment.

**'18.8 Contractor's Payment to Subcontractors.** Within fourteen (14) calendar days of when payment is received from the Owner, the Contractor shall pay all Subcontractors, materialmen, laborers and suppliers the amounts they are due for the Work covered by such payment.

**'18.8.1 In the event the Owner becomes informed that the Contractor has not paid a Subcontractor,** material-man, laborer, or supplier as provided herein, the Owner shall have the right, but not the duty, to issue future checks and payment to the Contractor of amounts otherwise due hereunder naming the Contractor and any such Subcontractor, material-man, laborer, or supplier as joint payees. Such joint check procedure, if employed by the Owner, shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to commit the Owner to repeat the procedure in the future.

**'18.8.2** The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payment to his subcontractors in similar manner.

**'18.8.3** The A-E or Owner may, on request, furnish to any Subcontractor information regarding the percentage of completion of the amounts applied for by the Contractor and the action thereon by the A-E.

**'18.8.4** Neither the Owner nor the A-E shall have any obligation to make payment to any Subcontractor except as may otherwise be required by law.

**'18.9 Owner's Rights Relating to Payments.** Neither payment to the Contractor, utilization of the project for any purpose by the Owner, nor any act or omission by the Owner shall be interpreted or construed as an acceptance of any Work of the Contractor not strictly in compliance with this Contract.

**'18.9.1 The Owner shall have the right to refuse to make payment** and, if necessary, may demand the return of a portion or all of the amount previously paid to the Contractor due to:

**'18.9.1.1** The quality of a portion, or all, of the Contractor's Work not being in accordance with the requirements of this Contract;

**'18.9.1.2** The quantity of the Contractor's Work not being as represented in the Contractor's Payment Request, or otherwise;

**'18.9.1.3** The Contractor's rate of progress being such that, in the Owner's opinion, substantial or final completion, or both, may be inexcusably delayed;

**'18.9.1.4** Claims made, or likely to be made, against the Owner;

**'18.9.1.5** Loss caused by the Contractor;

**'18.9.1.6** The Contractor's failure or refusal to perform any of its obligations to the Owner under this Contract.

In the event that the Owner makes written demand upon the Contractor for amounts previously paid by the Owner as contemplated in this Paragraph, the Contractor must promptly comply with such demand.

## **'19. Completion**

**'19.1 Commencement and Completion of Work.** The Contractor shall begin the Work on the Date of Commencement as specified in the Contract issued by the Owner.

**'19.1.1 The Contractor is expected to mobilize on site and begin work no later than fifteen (15) calendar days after the Date of Commencement,** unless he has notified the A-E and Owner in writing of acceptable reasons why it is not in the best interest of the Commonwealth and the Project that he will not mobilize by that date.

**'19.1.2 The Contractor shall diligently and expeditiously continue the performance** of the Contract continuously to and until Substantial Completion and Final Completion of the Project. All time limits stated in the Contract Documents are the essence of the Contract.

**'19.1.3 The Contractor shall accomplish the Work in accordance** with the construction schedule (as provided in Article 4) so as to achieve Substantial Completion and Final Completion dates as defined in the Contract Documents.

**'19.2 Date for Commencement of Commissioning.** Commissioning of specified building systems shall be scheduled to allow for the completion of the commissioning process by the Date of Substantial Completion. The Contractor shall work to complete the initial installation and startup of equipment involved in these building systems early enough in the project that the complete and properly conducted commissioning process can be completed including any corrective work and verification identified by the commissioning process. (See the associated sections of the technical specifications for the commissioning requirements and procedures for each building system which is to be commissioned).

**'19.3 Date for Commencement of Testing and Balancing.** Testing and Balancing of HVAC systems shall be scheduled to allow for the completion of the Testing and Balancing process by the Date of Substantial Completion. The Contractor shall work to complete the initial installation and startup of HVAC equipment early enough in the project that the complete and properly conducted testing and balancing process can be completed including any corrective work and verification identified by the testing and balancing process.

**'19.4 Substantial Completion of the Work.** The Substantial Completion Date shall be that date certified by the A-E, in consultation with the Owner, in accordance with the following procedures.

**'19.4.1 "Substantial Completion"** or "Substantially Complete" means the point in time when:

**'19.4.1.1 The progress of the Work,** or designated portion of the Work (as agreed in writing advance by the Owner, A-E and Contractor), is fully complete and functional in accordance with the requirements of the Contract Documents such that only items listed in the Punch list remain and the Work, or designated portion thereof, is ready to be occupied and/or utilized for its intended purpose;

**'19.4.1.2 The applicable Governmental Authorities** have issued a certificate of occupancy (or where Substantial Completion only applies to a designated portion of the Work, a temporary certificate of occupancy) and/or any other applicable approvals, licenses, certifications or other written evidence from the applicable Governmental Authority that said Work, or designated portion of the Work, has been completed to such authority's satisfaction and is ready to be occupied and/or used for its intended purpose.

**'19.4.1.2.1 Where the project requires specialized Governmental Authorities to inspect and accept the construction (i.e. Office of Inspector General, Federal Agencies, etc.)** a determination is to be made in the 'Special Conditions' of this Contract as to the timing of these

inspections or acceptances and how they affect the Date of Substantial Completion, Date of Final Completion or an Extended Date for Compliance for that specific inspection or acceptance requirement.

**'19.4.1.3 The A-E has issued an Owner approved certificate of Substantial Completion for the Work**, or designated portion of the Work, in accordance with the terms of the Contract Documents;

**'19.4.1.4 Operations and Maintenance Manuals**, have been received for review by the A-E and the A-E has determined that the Operations and Maintenance Manuals are complete.

**'19.4.1.4.1** Note that the Contractor shall submit Operations and Maintenance Manuals prior to the anticipated Date of Substantial Completion in order to allow the A-E reasonable time to review and approve or reject the submittal.

**'19.4.1.4.2** The A-E shall review and approve or reject the Operations and Maintenance Manuals within fourteen (14) calendar days of receipt from the Contractor. The Date of Substantial Completion shall not be earlier than the date of approval of the Operations and Maintenance Manuals by the A-E.

**'19.4.1.5 Warranty Samples**, have been reviewed and approved by the A-E.

**'19.4.1.5.1** Note that the Contractor shall submit samples of each required Warranty prior to the anticipated Date of Substantial Completion in order to allow the A-E reasonable time to review and approve or reject the submittal.

**'19.4.1.5.2** The A-E shall review and approve or reject the sample Warranties within fourteen (14) calendar days of receipt from the Contractor. The Date of Substantial Completion shall not be earlier than the date of approval of the samples of Warranties by the A-E.

**'19.4.1.6** With respect to all of the Project's building systems, including, without limitation, all systems being Commissioned, the Work, or designated portion of the Work (as agreed in writing in advance by the Owner, A-E and Contractor), is fully commissioned, balanced, tested and operational in compliance with the Contract Documents and applicable Laws ("Systems Commissioning"); The Date of Substantial Completion shall not be earlier than the date in which Systems Commissioning is completed.

**'19.4.1.7** All required initial and follow-up orientation and training has been accomplished in accordance with the requirements of the Contract Documents ("Systems Training"). The Date of Substantial Completion shall be no earlier than the date in which the final training session has been satisfactorily completed.

**'19.4.1.8** The Contractor shall have advised the Owner of insurance requirements including a list of all fixed and non-fixed equipment provided under the Work including replacement values for each item of equipment.

**'19.4.2** When the Contractor determines that Substantial Completion has been achieved, the Contractor shall notify the Owner and the A-E in writing. The notification shall be accompanied by a Contractor prepared list of those items of Work still to be completed or corrected. The failure of the Contractor to include any item or items on such list not completed or needing correction shall not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**'19.4.3 The A-E shall**, within a reasonable time after receipt of notification from the Contractor of Substantial Completion, make such inspection, with consultation of the Owner, to confirm that the Work has achieved Substantial Completion. If the Contractor's notification is not accompanied by the list provided in paragraph '19.2.1, the A-E and Owner may elect to postpone this inspection until receipt of the list proscribed.

**'19.4.4 Upon its confirmation** that the Contractor's work is substantially complete, the A-E shall prepare a Certificate of Substantial Completion which shall establish the Substantial Completion Date and the responsibilities between the Owner and Contractor for security, maintenance, heat, utilities and insurance, if not otherwise provided for in the Contract Documents, and a tentative list of items to be completed or corrected, within thirty (30) calendar days from the Substantial Completion Date. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of the responsibilities assigned to them in the certificate.

**'19.4.4.1 Should the A-E confirm that the Work has achieved Substantial Completion on the date of his inspection**, the A-E shall derive that the Contractor was Substantially Complete on the date of receipt of the notification from the Contractor indicated above.

**'19.4.4.2 When the Owner accepts Substantial Completion and occupies a building**, all operations, maintenance, utilities and insurance become the responsibility of the Owner, except those items specifically identified in the Certificate of Substantial Completion as remaining to be completed by the Contractor.

**'19.4.4.3** If, after making the inspection, the A-E fails to find that the Contractor's Work has achieved Substantial Completion, he will notify the Contractor in writing, giving the reasons therefore.

**'19.4.4.4** If the A-E through its inspection fails to find that the Contractor's Work has not achieved Substantial Completion and is required to repeat all, or any portion, of its inspection, the Contractor shall bear the cost of such repeat inspections which cost may be deducted by the Owner from any payment then or thereafter due the Contractor. This deduction by the Owner from any payment for this reason will be by a credit to the Contract Sum by Change Order.

**'19.5 Final Completion of the Work.** The A-E, upon receipt of written notice from the Contractor that the Work is finally complete and is ready for final inspection and acceptance, will promptly make such inspection and when he finds the Work completed and acceptable under the Contract Documents and the Contract fully performed, he will so notify the Contractor in writing, and the Contractor shall promptly issue a final Certificate of Payment to the Owner.

**'19.5.1** "Final Completion or "Finally Complete" means the point in time when:

**'19.5.1.1 The progress of the Work**, is fully complete and functional in accordance with the requirements of the Contract Documents such that no items listed in the Punch list remain uncorrected;

**'19.5.1.2 The applicable Governmental Authorities** have issued a final certificate of occupancy;

**'19.5.1.3 The A-E** has issued an Owner approved certificate of Final Completion for the Work, in accordance with the terms of the Contract Documents;

**'19.5.1.4 Warranty Binder**, have been reviewed and approved by the A-E.

**'19.5.1.4.1** Note that the Contractor shall submit a binder with original copies of all required Warranties prior to the anticipated Date of Final Completion in order to allow the A-E reasonable time to review and approve or reject the submittal.

**'19.5.1.4.2** The A-E shall review and approve or reject the Warranties within a reasonable time after receipt from the Contractor. The Date of Final Completion shall not be earlier than the date of receipt of the Warranty Binder by the A-E where the Warranty Binder is subsequently approved by the A-E.

**'19.5.1.5 With respect to all of the Project's building systems, including, without limitation, all systems being Commissioned**, the Work, is fully commissioned without "Corrective Actions" remaining to be completed in compliance with the Contract Documents and applicable Laws ("Systems Commissioning"); The Date of Final Completion shall not be earlier than the date in which Systems Commissioning is fully completed including all "Corrective Actions".

**'19.5.1.6 The Contractor has submitted a final Application for Payment** including a Final Affidavit as required by the Commonwealth.

**'19.5.1.7 The Contractor and the A-E** have submitted to the Owner a report of the status of LEED Certification documentation when required by a project that is under LEED Certification. Included in these reports is a listing of documentation that will be required for the final LEED Certification during the one year warranty period.

**'19.5.2 Should the A-E confirm that the Work has achieved Final Completion** on the date of his inspection, the A-E shall derive that the Contractor was Finally Complete on the date of receipt of the notification from the Contractor indicated above.

**'19.5.3 If the A-E is unable to issue its final Certificate of Payment** and is required to repeat its final inspection of the Project, the Contractor shall bear the cost of such repeat inspection(s), which costs may be deducted by the Owner from the Contractor's final payment;

**'19.6 Use of Adequately Complete Portions.** The Owner may use or occupy a specified portion of the Work at any stage, provided that:

**'19.6.1** such use or occupancy is consented to by insurers and

**'19.6.2** it is authorized by the issuance of a Temporary Certificate of Occupancy or a Certificate of Occupancy by public regulatory bodies having jurisdiction over the Work; and

**'19.6.3** prior to such use or occupation, the affected portion of the Work is jointly inspected by the Owner, Contractor and A-E to determine the precise stage of completion.

**Such possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents. The Owner's use of adequately completed portions (with the Contractor's agreement), while the Work of**

**the Project is not actually Substantially Complete, shall not be deemed as a defining factor in determining that the Project has reached Substantial Completion.**

***'19.7 Liquidated Damages/ Damages from Untimely Performance***

**'19.7.1 The Contractor shall pay the Owner an amount identified in the Contract Documents** for each and every calendar day of unexcused delay in achieving Substantial Completion and Final Completion beyond the date set for each.

**'19.7.1.1 Any sums due and payable hereunder by the Contractor** shall be payable, not as a penalty, but as liquidated damages representing delay damages sustained by the Owner, estimated at the time of executing this Contract.

**'19.7.1.2 When the Owner is able to determine an actual sum of Damages** from Untimely Performance, and that sum is less than the predetermined "Liquidated Damages", the Owner may, upon review of the particular circumstances of this specific Project, elect to apply the lesser amount of damages.

**'19.7.2 When the Owner reasonably believes that Substantial Completion will be inexcusably delayed, the Owner shall be entitled, but not required, to withhold from any amounts otherwise due the Contractor an amount then believed by the Owner to be adequate to recover liquidated damages applicable to such delays.** If and when the Contractor overcomes the delay in achieving Substantial Completion, or any part thereof, for which the Owner has withheld payment, the Owner shall promptly release to the Contractor those funds withheld, but no longer applicable, as liquidated damages.

**'19.7.3 The Contractor shall not have the right without justifiable cause** to contest the Owner's assessment of Liquidated Damages as defined by this Article and as indicated in the Special Conditions.

**'19.7.3.1 Should the Contractor believe he has justifiable cause for contesting the Owner's assessment of Liquidated Damages,** once the project work has achieved FINAL COMPLETION, the Contractor may submit to the Director of the Division of Engineering and Contract Administration written detailed explanation of the justifiable cause for contesting the Owner's assessment of Liquidated Damages.

**'19.7.3.1.1 Within fifteen (15) calendar days of the issuance of a Change Order which includes the Owner's assessment of Liquidated Damages,** the Contractor shall provide written notification to the Director of the Division of Engineering and Contract Administration of the Contractor's intent to contest the Owner's assessment of Liquidated Damages. Failure of the Contractor to make such written notification shall cause the Owner to execute the Change Order which includes the Owner's assessment of Liquidated Damages.

**'19.7.3.1.2 The Contractor's submission of the Final Application for Payment shall be evidence that the Contractor does not desire to contest the Owner's assessment of Liquidated Damages** and shall be evidence of the Contractor's agreement with the Owner's assessment of Liquidated Damages.

**'19.7.3.1.3 When the Director of the Division of Engineering and Contract Administration has reviewed** the submitted evidence from the Contractor, gathered other evidence and information related to the Contractor's contesting of the Owner's assessment of Liquidated Damages, and made a determination as to the, reasonableness, validity



and standing of the Contractor's contesting, the Director shall issue a final determination in the matter.

## **'20. Correction of Work**

**'20.1 Correction of Work Prior to Final Payment.** The Contractor shall promptly correct Work which is rejected by the A-E as failing to conform to the requirements of the Contract Documents. Such correction shall be required regardless of whether or not the nonconformities are observed before or after Substantial Completion, or whether or not the work has been fully fabricated, installed or completed.

**'20.2 Correction of Work After Final Payment.** Neither the Final Certificate of payment nor any provisions in the Contract Documents shall relieve the Contractor of responsibility for failure to conform to the requirements of the Contract Documents.

**'20.2.1 If within one year after the date of Final Completion** of the Work or designated portion thereof or after the date for commencement of warranties, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct the Work promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition.

**'20.2.1.1 This period of one year shall be extended with respect to portions of Work first performed after Final Completion** by the period of time between Final Completion and the actual performance of the Work. This obligation under this paragraph shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the conditions.

**'20.3 Responsibility for Related Costs.** In addition to being responsible for correcting the Work and removing any nonconforming Work or materials which are not corrected from the jobsite, the Contractor shall bear all other costs of bringing the affected Work into compliance with the Contract Documents. These include costs of any required additional testing and inspection services, A-E's services, and any resulting damages to property or to construction Work of other contractors or of the Owner.

**'20.4 Correction by Owner.** If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may take steps to correct the Work itself. If, within a ten (10) business day period after receipt of written notice to correct the nonconformity, the Contractor has not made serious efforts to correct the nonconformity, the Owner may without prejudice to any other remedies it may have, proceed to correct the non-conforming Work.

**'20.4.1** In such cases a Change Order shall be issued by the Owner with the approval of the A-E reflecting an equitable deduction from the Contract Sum to cover the cost of correcting the Work, including compensation for the A-E's additional services and other related expenses and damages. The amount of the Change Order shall be deducted from payments then or thereafter due the Contractor. If final payment has already been made, the Contractor shall pay the difference within a reasonable time, which is generally defined as 30 calendar days from the date of written request for such reimbursement by the Owner.

**'20.5 Ongoing Liability of Contractor for Defective Work.** The foregoing provisions establishing the specific obligation of the Contractor to perform corrective Work do not establish a period of limitations on other obligations of the Contractor under the Contract Documents. Even after the Contractor is no longer specifically obligated to perform corrective Work itself, it

shall still be held liable for nonconforming Work and for other breaches of its obligations under the Contract Documents.

**'20.6 Deduction for Uncorrected Work.** If the Owner deems it not expedient to correct Work which is not in accordance with the requirements of the Contract Documents, an appropriate Change Order shall be issued by the Owner with the approval of the A-E reflecting an equitable deduction from the Contract Sum on account of the uncorrected Work. The amount of the Change Order shall be deducted from payments then or thereafter due the Contractor. If final payment has already been made, the Contractor shall be responsible for paying the difference to the Owner within a reasonable time, which is generally defined as 30 calendar days from the date of written request for such reimbursement by the Owner.

## **'21. Suspension of Work**

**'21.1 Suspension by the Owner.** The Owner shall have the right at any time to direct the contractor to suspend its performance, or any portion thereof for a period of not more than thirty (30) calendar days. The notice of suspension shall be in writing and shall set forth the reason for the suspension. The written notice shall fix the approximate date on which Work is contemplated to be resumed. The Owner shall pay the Contractor as full compensation for such suspension the Contractor's Direct Job Expenses.

**'21.1.1 Should the Contractor believe that the Owner, by its actions, has suspended the Work,** but has not received a written notice of suspension from the Owner, the Contractor shall notify the Owner in writing that he believes a suspension of the Work has occurred and seek clarification from the Owner that such suspension of the Work is the Owner's intent by its actions. The Owner will promptly clarify for the Contractor its intentions related to suspension of the Work.

**'21.1.2 Without such written notice of suspension of the Work by the Owner,** the Contractor shall proceed with the Work as if it was not suspended and shall not be eligible for compensation as indicated in paragraph '21.1 above.

**'21.2 Other Suspension.** In the event the Owner should be prevented from proceeding with the work due to a bid protest, or enjoined by court order from proceeding with the Work or from authorizing its prosecution, either before or after the award, for a period up to ninety (90) calendar days, the delay shall not constitute cause for termination by the Contractor and the Contractor shall not be entitled to make or assert claim for damage by reason of said delay, but time for completion of Work shall be extended to such reasonable time as the Owner may determine will compensate for time lost by such delay. Such determination shall be set forth in a Change Order shall be final and binding upon both parties, and shall not require the signature of the Contractor to be in effect.

The Owner shall pay the Contractor as full compensation for such suspension the Contractor's reasonable costs actually incurred and paid as follows:

- '21.2.1** demobilization and remobilization, including such costs paid to subcontractors;
- '21.2.2** preserving and protecting work in place;
- '21.2.3** storage of materials or equipment purchased for the Project, including insurance thereon;
- '21.2.4** performing in a later, or during a longer, time frame than contemplated by this Contract.

**'21.3 Termination by the Contractor due to Suspension of the Work by the Owner.** If, through no act or fault of the Contractor, the Work is suspended for a period of more than thirty (30) calendar days by the Owner, or more than ninety (90) calendar days under an Order of



the Court or other public authority, then the Contractor may, after ten (10) business days from delivery of a written notice to the Owner and the A-E, terminate the Contract and recover from the Owner payment for all Work executed and reasonable expenses sustained.

**'21.3.1 If the A-E has failed to act on a request for payment,** within thirty (30) calendar days of submission, or if the Owner has failed to make any payment, within forty-five (45) calendar days of receipt of an approval application for payment, the Contractor may, upon ten (10) business days written notice to the Owner and the A-E stop the Work until he has been paid all amounts then due, in which event and upon resumption of the Work, a Change Order shall be issued adjusting the Contract Price or extending the Contract Time, or both, to compensate for the costs and delays attributable to the stoppage of the work, any such compensation being subject to the provisions, conditions and limitations contained in Article 26.

## **'22. Termination**

**'22.1 Termination of Contract for Convenience of Owner.** The Owner, for any reason whatsoever, may terminate the Contract for its own convenience when it determines that such termination will be in the best interest of the Commonwealth of Kentucky. The Owner shall give written notice of such termination to the Contractor specifying when termination becomes effective. The Contractor shall incur no further obligations in connection with the Work and the Contractor shall stop Work when such termination becomes effective. The Contractor shall also terminate outstanding orders and subcontracts. The Contractor shall settle the liabilities and claims arising out of the termination of Subcontracts and orders. The Owner may direct the Contractor to assign the Contractor's right, title and interest under termination orders or subcontracts to the Owner or its designee. The Contractor shall transfer title and deliver to the Owner such completed or partially completed Work and materials, equipment, parts, fixtures, information and Contract rights as the Contractor has. The Commonwealth shall negotiate a fair and just settlement with the Contractor in accordance with 200 KAR 5:312 Section 2. In such event, the following procedure shall be required:

**'22.1.1 The Contractor shall submit a termination claim to the Owner and the A-E** specifying the amounts due because of the termination for convenience together with costs, pricing or other data required by the Owner or the A-E. If the Contractor fails to file a termination claim within one (1) year from the effective date of termination, the Owner shall pay the Contractor, an amount derived in accordance with paragraph (3) below;

**'22.1.2 The Owner and the Contractor may agree to the compensation,** if any, due to the Contractor hereunder pursuant to 200 KAR 5:312 Section 2;

**'22.1.3 Absent agreement to the amount due to the Contractor,** the Owner shall pay the Contractor the following amounts:

**'22.1.3.1 Contract prices** for labor, materials, equipment and other services accepted under this Contract;

**'22.1.3.2 Reasonable costs** incurred in preparing to perform and in performing the terminated portion of the Work and in terminating the Contractor's performance, plus a fair and reasonable allowance for direct jobsite overhead and profit thereon (such profit shall not include anticipated profit or consequential damages); provided however, that if it appears that the Contractor would have not profited or would have sustained a loss if the entire Contract would have been completed, no profit shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated rate of loss, if any;

**'22.1.3.3 Reasonable costs** of settling and paying claims arising out of the termination of subcontracts or orders pursuant to the initial Paragraph of 22.1. These costs shall not include amounts paid in accordance with other provisions hereof.

**'22.1.3.4 The total sum to be paid the Contractor under 22.1** shall not exceed the total Contract Sum, as properly adjusted, reduced by the amount of payments otherwise made, and shall in no event include duplication of payment.

**'22.2 Termination of Contract for Cause.** If the Contractor should be adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency or, if the Contractor does not perform the Work, or any part thereof, in a timely manner, supply adequate labor, supervisory personnel or proper equipment or materials, or if it fails to timely discharge its obligations for labor, equipment and materials, or proceeds to disobey applicable law, or otherwise commits a violation of a material provision of the resulting Contract, then the Owner, in addition to any other rights it may have against the Contractor or others, may terminate the performance of the Contractor upon ten (10) days written notice by registered mail of declaration of default and assume possession of the Project site and of all materials and equipment at the site and may complete the Work.

**'22.2.1 In such case, the Contractor shall not be paid further until the Work is complete.** After final completion has been achieved, if any portion of the Contract Sum, as it may be modified hereunder, remains after the cost to the Owner of completing the Work, including all costs and expenses of every nature incurred, has been deducted by the Owner, such remainder shall belong to the Contractor. Otherwise, the Contractor shall pay and make whole the Owner for such cost. This obligation for payment shall survive the termination of the Contract. In the event the employment of the Contractor is terminated by the Owner for cause pursuant to this Paragraph 22.2 and it is subsequently determined by a Court of competent jurisdiction that such termination was without cause, such termination shall thereupon be deemed a Termination for Convenience under Paragraph 22.1 and the provisions of Paragraph 22.1 shall apply.

### **'23. Indemnification**

**The Contractor shall indemnify and hold the Owner harmless** from any and all claims, liability, damage, loss, cost and expense of every type whatsoever, regardless of whether such liability, claim, damage, loss, cost or expense is caused in part by the Owner, including, without limitation, attorneys' fees and expenses, in connection with the Contractor's performance of this Contract, provided that such claims, liability, damage, loss, cost or expense is due to sickness, personal injury, disease or death, or to loss or destruction of tangible property (other than the Work itself), including loss of use resulting therefrom, to the extent caused by the Contractor, or anyone for whose acts the Contractor may be liable.

### **'24. Insurance**

**'24.1 The Contractor shall furnish the Owner with certificates evidencing the required insurance coverage** prior to commencing work. Contractor shall keep up-to-date copies of such certificates on file with Owner until work is completed. Owner may require Contractor to submit policy endorsements or complete policy copies of the required insurance.

**'24.2 Contractor shall procure and maintain for the duration of the contract insurance** against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by Contractor, its agents, representatives, employees or subcontractors.

**'24.3 Minimum Scope of Insurance** Coverage shall be at least as broad as:

**24.3.1** Insurance Services Office commercial general liability coverage (“occurrence” Form CG 0001, Ed. 10/93).

**24.3.2** Insurance Services Office Form CA 0001 (Ed. 12/93) covering automobile liability, Code 1 “any auto.”

**24.3.3** Workers’ compensation insurance as required by the Workers’ Compensation Act (as contained in KRS Chapter 342) and employers liability insurance.

**’24.4 Minimum Limits of Insurance** Contractor shall maintain limits no less than:

**24.4.1 Commercial General Liability:**

\$1,000,000 combined single limit per occurrence for bodily injury, personal injury and property damage with a \$3,000,000 annual aggregate. The deductible or Self-Insured Retention per occurrence shall not be more than \$10,000.

**24.4.2 Automobile Liability:** \$500,000 combined single limit per accident for bodily injury and property damage.

**24.4.3 Workers’ Compensation and Employers Liability:** Workers’ compensation with statutory benefits without limit, as required by the Kentucky Workers Compensation Act, and employer’s liability limits of \$1,000,000 per accident.

**’24.5 Other Insurance Provisions** The policies are to contain, or be endorsed to contain, the following provisions:

**’24.5.1 Commercial General Liability and Automobile Liability Coverages.**

**’24.5.1.1 Owner, its officers and employees are to be covered as insureds as respects:** liability arising out of activities performed by or on behalf of the Contractor; general supervision of the work by Owner; products and completed operations of the Contractor; premises owned, occupied or used by the Contractor, or automobiles owned, leased, hired or borrowed by the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to Owner, its officers or employees.

**’24.5.1.2 The Contractor’s insurance coverage shall be primary insurance as respects Owner,** its officers and employees. Any insurance of self-insurance maintained by Owner shall be excess of the Contractor’s insurance and shall not contribute to it.

**’24.5.1.3** Any failure to comply with reporting provisions of the policies shall not affect coverage provided to Owner, its officers or employees.

**’24.5.1.4** The Contractor’s insurance shall apply separately to each insured against whom claim is made or suit is brought except with respect to the limits of the insurer’s liability.

**’24.5.2 All Coverages.** Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days’ prior written notice by certified mail, return receipt requested, has been given to Owner.

**’24.6 Acceptability of Insurers** Insurance is to be placed with insurers with an A.M. Best’s rating of no less than A VII, authorized to write insurance in the Commonwealth of Kentucky.

**’24.7 Verification of Coverage** The Contractor shall furnish the Owner with certificates evidencing the required insurance coverage prior to commencing work. Contractor shall keep up-to-date copies of such certificates on file with Owner until work is completed. Owner may

require Contractor to submit policy endorsements or complete policy copies of the required insurance.

**'24.8 Subcontractors** Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to all of the requirements stated herein.

**'24.9 The Contractor shall provide all Risks Insurance** in an amount of not less than one hundred percent (100%) of the insurable value of all the work. The coverage, is to be written on CP 00 20 06 95 or equivalent acceptable to the Commonwealth. All coinsurance clauses in the Risks Insurance policy will be waived. All rights of subrogation against the Owner (i.e. the Commonwealth) will be waived by the insurer. Such insurance shall be for the benefit of the Contractor, Owner and any Subcontractor engaged on this project, as the Owner shall find their respective interest may appear. The Risks Insurance must be dated and in force on the date indicated in the Contract to begin work.

**'24.10 The insurance coverage required by the contract documents shall be in compliance with the laws of the Commonwealth of Kentucky** and shall be placed with a licensed resident or non-resident agent who represents insurance companies authorized to do business in Kentucky.

**'24.11** The Certificate of Insurance or Certificates of Insurance will have the following endorsements as an attachment to the Certificate or Certificate's.

**'24.11.2** The Commonwealth of Kentucky, Division of Engineering and Contract Administration will be named as an additional insured.

**'24.11.3** The policy is primary coverage and any insurance or self-insurance maintained by the Commonwealth of Kentucky shall be excess.

**'24.11.4** Any failure of the named insured to comply with the reporting provisions of the policy shall not affect coverage provided to the Commonwealth of Kentucky, it's officers or employees.

**'24.11.5** All Coverages. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be suspended, voided, cancelled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to Owner.

## **'25. Performance and Payment Bonds**

**The Contractor shall furnish separate performance and payment bonds to the Owner.** The Contractor shall furnish a performance bond satisfactory to the Owner in an amount equal to one hundred percent (100%) of the Contract Sum as security for the faithful performance of the Contract. The Contractor shall also furnish a payment bond satisfactory to the Owner in an amount equal to one hundred percent (100%) of the Contract Sum for the protection of all persons performing labor or furnishing materials, equipment or supplies for the Contractor or his Subcontractor for the performance of the Work provided for in the Contract, including security for payment of all unemployment contributions which become due and payable under Kentucky Unemployment Insurance Law.

**'25.1 Each bond furnished by the Contractor shall incorporate** by reference the terms of the Contract as fully as though they were set forth verbatim in such bonds. In the event the Contract Sum is adjusted by Change Order executed by the Contractor, the penal sum of both the performance bond and the payment bond shall be deemed increased by like amount.

**'25.2 The performance and payment bonds shall be executed** by a surety company authorized to do business in this Commonwealth, and the contract instrument of bonds must be countersigned by a duly appointed and licensed resident agent.

**'26. Claims by the Contractor/ Concealed Conditions/ Disputes**

**'26.1** Claims by the Contractor against the Owner are subject to the following:

**'26.1.1 All Contractor claims against the Owner shall be initiated by a written claim** submitted to the Owner and the A-E. Such claim shall be filed with the Owner and the A-E no later than seven (7) calendar days after the event, or the first appearance of the circumstances, causing the claim, and same shall set forth in detail all known facts and circumstances supporting the claim;

**'26.1.2 The Contractor and the Owner shall continue their performance** regardless of the existence of any claims submitted by the Contractor.

**'26.1.3 In the event the Contractor discovers previously concealed and unknown site conditions** which differ materially from those indicated in the Contract Documents, or unknown site conditions which are materially at variance from those typically and ordinarily encountered in the general geographical location of the Project, the Contract Sum shall be modified, either upward or downward, upon the written claim made by either party within seven (7) calendar days after the first appearance to such party of the circumstances.

**'26.1.3.1 As a condition precedent** to the Owner having any liability to the Contractor due to concealed and unknown conditions, the Contractor must give the Owner and the A-E written notice of, and an opportunity to observe, such condition prior to disturbing it.

**'26.1.3.2 The failure by the Contractor to give the written notice** and make the claim as provided by this paragraph shall constitute a waiver by the Contractor of any rights arising out of or relating to such concealed and unknown condition;

**'26.1.4 In the event the Contractor seeks to make a claim** for an increase in the Contract Sum, as a condition precedent to any liability of the Owner therefor, the Contractor shall strictly comply with the requirements of the first paragraph of this Article and such claim shall be made by the Contractor before proceeding to execute any additional or changed Work. Failure of the condition precedent to occur shall constitute a waiver by the Contractor of any claim for additional compensation;

**'26.1.5 In connection with any claim by the Contractor** against the Owner for compensation in excess of the Contract Sum, any liability of the Owner for the Contractor's cost shall be strictly limited to direct cost incurred by the Contractor and shall in no event include indirect cost or consequential damages of the Contractor. The Contractor shall provide a detailed breakdown of the direct cost incurred by the Contractor. The inclusion of the Contractor's 15% OHP to this direct cost shall constitute the Owner's reimbursement to the Contractor for all indirect cost and consequential damages.

**'26.1.6 The Owner shall not be liable to the Contractor** for claims of third-parties including subcontractors, unless and until liability of the Contractor has been established therefor in a court of competent jurisdiction;

**'26.2 In the event the Contractor should be delayed in performing any task** which at the time of the delay is then critical, or which during the delay becomes critical, as the sole result of any act or omission by the Owner or someone acting in the Owner's behalf, or by Owner-authorized Change Orders, unusually bad weather not reasonably anticipatable, fire or other

Acts of God, the date for achieving Substantial Completion, or, as applicable, final completion, shall be appropriately adjusted by the Owner upon the written claim of the Contractor to the Owner and the A-E.

**'26.2.1 An extension of time shall not mean** that the Contractor is entitled to additional compensation.

**'26.2.2 A task is critical within the meaning of this paragraph** if, and only if, said task is on the critical path of the Project schedule so that a delay in performing such task will delay the ultimate completion of the Project.

**'26.2.3 Any claim for an extension of time by the Contractor** shall strictly comply with the requirements of the first paragraph of this Article above. If the Contractor fails to make such claim as required in this paragraph, any claim for an extension of time shall be waived.

**'26.3 All claims under this Contract shall be made in accordance** with KRS 45A.225 to 45A.290. The provisions of these statutes do not toll the running of the Statute of Limitations set forth in KRS 45A.260. Any suit pursuant to KRS 45A.245 shall be commenced within one (1) year of the Substantial Completion Date specified in the Contract. If the Contractor does not commence suit within one (1) year of the date specified in the Contract, the Contractor shall be foreclosed from proceeding in court pursuant to KRS 45A.245.

**'26.3.1 The Owner and Contractor agree** that any suit, action or proceeding with respect to this Contract may only be brought in or entered by the courts of the Commonwealth of Kentucky situated in Frankfort, Franklin County, Kentucky, or the United States District Court for the Eastern District of Kentucky, Frankfort Division, and the parties hereby submit to the non-exclusive jurisdiction of such courts for the purpose of any such suit, action, proceeding or judgment and waive any other preferential jurisdiction by reason of domicile or location. The parties hereby agree that any such legal action shall be tried by the court sitting without a jury. The parties hereby irrevocably waive any objection that they may now or hereafter have to the laying of venue of any suit, action or proceeding arising out of or related to this Contract brought in the courts of the Commonwealth of Kentucky situated in Frankfort, Franklin County, Kentucky, or the United States District Court for the Eastern District of Kentucky, Frankfort Division, and also hereby irrevocably waive any claim that any such suit, action or proceeding brought in any one of the above-described courts has been brought in an inconvenient forum.

## **'27 Liens**

The filing and perfection of liens for labor, materials, supplies and rental equipment supplied on the work are governed by KRS 376.195 to 376.260.

**'27.1 The lien shall attach only to any unpaid balance** or retainage due the Contractor for the improvement from the time a copy of statement of lien, attested by the County Clerk, is delivered to the Owner, pursuant to the provisions of KRS 376.240

**'27.2 Statements of lien shall be filed with the Franklin County Clerk** and action to enforce the same must be instituted in the Franklin Circuit Court, Frankfort, Kentucky, pursuant to KRS 376.250(2).

## **'28 Assignments**

Neither party to the Contract shall assign the Contract, or any portion thereof without the written consent of the other, nor shall the Contractor assign any monies due or to become due to him hereunder without notification to the Owner. Notification of Assignments, shall be given on State



forms and in accordance with the procedures and regulations of the Finance and Administration Cabinet.

### **'29 Separate Contracts**

**'29.1 Owner's Right to Perform Construction and to Award Separate Contracts.** The Owner reserves the right to let other contracts in connection with the Project or to perform Work with its own forces. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work and shall properly connect and coordinate his Work with theirs.

**'29.1.1 If any part of the Contractor's Work depends** for proper execution or results upon the Work of any other contractor, the Contractor shall promptly report to the A-E any observed defects in such Work that render it unsuitable for proper execution or connection. His failure to inspect and report shall constitute an acceptance of the other contractor's Work as fit and proper for the reception of his Work, except as to defects which may develop in the other contractor's Work after the execution of his Work.

**'29.1.2 If any part of another contractor's work depends on the Contractor's Work for proper** execution, the Contractor shall promptly perform that Work as required to allow the other contractor's work to progress as originally intended by the Owner's separate contract with that contractor.

**'29.1.3** Whenever Work being done by the Owner's forces or by other Contractors work under separate agreement with the Owner is contiguous to Work covered by this Contract, the respective rights of the various interests involved shall be established by the A-E to secure the completion of the various portions of the Work in general harmony.

**'29.2 Mutual Responsibility of Contractors.** Should the Contractor cause damage to any separate contractor on the Work, the Contractor agrees, upon due notice, to settle with such contractor if he will so settle. If such separate 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 Contractor's expense and if any judgment against the Owner arises therefrom, the Contractor shall pay or satisfy it and pay all costs incurred by the Owner.

### **'30 Allowances**

**'30.1 The Contractor shall have included in the Contract Sum all allowances stated in the Contract Documents** and shall cause the Work so designated to be done as the Owner may direct. If the actual price for purchasing the "allowed material" is more or less than the "cash allowance," the Contract Sum shall be adjusted accordingly.

**'30.2 The adjustment in Contract Sum shall be made on the basis** of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the "allowed materials" shall be included in the applicable sections of the Contract specifications covering this Work. (see Article 14, paragraph 14.2 for more information).

### **'31 Project Meetings**

**'31.1 Pre-Construction Conference:** No later than 10 calendar days after execution of the Contract a Pre-Construction Conference will be held at the Project Site or another convenient location. This meeting will be scheduled by the Owner through the A-E.

**'31.1.1 Attendance at the Pre-Construction conference is mandatory for the following personnel:** Authorized Representatives of the Owner; A-E and their

consultants; Contractor and his Project Manager, Job Superintendent and key personnel; all major subcontractors; Using Agency on-site personnel; and other persons designated by the A-E, Owner, or Contractor to be critical to the project.

'31.1.2 All participants shall be familiar with the Project and authorized to conclude matters relating to the Work.

'31.1.3 Agenda for the meeting will include all matters indicated in the DECA Capital Construction Procedures Manual related to the project. The meeting will be conducted by the A-E and minutes distributed within three working days following the meeting.

'31.2 **Pre-Installation Conferences:** Pre-installation Conferences shall be held at the Project Site or another convenient location for any item of the work requiring a pre-installation conference. The conference is required PRIOR to each construction activity that requires coordination with other construction.

'31.2.1 **Attendance at the Pre-Installation Conference is mandatory for the following personnel:** Authorized Representatives of the Owner; A-E and their consultants who have responsibilities related to the installation; Contractor and his Project Manager, Job Superintendent and key personnel; all subcontractors with work related to the installation; Installers of the work; Manufacturer's and Fabricator's Representatives related to the installation; and other persons designated by the A-E, Owner, or Contractor to be critical to the project.

'31.2.2 All participants shall be familiar with the up-coming installation and authorized to conclude matters relating to the Work.

'31.2.3 Agenda for the meeting will include all matters indicated in the DECA Capital Construction Procedures Manual related to the project. The meeting will be conducted by the Contractor and minutes distributed within three working days following the meeting.

'31.3 **Project Progress Meetings:** At regular intervals during the construction (a minimum of monthly, but may be more frequently at the discretion of the A-E/ Owner, Project Progress Meetings will be held at the Project Site or another convenient location. This meeting will be scheduled at the Pre-Construction Conference or when more frequently needed by the Owner through the A-E.

'31.3.1 **Attendance at the Project Progress Meeting is mandatory for the following personnel:** Authorized Representatives of the Owner; A-E and their consultants; Contractor and his Project Manager, Job Superintendent and key personnel; all major subcontractors who have work completing, continuing or commencing; Using Agency on-site personnel; and other persons designated by the A-E, Owner, or Contractor to be critical to the project.

'31.3.2 All participants shall be familiar with the Project and authorized to conclude matters relating to the Work.

'31.3.3 Agenda for the meeting will include all matters indicated in the DECA Capital Construction Procedures Manual related to the project. The meeting will be conducted by the A-E and minutes distributed within three working days following the meeting.



**'31.3.4** Elsewhere in these General Conditions are submittals and other requirements of the Contractor that are to be provided at each Project Progress Meeting (i.e. updated Project Schedule, updated submittal log; updated RFI log, etc.

## **'32. Miscellaneous Provisions Regarding Contractor's Work**

**'32.1 Project Site Limits.** The Contractor shall confine his apparatus, the storage of materials, and the operations of his workmen to Project site limits indicated by the Contract Documents.

**'32.2 Points of Reference.** The Contractor shall carefully preserve bench marks, reference points and stakes, and in case of willful or careless destruction, he shall be charged with the resulting expense of replacement and shall be responsible for any mistake that may be caused by their unnecessary loss or disturbance.

**'32.3 Cutting and Patching.** The Contractor shall be responsible for cutting, fitting or patching required to complete the Project or make its parts fit together in a proper manner. The Contractor shall not endanger other parts of the Project, including work by the Owner or other contractors as provided in Article 29, by cutting, patching, or excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a separate contractor without written consent of the Owner or such separate contractor. Such consent shall not be unreasonably withheld.

**'32.4 Cleanup.** The Contractor shall at all times keep the Project premises and surrounding area free from the accumulation of waste materials or rubbish caused by his operations in connection with the Project. Upon completion of the Work, and prior to final inspection and acceptance, the Contractor shall remove all remaining waste materials, rubbish, Contractor's construction equipment, tools, machinery, and surplus materials and leave the Project (including but not limited to glass, hardware, fixtures, masonry, tile and marble) in a clean and usable condition satisfactory to the A-E. Floors shall be cleaned and waxed in accordance with the requirements of the Contract specifications. If the Contractor fails to clean up as provided in the Contract Documents, the Owner may perform the cleaning tasks and charge the cost to the Contractor by Change Order.

### **'32.5 Guarantees, Warranties and "As-Built" Drawings.**

**'32.5.1** Prior to final payment for the Work, the Contractor shall assemble and present to the A-E all guarantees and warranties required by the Contract Documents.

**'32.5.2** All warranties for materials, equipment and installations constructed by this project shall commence on the Date of Substantial Completion and continue for the period of time indicated for the specific material, equipment or installation.

**'32.5.3** Additionally the Contractor shall provide "Record" Drawings prior to final payment.

**'32.6 Governing Law.** The Contract shall be governed by the laws of the Commonwealth of Kentucky.

**'32.6.1 Statutory Limitation Periods.** Statutes of Limitations are governed by KRS 45A.260(2).

**'32.6.2 Written Notice.** Written notice shall be deemed to have been given if delivered in person to the individual or to a member of the organization or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last known business address known to the notifying party.

**'33. Apprentices**

Apprentices (for all classifications of work) shall be permitted to work only under an apprenticeship agreement approved by the Kentucky Supervisor of Apprenticeship and by the Kentucky Apprenticeship Council which is recognized by the Bureau of Apprenticeship and Training, U. S. Department of Labor.

**'34. Nondiscrimination in Employment**

During the performance of the Contract, the Contractor agrees as follows:

**'34.1** The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, national origin, or disability in employment.

**'34.2** The Contractor will take affirmative action in regard to employment, upgrading, demotion, transfer, recruitment, recruitment advertising, layoff, termination, rates of pay or other forms of compensation, and selection for training, so as to ensure that applicants are employed and that employees during employment are treated without regard to their race, color, religion, sex, age, or national origin; however, when layoffs occur, employees shall be laid off according to seniority with the youngest employees being laid off first. When employees are recalled, this shall be done in the reverse way the employees were laid off;

**'34.3** The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, or national origin;

**'34.4** The Contractor will post notices in conspicuous places, available to employees and applicants for employment, setting forth the provisions of the nondiscrimination clauses required by this section;

**'34.5** The Contractor shall send to each labor union or representatives of workers with which he has a collective bargaining agreement or other contract or understanding, a notice advising the labor union or workers' representatives of the Contractor's commitments under this section.

Failure to comply with the above nondiscrimination clause constitutes material breach of Contract.

**'35 Affirmative Action; Reporting Requirements**

**'35.1** The Contractor and Subcontractors are exempt from any affirmative action or reporting requirements, under the Kentucky Equal Employment Act of 1978, KRS 45.560 to 45.640 hereinafter referred to as The Act, if any of the following conditions are applicable:

(1) the Contract or subcontract awarded is in the amount of five hundred thousand dollars (\$500,000) or less, and the amount of the contract is not a subterfuge to avoid compliance with the provisions of The Act; or

(2) the Contractor or Subcontractor utilizes the services of fewer than eight (8) employees during the course of the Contract ; or

(3) the Contractor or subcontractor employs only family members or relatives; or

(4) the Contractor or Subcontractor employs only persons having a direct Ownership interest in the business and such interest in not a subterfuge to avoid compliance with the provisions of The Act.

**'35.2 The Contractor or Subcontractor not otherwise exempted** shall for the duration of the Contract, hire minorities from within the drawing area to satisfy the agreed upon goals and timetables set out in addenda to the Contract. Should the union with which the Contractor has collective bargaining agreements be unwilling to provide sufficient minorities to satisfy the goals and timetables, the Contractor shall hire minorities from other sources within the drawing area to satisfy the goals and timetables in the addenda to the Contract.

**'35.3** The equal employment provisions of The Act may be met in part by the Contractor subcontracting to a minority contractor or subcontractor. A minority contractor or subcontractor shall be defined by the addenda to this Contract, or if none, by the Act.

**'35.4** Each Contractor shall, for the length of the Contract, furnish such information as required by The Act and by such rules, regulations and orders issued pursuant thereto and will permit access to all books and records pertaining to his employment practices and work sites by the contracting agency and the department for purposes of investigation to ascertain compliance with The Act and such rules, regulations and orders issued pursuant thereto.

**'35.5** If the Contractor is found to have committed an unlawful practice against a provision of The Act during the course of performing under this Contract, (if covered by The Act), the Owner may cancel or terminate the Contract, conditioned upon a program for future compliance approved by the Owner. The Owner may also declare such Contractor ineligible to bid on further contracts until such time as the Contractor complies in full with the requirements of The Act.

**'35.6** The Contractor shall not be required to terminate an existing employee, upon proof that employee was employed prior to the date of the Contract nor hire anyone who fails to demonstrate the minimum skills required to perform a particular job.

### **'36 Access to Records**

**'36.1 The contractor, as defined in KRS 45A.030(7), agrees that the contracting agency, the Finance and Administration Cabinet, the Auditor of Public Accounts, and the Legislative Research Commission, or their duly authorized representatives, shall have access to any books, documents, papers, records, or other evidence, which are directly pertinent to this contract for the purpose of financial audit or program review.**

**'36.2 Furthermore, any books, documents, papers, records, or other evidence provided to the contracting agency, the Finance and Administration Cabinet, the Auditor of Public Accounts, or the Legislative Research Commission which are directly pertinent to the contract shall be subject to public disclosure regardless of the proprietary nature of the information, unless specific information is identified and exempted and agreed to by the Secretary of the Finance and Administration Cabinet as meeting the provisions of KRS 61.878(1)(c) prior to the execution of the contract.**

**'36.3 The Secretary of the Finance and Administration Cabinet shall not restrict the public release of any information which would otherwise be subject to public release if a state government agency was providing the service. (22 Ky.R. 1510; eff. 5-16-96.)**

**'37 Commonwealth Project Forms and other weblinks:**

**'37.1 The Commonwealth of Kentucky does not recognize any project forms from third party sources** (i.e. American Institute of A-Es; Association of Construction and Development; Association of General Contractors; etc.) unless the Commonwealth has not adopted specific documents.

**'37.1.1 When the Commonwealth has not adopted specific documents for a construction document purpose**, other documents may be used provided that they do not conflict with these General Conditions and other documents and contracts of the Commonwealth in any respect.

**'37.1.2 Any conflict between a construction document utilized** and any provision of these General Conditions or other documents and Contracts of the Commonwealth, shall be immediately considered null and void.

**'37.2 The weblink to the State Planroom site where Commonwealth Construction forms, contracts, and manuals are located is:**

<https://finance.ky.gov/services/stateplan/Pages/ConstructionFormsandInformation.aspx>

**37.2.1 A listing of documents available on this site includes the following:**

## Required Affidavits and Statements

- Affidavit for Final Payment (B-210-13)
- Affidavit for Bidder, Offerors and Contractors
- Vendor Report of Prior Violations

## Invoices and Change Order Form

- DOA-24 Invoice \*For contracts greater than \$400,000 (05-06-08)
- SAS-25 Invoice Short Form \*For contracts less than \$400,000 (09-29-11)
- SAS-25 A-Eing Consultants Form (11-19-10)
- SAS-42 Change Order Form (09-27-06)

## Example Invoice Forms

- DOA-24 Continuation Sheet (Example)
- DOA-24 Long Form (Example) (09-27-06)
- SAS-25 Short Form (Example) (09-29-11)

## EEO Forms

- Affidavit of Intent to Comply
- EEO-1: Employer Information Report
- Subcontractor Reporting Part

## Manuals

- Capital Construction Project Procedures Manual (Updated 6-22-13)
- Technical Guidelines and Specifications - Complete Version (12-15-13)
- Capital Construction Project Procedures manual (Full collection)

**'37.3 The weblink to the State's Document Collaboration System is:**

<https://www.stateofkyprojects.com/>

**'37.3.1 This Document Collaboration System shall be used** for all official and/or required communication and documentation of any Capital Construction Project where these General Conditions apply.

**END OF GENERAL CONDITIONS**

### Payment Bond - Part IV

**CONTRACTOR** (Name and Address):

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

**SURETY** (Name and Principal Place of Business):

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

**OWNER** (Name and Address):

Commonwealth of Kentucky  
Finance and Administration Cabinet  
Bush Building 1<sup>st</sup> Floor  
403 Wapping Street  
Frankfort, KY 40601-2638

**CONSTRUCTION CONTRACT** - \_\_\_\_\_

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

AMOUNT: \_\_\_\_\_

DESCRIPTION (Name and Location)

Invitation No: \_\_\_\_\_

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

**BOND**

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

AMOUNT: \_\_\_\_\_

**CONTRACTOR AS PRINCIPAL**

Company: \_\_\_\_\_ (Corporate Seal)

**SURETY**

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_

Name and Title:

Signature: \_\_\_\_\_

Name and Title:

Name, Address and Telephone of AGENT or BROKER:

Name, Address and Telephone of AGENT or BROKER:

Whereas, the Owner has required the Contractor to furnish this Payment Bond containing the terms and conditions set forth herein as a condition to executing the Construction Contract with the Contractor;

Now therefore, the Surety and the Contractor, both severally, and for themselves, their heirs, administrators, executors and successors agree:

1. The Construction Contract is hereby incorporated herein and by reference made a part hereof to the same extent and effect as though it were copied verbatim herein. The Surety and the Contractor are bound for the full performance of the Construction Contract including without exception all of its terms and conditions, both express and implied, and, without limitation, specifically including Contractor's obligation to pay for labor, materials, services and equipment provided in connection with the Construction Contract performance.

2. For purposes of this Payment Bond, Beneficiary is defined as person or entity who has actually provided labor, material, equipment, services or other items for use in furtherance of the Construction Contract, and having:

- (A) a direct contract with the Contractor; or
- (B) a direct contract with a subcontractor of the Contractor; or
- (C) rights, under the laws of the jurisdiction where the Project is located, to file a lien, a claim or notice of lien, or otherwise make a claim against the Project or against funds held by the Owner, if the Project is, or were, subject to such filing.

3. The Surety shall not be obligated hereunder to a Beneficiary other than a Beneficiary having a direct contract with the Contractor unless such Beneficiary has given written notice of its claim to the Contractor and the Surety as follows:

(A) the period of time provided by the jurisdiction wherein the Project is located for (1) filing a lien, claim of lien, notice of lien, if the Project is, or were, subject to such filing (KRS 376.230), or (2) otherwise making a claim against the Project or against funds held by the Owner;

(B) address, the person or entity to whom such labor, material, equipment, services or other items were provided.

4. In no event shall the Surety be obligated hereunder for sums in excess of the Penal Sum as it may be modified by addendum.

5. Upon receipt of claim from a Beneficiary hereunder, the Surety shall promptly, and in no event later than 30 days after receipt of such claim, respond to such claim in writing (furnishing a copy of such response to the owner) by:

- (A) making payment of all sums not in dispute; and
- (B) stating the basis for disputing any sums not paid.

6. No action shall be commenced by a Beneficiary hereunder after the passage of the longer of two (2) years following the date on which the final payment of the contract falls due or, if this bond is provided in compliance with applicable law, any limitation period provided therein. If the limitation period contained in this Paragraph is unenforceable, it shall be deemed amended to provide the minimum period for an action against the Surety on a payment bond by a third-party beneficiary thereof.

7. Any and all notices to the Surety or the Contractor shall be given by Certified Mail, Return Receipt Requested, to the address set forth for each party above.

**Commonwealth of Kentucky  
Finance and Administration Cabinet  
Department for Facilities and Support Services  
Division of Engineering and Contract Administration**

**Performance Bond - Part V**

**CONTRACTOR** (Name and Address):

**SURETY** (Name and Principal Place of Business):

**OWNER** (Name and Address):  
Commonwealth of Kentucky  
Finance and Administration Cabinet  
Bush Building 1<sup>st</sup> Floor  
403 Wapping Street  
Frankfort, KY 40601-2638

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

**CONSTRUCTION CONTRACT - «ContractNumber»**

DATE:  
AMOUNT:

DESCRIPTION (Name and Location)

**BOND**

DATE:  
AMOUNT:

**CONTRACTOR AS PRINCIPAL**

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title:

**SURETY**  
Company: \_\_\_\_\_ (Corporate Seal)

Name, Address and Telephone of AGENT or BROKER:

Signature: \_\_\_\_\_  
Name and Title:

Name, Address and Telephone of AGENT or BROKER:

Whereas, the Owner has required the Contractor to furnish this Performance Bond containing the terms and conditions set forth herein as a condition to executing the Construction Contract with the Contractor;

Now therefore, the Surety and the Contractor, both severally, and for themselves, their heirs, administrators, executors and successors agree:

1. The Construction Contract is hereby incorporated herein and by reference made a part hereof to the same extent and effect as though it were copied verbatim herein. The Surety and the Contractor are bound for the full performance of the Construction Contract including without exception all of its terms and conditions, both express and implied.

2. If the Contractor is in default of the Construction Contract and the Owner, by written notice to the Contractor and the

Surety, declares the Contractor to be in default and terminates the right of the Contractor to proceed, the Surety shall thereupon promptly notify the Owner in writing as to which of the actions permitted to the Surety in Paragraph 3 it will take.

3. Upon the default and termination of the Contractor and notice to the Contractor and Surety as provided in Paragraph 2 above, the Surety shall within 30 days proceed to take one or, at its option, more than one of the following courses of action:

(A) Proceed itself, or through others acting on its behalf, to complete full performance of the Construction Contract including, without limitation, correction of defective and nonconforming work performed by or on behalf of the Contractor. During such performance by the Surety the Owner shall pay the Surety from its own funds only such sums as would have been due and payable to

the Contractor in the absence of the default and termination.

(B) Applicable law permitting, and with the prior written consent of the Owner, obtain bids or proposals from contractors previously identified as being acceptable to the Owner, for full performance of the Construction Contract. The Surety shall furnish the Owner a copy of such bids or proposals upon receipt of same. The Surety shall promptly select, with the agreement of the Owner, the best responsive bid or proposal and shall promptly tender the contractor submitting it, together with a contract for fulfillment and completion of the Construction Contract executed by the completing contractor, to the Owner for the Owner's execution. Upon execution by the Owner of the contract for fulfillment and completion of the Construction Contract, the completing contractor shall furnish to the Owner a Performance Bond and a separate payment bond, each in the form of those bonds previously furnished to the Owner for the project by the Contractor. Each such bond shall be in the penal sum of the (1) fixed price for completion, (2) guaranteed maximum price for completions, or (3) estimated price for completion, whichever is applicable. The Owner shall pay the completing contractor from its own funds only such sums as would have been due and payable to the Contractor under the Construction Contract as and when they would have been due and payable to the Contractor in the absence of the default and termination. To the extent that the Owner is obligated to pay the completing contractor sums which would not have then been due and payable to the Contractor under the Construction Contract, the Surety shall provide the Owner with such sums in a sufficiently timely manner that the Owner can utilize such sums in making timely payment to the completing contractor; or.

(C) Take any and all other acts if any, mutually agreed upon in writing by the Owner and the Surety.

4. In addition to those duties set forth hereinabove, the Surety shall promptly pay the Owner all loss, costs and expenses resulting from the Contractor's default(s), including, without limitation, fees, expenses and costs for

architects, engineers, consultants, testing, surveying and attorneys, liquidated or actual damages, as applicable, for delay in completion of the Project, and fees, expenses and costs incurred at the direction, request, or as a result of the acts or omissions of the Surety.

5. In no event shall the Surety be obligated to the Owner hereunder for any sum in excess of the Penal Sum as it may be modified by addendum.

6. The Surety waives notice of any changes to the Construction Contract including, without limitation, changes in the contract time, the contract price, or the work to be performed.

7. This Performance Bond is provided by the Surety for the sole and exclusive benefit of the Owner, and, if applicable, any dual obligee designated by rider attached hereto, together with their heirs, administrators, executors, successors or assigns. No other party, person or entity shall have any rights against the Surety hereunder.

8. No action shall be commenced hereunder after the passage of the longer of two (2) years following the date on which the final payment of the contract falls due or, if this bond is provided in compliance with applicable law, any limitation period provided therein. If the limitation period contained in the Paragraph is unenforceable, it shall be deemed amended to provide the minimum period for an action against the Surety on a performance bond.

9. Any and all notices to the Surety, the Contractor or the Owner shall be given by Certified Mail, Return Receipt Requested, to the address set forth for each party above.

10. Any statutory limitation, which may be contractually superseded, to the contrary notwithstanding, any action hereon may be instituted so long as the applicable statute of limitations governing the Construction Contract has not run or expired.

**PART VI**

**FINANCE AND ADMINISTRATION CABINET  
DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES  
DIVIION OF ENGINEERING AND CONTRACT ADMINISTRATION**

**AGREEMENT BETWEEN OWNER AND CONTRACTOR**

This **AGREEMENT**, between the Owner, the **COMMONWEALTH OF KENTUCKY**, and the Contractor \_\_\_\_\_

The Architect is: \_\_\_\_\_

This Agreement, properly by the parties, shall be final and binding only upon the issuance of the Finance and Administration Cabinet Construction Contract.

The Owner and Contractor agree as set forth below.

**Article No. 1 THE CONTRACT DOCUMENTS:**

The Contract Documents consist of the Agreement, the Official Bid Documentl, the Invitation to Bids, the Instructions to Bidders, the General Conditions, Supplement Conditions, Drawings, Specifications, and Addenda issued prior to the execution of this Agreement, and modifications made after the execution of this Agreement. The Contract Documents represent the entire and integrated agreement between the parties. All of these documents are as fully a part of this Agreement as if attached to this Agreement or repeated herein.

**Article No. 2 SCOPE OF WORK:**

The Contractor shall execute the entire work described in the Contract Documents entitled: **INVITATION TO BID NO.** \_\_\_\_\_  
**SOLICITATION NO.** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

A listing of the Specifications, Drawings and Addenda are contained in Article 11 of this Agreement



**Article No. 3 TIME OF COMPLETION:**

The date of commencement for the work shall be the date upon which the Owner issues the Contract Documents. The Contractor shall achieve substantial completion of the entire work (as defined by Article 19.4 of the General Conditions) not later than \_\_\_\_\_ calendar days/date after the date of commencement for the work, subject to adjustments of contract time as provided in the Contract Documents. Final completion of the work shall be achieved \_\_\_\_\_ calendar days/date after the scheduled date of substantial completion.

**Article No. 4 LIQUIDATED DAMAGES:**

It is understood by the parties that time is of the essence of this contract, and that the Owner will sustain substantial financial damages and other injuries in the event of a failure of the Contractor to complete the work in a timely manner. In light of these foreseeable losses, and the difficulty of proof of loss, the Contractor shall be assessed liquidated damages in the amount of \_\_\_\_\_ for each calendar day between the date set for substantial completion of this work and the actual date upon which substantial completion is achieved in accordance with Article 19.4 of the General Conditions. The Contractor shall be assessed liquidated damages in the amount of \_\_\_\_\_ for each calendar day between the date set for final completion of this work and the actual date upon which final completion is achieved in accordance with Article 19.5 of the General Conditions. In the event that the Contractor abandons the work prior to the substantial completion or is terminated for default under Article 22.2 of the General Conditions, the Owner may upon completion of the work recover either (1) liquidated damages for the entire period of delay to substantial completion or final completion under this Article, or (2) actual delay-related damages. This recovery will be in addition to any other rights and remedies the Owner may have against the Contractor.

**Article No. 5 CONTRACT SUM:**

The Owner shall pay the Contractor for the Contractor's performance of the contract the sum of \_\_\_\_\_, ( \_\_\_\_\_ ), subject to additions and deductions as provided in the Contract Documents. The Contract Sum is based upon the alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner.

**Article No. 6 PROGRESS PAYMENTS:**

Based upon applications for payment submitted to the Architect by the Contractor, the Owner shall make progress payments on the account of the Contract Sum to the Contractor in accordance with Article 18 of the General Conditions.

**Article No. 7 ACCEPTANCE AND FINAL PAYMENT:**

Final payment shall be due in accordance with Article 18.7 of the General Conditions provided, that all work has been fully completed in accordance with the plans and specifications as evidenced by a certificate by the Architect for the project, and it has been accepted by the Owner. Further, final payment is contingent upon receipt of "As-Built" drawings from the Contractor. The Contractor shall submit with his final payment application evidence satisfactory to the Architect that all payrolls, material bills and other indebtedness connected with the work have been paid or that provisions for the satisfaction thereof have been made.

**Article No. 8 CHANGES IN THE WORK:**

The Owner, without invalidating the contract, may delete, add to or modify the work in accordance with Article 14 of the General Conditions.

**Article No. 9 SPECIAL NOTICE REGARDING PAYROLL TAXES, ETC:**

The Contractor hereby certifies that he has fully informed himself of the conditions relating to construction and labor under which the work under this contract is to be performed, and accepts liability for payment of all payroll taxes on deductions required by local, state, and federal law, including but not limited to old age pension, social security, or annuities, and agrees that he shall employ, so far as is predictable, methods and means in carrying out his work as will not interfere with or interrupt the work of any other contractor working on or adjacent to the site for this work.

**Article 10 TERMINATION OR SUSPENSION:**

The contract may be terminated by the Owner upon the default of the Contractor and terminated for convenience of the Owner as provided for in Article 22 of the General Conditions.

**Article No. 11 ENUMERATION OF SPECIFICATIONS, DRAWINGS AND ADDENDA:**

The Contract Documents, except for Modifications issued after the execution of this Agreement, include the following specifications, drawings and addenda:

**SPECIFICATIONS:**

<b>DOCUMENT</b>	<b>TITLE</b>	<b>PAGES</b>

**DRAWINGS:**

<b>SHEET NUMBERS</b>

**ADDENDA:**

<b>NUMBERS</b>

PROJECT MANAGER: \_\_\_\_\_  
AGENCY CONTACT: \_\_\_\_\_  
ARCHITECT: \_\_\_\_\_  
CONSULTANT: \_\_\_\_\_

Date for Substantial Completion: \_\_\_\_\_  
Date for Final Completion: \_\_\_\_\_

KYTC Maintenance Facility  
 Liberty, Kentucky  
 Project # 609-C9NW-Z001-A10

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KYTC Maintenance Facility  
Liberty, Kentucky  
Project # 609-C9NW-Z001-A10

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**Articles****'1 Special Conditions:**

These Special Conditions are provided as a supplement to the General Conditions in the Specifications. Special Conditions will also supersede General Conditions where changes are necessary to coordinate with specific project requirements.

**'2 The Project:**

These specifications and drawings accompanying them describe the work to be performed and materials to be furnished for the:

**KYTC Maintenance Facility  
1090 S. Wallace Wilkinson Blvd.  
Liberty, KY  
Account No: 609-C9NW-Z001-A10**

**Project Description:**

The project is to be a new maintenance garage for the Kentucky Transportation Cabinet, District 8. The building will be an 8,000 square feet pre-engineered metal building with metal wall and roof panels and a thermal insulation/liner system. The structural system consists of a pre-engineered steel frame skeleton with conventional poured in place concrete shallow foundations, piers, grade beams and concrete floor slabs. The building layout consists of a 6,000 sf vehicle area with two vehicle bays, and a 2,000 sf support area containing offices, toilets, shower, break room and storage. Interior partitions will be light gauge steel framing with gypsum board surface and sound batt insulation. Occupied support spaces will have exposed concrete flooring and acoustic panel ceilings. Pedestrian doors will be hollow metal, windows will be aluminum framed with insulating glass. Vehicle doors will be by Owner. Site work consists of excavation and engineered fill for the building pad, minimal



## Special Conditions - 010000

sidewalks, and parking and asphalt paving. Site furnishings include signage and flagpole. Water service shall be from municipal system, sanitary will gravity flow to municipal system. The building will utilize natural gas for heat. HVAC for occupied support spaces will be a packaged horizontal HVAC unit. Vehicle bays will be heated with gas unit heaters and ventilated with exhaust fans. Electrical work includes a 120/240V power distribution system and LED lighting. Communications systems will include telephone and data wiring and devices.

### **‘3 Project Contacts:**

(Refer to Drawings for Company Addresses / Phone Numbers)

In the roles defined by the General Conditions as “Architect” and as used throughout the Contract Documents as the Architect of the work being constructed, the following firm and its sub-consultants are working under separate contract with the Owner to provide the services under this role:

**Architect:**                      Company Name: Clotfelter-Samokar, PSC  
    Principal-In-Charge: Scott Jackson  
    Project Manager: Scott Jackson

**Engineer/s:**                      Company Name: Brown + Kubican Structural Engineers  
    Principal-In-Charge: Dan Kubican  
    Project Manager: Jay Wang

**Engineer/s:**                      Company Name: Staggs & Fisher  
    Principal-In-Charge: Wayne Thomas  
    Project Manager: Chris Keath

In the roles defined by the General Conditions as “Owner” and as used throughout the Contract Documents as the Owner of the work being constructed, is the Commonwealth of Kentucky, acting through the Finance and Administration Cabinet, Department for Facilities Management and Support Services, Division of Engineering and Contract Administration. The Owner is solely represented by the following:

**Owner:**                              **Finance and Administration Cabinet**  
    **Facilities and Support Services**  
    **Division of Engineering and Contract Administration**  
    Project Manager: Bill Novak  
    Associate Director: Frieda Myers  
    Director: Jennifer Linton

In the role defined by General Conditions, “Agency or Using Agency”, is a state government entity which utilizes the work being constructed. This agency is a client of the Owner and advises the Owner on matters related to the project. This Using Agency does not possess the legal authority of Owner:

**Using Agency:**                      **Kentucky Transportation Cabinet**  
    Project Manager: Terry Denny  
    Director: Jim Gray

## Special Conditions - 010000

In the roles defined by the General Conditions as “Commissioning Authority” and as used throughout the Contract Documents as the Commissioning Agent of the work being constructed, the following firm is working under separate contract with the Owner to provide the services under this role:

**Commissioning Authority:** Company Name: N/A  
Principal-In-Charge: \_\_\_\_\_  
Project Manager: \_\_\_\_\_

In the roles defined by the General Conditions as “Special Inspector” and as used throughout the Contract Documents as the firm performing Special Inspections as required by the Kentucky Building Code for the work being constructed,, the following firm is working under separate contract with the Owner to provide the services under this role:

**Special Inspector:** Company Name: To be determined  
Principal-In-Charge: \_\_\_\_\_  
Project Manager: \_\_\_\_\_

### **‘4 Times of Completion:**

Subject to the conditions of Article ‘16 – “Delays and Extension of Time” of the General Conditions, the work to be performed under this Contract shall be completed as follows:

**Substantial Completion:** 270 Calendar Days from date of Executed Contract for Construction. Article ‘19.4 of the General Conditions sets forth specific requirements of the Commonwealth of Kentucky that are necessary to be fulfilled by the Contractor in order to be determined to have accomplished Substantial Completion by this date. Refer to Article ‘11 of these Special Conditions for additional requirements of this specific project required to accomplish Substantial Completion.

**Final Completion:** 30 Calendar Days beyond Substantial Completion. Article ‘19.5 of the General Conditions sets forth specific requirements of the Commonwealth of Kentucky that are necessary to be fulfilled by the Contractor in order to be determined to have accomplished Final Completion by this date. Refer to Article ‘11 of these Special Conditions for additional requirements of this specific project required to accomplish Final Completion.

As indicated in Article ‘4 of the General Conditions, “Construction Schedule”, the following limitations of work times are set forth herein that are to be accounted for by the Contractor in scheduling and sequencing of the work:

**Work Restrictions and “Black-Out” Dates:** N/A.

**Project Phasing (Separate start and completion dates):** N/A.

**Limitations on daily work times:** After hours and weekend work allowed with prior two day notice.

**Work being Performed by the Owner or by Others:**

The Owner will furnish and install the following components:

Oil – water separator; Contractor to excavate and backfill, and to make plumbing connections.

## Special Conditions - 010000

Overhead sectional doors; Contractor to provide power and switching connections.

Radio communications antenna tower; Contractor to provide concrete foundation, coordinate with Owner to allow installation of antenna tower base anchors in concrete formwork.

Ice Machine.

Access control device and wiring. Contractor to provide conduits and boxes rough-in.

Site enclosure fence modifications.

The Owner will furnish and Contractor will install the following components:

Air Compressor.

### Work Under Separate Contracts:

**Building Demolition:** Demolition and removal of existing buildings/structures will be by others, as noted on the Drawings. This work is scheduled to be completed prior to Contractor mobilization on site.

**Contaminated Soils Remediation:** Contaminated soils have been documented beneath the existing building slab, related to an in-ground hydraulic lift (removed in the 1990's). Removal of contaminated soils and disposal will be by others, as noted on the Drawings.

**Products ordered by the Owner in Advance/ Anticipated Delivery Dates:** Delivery dates for Owner furnished items will be coordinated at the pre-construction meeting.

**Construction Contract Time required for Commissioning:** N/A.

**Construction Contract Time required for Testing and Balancing:** Testing and Balancing of HVAC systems is expected to require 3 days. Contractor is to account for this required time in their Construction Schedule and is responsible for scheduling the work so that all work and Testing and Balancing can be accomplished by the established Date of Substantial Completion.

### **'5 Liquidated Damages / Damages from Untimely Performance:**

In accordance with Article '19.7 of the General Conditions, the Contractor shall pay the Owner the following identified amount for each and every calendar day of unexcused delay in achieving Substantial Completion and Final Completion beyond the date set for below for each:

**Substantial Completion Liquidated Damages** are \$550.00/calendar day for each day beyond the established Date of Substantial Completion until the Actual Date of Substantial Completion is achieved. (See Article '19.4 of the General Conditions and Article '11 of these Special Conditions for requirements for Substantial Completion).

**Final Completion Liquidated Damages** are \$150.00/calendar day for each day beyond the established Date of Final Completion until the Actual Date of Final Completion is achieved. (See Article '19.5 of the General Conditions and Article '11 of these Special Conditions for requirements for Final Completion).

## Special Conditions - 010000

### '6 Contractor Provided Temporary Facilities and Controls:

**Construction Office/Trailer:** Contractor to provide office/trailer for construction administration use. Location to be determined at pre-construction meeting.

**Staging / Parking:** Available on site. Location to be determined at pre-construction meeting.

**Temporary Fencing and Signage:** Temporary fencing is not required but may be provided at Contractor's option and expense. A Project Sign is not required. Provide construction/wayfinding and safety signage as necessary for construction operations and as required by authorities having jurisdiction.

**Portable Toilet Facilities:** are required.

#### Utilities:

- Water: Provide New Temporary Service. Contractor to include any tap fee for sewer or water in bid.
- Electric: Provide New Temporary Service. Contractor to set up temporary meter and panel.
- Gas: Provide New Service. Use of gas service for temporary utilities is Contractor's option, at Contractor's expense. Permanent equipment is not to be used for temporary heat.

### '7 Special Inspections and Testing:

Article '12 of the General Conditions and the technical specifications of the Contract Documents define and establish the requirements and provisions for Inspection of the Work, Special Inspections performed by others working under separate contract with the Owner, and testing to be provided by the Contractor.

**Structural Special Inspections and Testing:** Owner provided. See Construction Documents for description of the structural items requiring special inspections.

**Site Special Inspections and Testing:** Owner provided. See Construction Documents for description of the site items requiring special inspections.

**Contractor Provided Testing:** All other testing required by the Contract Documents are Contractor-Provided Testing.

### '8 Allowances included in the Contract Amount:

The Contractor is required by Article '30 of the General Conditions to include in the Contract Amount the following Allowances:

N/A

### '9 Unit Prices established by the Form of Proposal:

The Contractor is required at time of submitting a bid proposal for this work to provide specific Unit Prices that will be used to add or deduct those specific work items or services by an established unit of measure and the stated price per unit.

## Special Conditions - 010000

Unit prices include all necessary materials, costs of delivery, installation labor, tools and equipment necessary to provide the unit measured item. If a unit price is used in a change to the work by Change Order, the contractor's overhead, profit, insurance and bonds, and administrative costs are included in the prescribed markup permitted by Article '14 of the General Conditions "Changes in the Work" and are not to be included in the unit price.

For a schedule of Unit Prices see the "Unit Prices" section of the Bid Form of Proposal.

### '10 Schedule of Additive Alternates:

The Bid Form of Proposal includes Additive Alternates that, if accepted by the Owner during review of bids, become a part of the Contract Amount. Additive Alternates are listed in the order which they will be considered and may be accepted by the Owner to be included in the base Contract of the Work. The following is the sequential listing and description of Additive Alternates:

**Alternate No. 1, Additional Paving:** Provide all labor and materials as required for additional earthwork, storm drainage and paving as identified in the Drawings and Specifications.

### '11 Additional Project Completion or Project Close-Out Required:

Article '19.4 of the General Conditions "Substantial Completion" defines the specific MANDATORY requirements to be accomplished or provided to achieve Substantial Completion of the Project. In addition to those requirements, the following requirements are also MANDATORY requirements to be accomplished or provided to achieve Substantial Completion of this Project:

N/A

Article '19.5 of the General Conditions "Final Completion" defines the specific MANDATORY requirements to be accomplished or provided to achieve Final Completion of the Project. In addition to those requirements, the following requirements are also MANDATORY requirements to be accomplished or provided to achieve Final Completion of this Project:

**As-Built Survey:** Contractor to provide a Stamped/Signed As-Built Survey by a Registered Land Surveyor, including all limits of construction. As-Built Survey is to include contours, utilities, building(s), and other normal requirements for construction land survey defined in the General Conditions.

### '12 Special Project Site Security or Access Requirements:

N/A

### '13 Special Delegated Design Requirements:

Items listed require Delegated Design. Refer to the Construction Documents for the design requirements.

N/A

### '14 Other Special Conditions of Contract:

**Weather Data:** Article 16.1.2.1 of the General Conditions references NOAA historical weather data. Historical data for this project site shall be determined from the Danville Station. A copy of the historical climate data for

**Special Conditions - 010000**

this Station is included following this section. The Mean Number of Days of Daily Precipitation  $\geq 0.10$  will determine the baseline for monthly adverse weather conditions. Rain events less than 0.10 will not be considered adverse weather.

**END OF SPECIAL CONDITIONS**

# Climatology of the United States

## No. 20

### 1971-2000

**Station: DANVILLE, KY**

**COOP ID: 152040**

**Climate Division: KY 3**

**NWS Call Sign:**

**Elevation: 900 Feet**

**Lat: 37°40N**

**Lon: 84°46W**

### Temperature (°F)

Mean (1)				Extremes										Degree Days (1) Base Temp 65		Mean Number of Days (3)					
Month	Daily Max	Daily Min	Mean	Highest Daily(2)	Year	Day	Highest Month(1) Mean	Year	Lowest Daily(2)	Year	Day	Lowest Month(1) Mean	Year	Heating	Cooling	Max >= 100	Max >= 90	Max >= 50	Max <= 32	Min <= 32	Min <= 0
Jan	40.5	23.3	31.9	79	1943	24	42.5	1990	-20	1994	20	16.5	1977	1026	0	.0	.0	7.8	7.9	24.6	1.5
Feb	45.2	26.2	35.7	79	1999	11	43.3	2000	-9+	1996	4	21.6	1978	820	0	.0	.0	10.8	5.3	20.2	.4
Mar	55.3	34.3	44.8	85	1998	30	50.9	1973	-1+	1980	3	38.9+	1978	627	0	.0	.0	21.4	.7	14.6	@
Apr	65.3	43.2	54.3	90+	1989	26	59.7	1985	17	1944	5	49.8	1983	330	7	.0	@	28.0	.0	3.8	.0
May	73.7	52.9	63.3	95	1941	22	70.1	1987	27	1963	1	58.4	1976	149	97	.0	.2	30.9	.0	.1	.0
Jun	81.7	61.6	71.7	107	1936	29	75.6	1984	41+	1984	1	66.3	1972	17	216	@	3.1	30.0	.0	.0	.0
Jul	85.8	65.9	75.9	103+	1999	31	80.8	1999	47+	1944	22	71.9+	1979	0	336	.2	8.5	31.0	.0	.0	.0
Aug	85.0	64.2	74.6	105	1936	21	80.6	1983	42+	1986	29	70.3	1992	6	303	.2	7.1	31.0	.0	.0	.0
Sep	79.0	57.3	68.2	104+	1954	6	75.4	1998	32	1942	29	62.5	1974	52	147	@	3.0	30.0	.0	.0	.0
Oct	67.9	45.3	56.6	95	1953	1	63.2	1971	21+	1976	29	49.7	1976	292	32	.0	@	30.1	.0	2.0	.0
Nov	55.6	36.4	46.0	83+	1987	2	52.6	1985	-3+	1950	26	37.6	1976	570	0	.0	.0	20.3	.2	11.3	.0
Dec	45.2	27.6	36.4	75+	2001	6	45.1	1984	-18+	1989	23	24.3	1989	887	0	.0	.0	11.6	4.5	21.0	.5
Ann	65.0	44.9	55.0	107	1936	29	80.8	1999	-20	1994	20	16.5	1977	4776	1138	.4	21.9	282.9	18.6	97.6	2.4

+ Also occurred on an earlier date(s)

@ Denotes mean number of days greater than 0 but less than .05

Complete documentation available from: [www.ncdc.noaa.gov/oa/climate/normal/usnormals.html](http://www.ncdc.noaa.gov/oa/climate/normal/usnormals.html)

Issue Date: February 2004

(1) From the 1971-2000 Monthly Normals

(2) Derived from station's available digital record: 1933-2001

(3) Derived from 1971-2000 serially complete daily data

# Climatography of the United States

## No. 20 1971-2000

National Climatic Data Center  
Federal Building 115 of 1000  
151 Patton Avenue  
Asheville, North Carolina 28801  
www.ncdc.noaa.gov

Station: DANVILLE, KY

COOP ID: 152040

Climate Division: KY 3

NWS Call Sign:

Elevation: 900 Feet Lat: 37°40N

Lon: 84°46W

### Precipitation (inches)

		Precipitation Totals								Mean Number of Days (3)				Precipitation Probabilities (1)											
														Probability that the monthly/annual precipitation will be equal to or less than the indicated amount											
Means/Medians(1)		Extremes							Daily Precipitation				Monthly/Annual Precipitation vs Probability Levels												
													These values were determined from the incomplete gamma distribution												
Month	Mean	Median	Highest Daily(2)	Year	Day	Highest Monthly(1)	Year	Lowest Monthly(1)	Year	>= 0.01	>= 0.10	>= 0.50	>= 1.00	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95	
Jan	3.66	3.71	3.17	1945	1	7.04	1974	.52	1981	11.4	7.1	2.6	.8	1.05	1.40	1.93	2.38	2.83	3.29	3.80	4.40	5.18	6.41	7.55	
Feb	3.86	3.77	4.00	1989	14	13.05	1989	1.16	1980	10.4	6.5	2.6	.9	1.16	1.53	2.08	2.55	3.01	3.49	4.01	4.63	5.44	6.69	7.85	
Mar	4.96	4.25	5.30	1997	2	14.25	1997	1.72	1983	12.2	8.8	3.2	1.3	1.62	2.09	2.79	3.38	3.94	4.53	5.17	5.92	6.89	8.38	9.77	
Apr	3.98	3.83	3.30	1972	22	12.65	1972	.86	1986	11.3	7.7	2.7	.9	1.08	1.46	2.03	2.53	3.02	3.54	4.11	4.79	5.68	7.06	8.35	
May	4.94	3.98	3.25	1995	14	11.70	1995	1.50	1987	11.3	8.5	3.6	1.2	1.73	2.20	2.87	3.44	3.99	4.55	5.16	5.87	6.78	8.19	9.49	
Jun	4.77	4.37	4.70	1989	16	12.07	1989	.54	1984	10.2	7.3	3.3	1.5	1.22	1.67	2.36	2.97	3.58	4.21	4.92	5.76	6.86	8.60	10.22	
Jul	4.83	4.57	6.37	1996	20	11.17	1996	1.31	1999	9.4	7.1	3.3	1.3	1.93	2.37	3.01	3.53	4.02	4.52	5.06	5.69	6.48	7.69	8.80	
Aug	3.40	3.07	3.41	1944	27	9.62	1974	.96	1983	8.7	5.9	2.4	1.0	1.12	1.44	1.92	2.32	2.71	3.11	3.54	4.06	4.71	5.73	6.68	
Sep	3.29	2.44	3.52	1986	24	9.96	1979	.53	1983	7.8	5.1	2.0	.9	.53	.81	1.29	1.74	2.21	2.72	3.31	4.02	4.98	6.53	8.02	
Oct	3.15	3.11	3.32	1977	2	6.34	1983	.40	1987	8.4	5.8	2.0	.8	.80	1.10	1.56	1.96	2.36	2.78	3.25	3.80	4.52	5.67	6.74	
Nov	3.68	3.75	2.86	1973	27	8.32	1973	.45	1976	10.1	7.0	2.4	.8	.98	1.33	1.86	2.33	2.79	3.27	3.80	4.43	5.26	6.55	7.76	
Dec	4.35	3.87	4.14	1978	9	12.10	1978	1.23	1985	11.5	7.3	3.0	1.2	1.30	1.71	2.33	2.87	3.39	3.93	4.52	5.22	6.13	7.54	8.86	
Ann	48.87	47.82	6.37	Jul 1996	20	14.25	Mar 1997	.40	Oct 1987	122.7	84.1	33.1	12.6	33.83	36.71	40.42	43.25	45.76	48.20	50.73	53.53	56.93	61.88	66.18	

+ Also occurred on an earlier date(s)

# Denotes amounts of a trace

@ Denotes mean number of days greater than 0 but less than .05

\*\* Statistics not computed because less than six years out of thirty had measurable precipitation

(1) From the 1971-2000 Monthly Normals

(2) Derived from station's available digital record: 1933-2001

(3) Derived from 1971-2000 serially complete daily data

Complete documentation available from:  
[www.ncdc.noaa.gov/oa/climate/normals/usnormals.html](http://www.ncdc.noaa.gov/oa/climate/normals/usnormals.html)



# Climatography of the United States No. 20 1971-2000

U.S. Department of Commerce  
National Oceanic & Atmospheric Administration  
National Environmental Satellite, Data,  
and Information Services

National Climatic Data Center  
Federal Building  
151 Patton Avenue  
Asheville, North Carolina 28801  
www.ncdc.noaa.gov

**Station: DANVILLE, KY**

**COOP ID: 152040**

**Climate Division: KY 3**

**NWS Call Sign:**

**Elevation: 900 Feet**

**Lat: 37° 40N**

**Lon: 84° 46W**

Snow (inches)														
Snow Totals														
Means/Medians (1)				Extremes (2)										
Month	Snow Fall Mean	Snow Fall Median	Snow Depth Mean	Snow Depth Median	Highest Daily Snow Fall	Day	Highest Monthly Snow Fall	Year	Day	Highest Daily Snow Depth	Year	Day	Highest Monthly Snow Depth	Year
Jan	4.0	2.8	1	#	9.0	7	15.7	1978	21	11	1978	21	5	1978
Feb	5.5	3.7	1	#	7.5	7	19.4	1986	15	9	1986	15	4	1978
Mar	1.8	.7	#	#	4.0	4	8.1	1971	3	7	1978	3	1	1978
Apr	.1	.0	#	0	.5	15	.9	1980	8	1	1982	8	#+	1985
May	#	.0	0	0	#	7	#	1989	0	0	0	0	0	0
Jun	.0	.0	0	0	.0	0	.0	0	0	0	0	0	0	0
Jul	.0	.0	0	0	.0	0	.0	0	0	0	0	0	0	0
Aug	.0	.0	0	0	.0	0	.0	0	0	0	0	0	0	0
Sep	.0	.0	0	0	.0	0	.0	0	0	0	0	0	0	0
Oct	.0	.0	0	0	.0	0	.0	0	0	0	0	0	0	0
Nov	.3	.0	#	0	2.1	28	2.7	1977	30	2	1976	30	#+	1997
Dec	1.6	.8	#	#	4.0	3	6.5	2000	7	3	1984	7	#+	2000
Ann	13.3	8.0	N/A	N/A	9.0	7	19.4	Jan 1996	21	11	Jan 1978	21	5	Jan 1978
				Snow Number of Days (1)										
				Snow Fall >= Thresholds					Snow Depth >= Thresholds					
				0.1	1.0	3.0	5.0	10.0	1	3	5	10		
Jan	4.0	2.8	1	#	2.9	1.5	.4	.1	.0	5.6	3.1	1.3	.3	
Feb	5.5	3.7	1	#	2.8	1.5	.6	.1	.0	5.7	3.4	1.1	.0	
Mar	1.8	.7	#	#	1.1	.5	.2	.0	.0	1.0	.4	.1	.0	
Apr	.1	.0	#	0	.1	.0	.0	.0	@	.0	.0	.0	.0	
May	#	.0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
Jun	.0	.0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
Jul	.0	.0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
Aug	.0	.0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
Sep	.0	.0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
Oct	.0	.0	0	0	.0	.0	.0	.0	.0	.0	.0	.0	.0	
Nov	.3	.0	#	0	.4	.1	.0	.0	.2	.0	.0	.0	.0	
Dec	1.6	.8	#	#	1.4	.5	.1	.0	1.3	.1	.0	.0	.0	
Ann	13.3	8.0	N/A	N/A	8.7	4.1	1.3	.2	13.8	7.0	2.5	1.1	.0	116 of 1000

+ Also occurred on an earlier date(s) #Denotes trace amounts

(1) Derived from Snow Climatology and 1971-2000 daily data

(2) Derived from 1971-2000 daily data

-9/-9.9 represents missing values

Complete documentation available from:

Annual statistics for Mean/Median snow depths are not appropriate

www.ncdc.noaa.gov/oa/climate/normal/usnormals.html

**Station: DANVILLE, KY**

**1971-2000**

**COOP ID: 152040**

**Climate Division: KY 3**

**Elevation: 900 Feet**

**Lat: 37° 40N**

**Lon: 84° 46W**

Freeze Data										
Spring Freeze Dates (Month/Day)										
Temp (F)	Probability of later date in spring (thru Jul 31) than indicated(*)									
	.10	.20	.30	.40	.50	.60	.70	.80	.90	
36	5/10	5/05	5/01	4/28	4/25	4/22	4/19	4/15	4/10	
32	4/26	4/21	4/18	4/15	4/12	4/10	4/07	4/04	3/30	
28	4/16	4/11	4/07	4/04	4/01	3/29	3/26	3/22	3/17	
24	4/05	3/30	3/25	3/21	3/17	3/14	3/10	3/05	2/26	
20	3/28	3/20	3/15	3/11	3/06	3/02	2/25	2/20	2/13	
16	3/12	3/05	2/28	2/24	2/21	2/17	2/13	2/08	2/02	
Fall Freeze Dates (Month/Day)										
Temp (F)	Probability of earlier date in fall (beginning Aug 1) than indicated(*)									
	.10	.20	.30	.40	.50	.60	.70	.80	.90	
36	10/03	10/08	10/11	10/14	10/17	10/19	10/22	10/25	10/30	
32	10/13	10/18	10/21	10/24	10/27	10/30	11/02	11/05	11/10	
28	10/23	10/28	11/01	11/04	11/06	11/09	11/12	11/16	11/21	
24	11/01	11/07	11/12	11/15	11/19	11/22	11/26	11/30	12/06	
20	11/09	11/15	11/20	11/23	11/27	11/30	12/04	12/09	12/15	
16	11/15	11/25	12/02	12/08	12/13	12/19	12/25	1/01	1/10	
Freeze Free Period										
Temp (F)	Probability of longer than indicated freeze free period (Days)									
	.10	.20	.30	.40	.50	.60	.70	.80	.90	
36	196	188	183	178	174	170	165	160	152	
32	215	209	204	200	197	193	189	185	179	
28	239	232	227	223	218	214	210	205	197	
24	268	260	255	250	245	241	236	231	223	
20	290	281	275	270	265	260	255	249	240	
16	320	309	303	297	292	287	281	275	266	

\* Probability of observing a temperature as cold, or colder, later in the spring or earlier in the fall than the indicated date.  
 0/00 Indicates that the probability of occurrence of threshold temperature is less than the indicated probability.  
 Derived from 1971-2000 serially complete daily data

# Climatology of the United States

National Climatic Data Center  
Federal Building  
151 Patton Avenue  
Asheville, North Carolina 28801  
www.ncdc.noaa.gov

U.S. Department of Commerce  
National Oceanic & Atmospheric Administration  
National Environmental Satellite, Data,  
and Information Service

**No. 20**  
**1971-2000**

**COOP ID: 152040**

**Station: DANVILLE, KY**

**Climate Division: KY 3**      **NWS Call Sign:**

**Elevation: 900 Feet**      **Lat: 37° 40N**

**Lon: 84° 46W**

## Degree Days to Selected Base Temperatures (°F)

Base	Heating Degree Days (1)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Ann
<b>Below</b>												
<b>65</b>	1026	820	627	330	149	17	0	6	52	292	570	4776
<b>60</b>	871	680	480	202	76	3	0	0	16	182	425	3667
<b>57</b>	787	602	393	139	45	1	0	0	7	129	343	3095
<b>55</b>	728	550	339	103	30	0	0	0	4	100	291	2735
<b>50</b>	585	422	221	40	10	0	0	0	0	45	179	1953
<b>32</b>	195	101	17	0	0	0	0	0	0	0	7	429

## Cooling Degree Days (1)

Base	Cooling Degree Days (1)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Ann
<b>Above</b>												
<b>32</b>	192	205	412	668	971	1189	1359	1320	1085	763	427	8836
<b>55</b>	12	9	22	81	288	500	646	607	398	150	21	2747
<b>57</b>	9	6	14	56	241	440	584	545	342	117	13	2377
<b>60</b>	0	0	7	29	179	353	491	452	261	77	5	1854
<b>65</b>	0	0	0	7	97	216	336	303	147	32	0	1138
<b>70</b>	0	0	0	1	42	107	195	171	66	10	0	592

## Growing Degree Units (2)

Base	Growing Degree Units (Monthly)												Growing Degree Units (Accumulated Monthly)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>40</b>	57	97	231	456	745	969	1129	1090	860	532	247	96	57	154	385	841	1586	2555	3684	4774	5634	6166	6413	6509
<b>45</b>	27	53	138	321	590	819	974	935	710	385	153	49	27	80	218	539	1129	1948	2922	3857	4567	4952	5105	5154
<b>50</b>	10	21	74	204	436	669	819	780	560	255	83	19	10	31	105	309	745	1414	2233	3013	3573	3828	3911	3930
<b>55</b>	1	6	37	118	294	519	664	625	413	148	39	5	1	7	44	162	456	975	1639	2264	2677	2825	2864	2869
<b>60</b>	0	0	10	55	175	370	509	470	278	68	10	0	0	0	10	65	240	610	1119	1589	1867	1935	1945	1945
<b>Base</b>																								
<b>50/86</b>	33	62	148	279	463	661	783	751	561	323	136	54	33	95	243	522	985	1646	2429	3180	3741	4064	4200	4254

(1) Derived from the 1971-2000 Monthly Normals

(2) Derived from 1971-2000 serially complete daily data

**Note:** For corn, temperatures below 50 are set to 50, and temperatures above 86 are set to 86

Complete documentation available from:

[www.ncdc.noaa.gov/oa/climate/normal/usnormals.html](http://www.ncdc.noaa.gov/oa/climate/normal/usnormals.html)

## **SECTION 01 23 00 - ALTERNATES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for alternates.

#### **1.2 DEFINITIONS**

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

#### **1.3 PROCEDURES**

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

### **PART 2 - PRODUCTS (Not Used)**

### **PART 3 - EXECUTION**

KYTC Maintenance Facility  
Liberty, Kentucky  
Project # 609-C9NW-Z001-A10

**3.1 SCHEDULE OF ALTERNATES**

A. Alternate No. 1: Additional Paving.

1. Provide all labor and materials as required for additional earth work, storm drainage and paving as identified in the Drawings and Specifications.

**END OF SECTION 01 23 00**

## **SECTION 01 40 00 - QUALITY REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

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

#### **1.2 DEFINITIONS**

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

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- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### **1.3 CONFLICTING REQUIREMENTS**

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### **1.4 INFORMATIONAL SUBMITTALS**

- A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - 4. Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.

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7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

## 1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.



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4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

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2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
  - I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
  - J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
    1. Contractor responsibilities include the following:
      - a. Provide test specimens representative of proposed products and construction.
      - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
    2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

## 1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

- B. **Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility.** Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.
- D. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

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4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  6. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## **1.8 SPECIAL TESTS AND INSPECTIONS**

- A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner. Refer to the General Conditions and Structural Drawings for requirements of the various parties involved.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 TEST AND INSPECTION LOG**

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.

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- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### **3.2 REPAIR AND PROTECTION**

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the requirements for cutting and patching in the General Conditions.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION 01 40 00**

## **SECTION 01 41 10– STRUCTURAL SPECIAL INSPECTION**

### **PART 1 – GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. General Conditions of the Construction Contract Inspection of Work / Defective or Incomplete Work / Special Inspections shall apply in its entirety to this project. Where any conflict exists between this Specification Section and the General Conditions, the General Conditions provisions shall supersede in all aspects.

#### **1.2 SUMMARY**

- A. Special Inspections as defined in Section 1704 of The Kentucky Building Code are required.
- B. Seismic Design Category and basic wind speed for the structure are shown in the General Notes section of the structural drawings.
- C. Special inspections per Kentucky Building Code Sections 1704 and 1705 are required for the following materials and work:
  - 1. Inspection of Fabricators per Section 1704.2.5 of the Kentucky Building Code.
  - 2. Steel Construction per Section 1705.2 of the Kentucky Building Code.
  - 3. Concrete Construction per Section 1705.3 of the Kentucky Building Code.
  - 4. Prepared Fill per Section 1705.6 of the Kentucky Building Code.

#### **1.3 SCOPE**

- A. The scope of the construction work to be inspected / tested / observed is that structural and foundation work shown on the structural construction drawings (S-sheets) as well as the following:
  - 1. Geotechnical fill immediately below and within the footprint of the building shown on the structural drawings.
- B. All inspections and tests performed shall be documented by report including, but not limited to, inspections for concrete placement, reinforcing inspection, curing, fabricators, etc.

#### 1.4 DEFINITIONS

- A. In accordance with the intent of the Building Code, inspection work specified to be “continuous” shall be inspected the full, uninterrupted time that the Contractor is performing said construction work. Work specified to be “periodic” may be inspected as convenient to the Inspector, except that all work must be inspected prior to being covered by other work, during the working hours of the Contractor, and in a fashion that does not delay the Contractor. Regardless as to whether inspections are performed in “continuous” or “periodic” fashion, 100% of the construction work shall be inspected, unless noted otherwise.

#### 1.5 SELECTION AND PAYMENT

- A. The Inspection Agency shall be retained by the Owner. Costs for reinspection and retesting, should discrepancies be found, will be paid for by the Owner, except where rework is due to negligence or omission deemed excessive by the Owner.
1. In case of excessive rework, such retesting and reinspection shall be paid for by the Owner as an additional service of the Inspection Agency, but will be backcharged by deductive change order to the Contractor’s contract.
  2. In case of excessive waste/lost time of the Special Inspector due to inadequate scheduling by the General Contractor, such time shall be paid for by the Owner as an additional service of the Inspection Agency but will be backcharged by deductive change order to the Contractor’s contract.
- B. Special Inspections are additional to testing and inspection requirements shown elsewhere in the specifications and on the drawings, which is to be paid for by the General Contractor. The General Contractor shall also pay for additional structural testing and inspection required for his convenience. Inspection work not part of the Structural Special Inspections may be performed by an Inspection Agency of the Contractor’s choosing, unless noted otherwise.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.
- B. Fabricator certificate of current good standing with Qualified Certification Program.
- C. Fabricators exempt from special inspection shall submit a *Certificate of Compliance* to the structural engineer of record at the completion of fabrication stating that all work was completed in accordance with the approved construction documents.

#### 1.7 QUALITY ASSURANCE

- A. Qualified Certification Authorities: Subject to compliance with Kentucky Building Code Requirements, Qualified Certification Authorities providing certification which may be applicable to Project include:
1. American Concrete Institute (ACI).

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2. American Institute of Steel Construction (AISC).
3. American Society of Nondestructive Testing (ASNT).
4. American Welding Society (AWS).
5. International Accreditation Service (IAS).
6. International Code Council (ICC).
7. National Institute of Certified Engineering Technology (NICET).

## **PART 2 – EXECUTION**

### **2.1 PROGRESS MEETINGS**

- A. The Special Inspector's designated Project Manager is to attend any pre-construction meetings which may be conducted at the construction site by the Structural Engineer to discuss quality issues.
- B. The Special Inspector's designated Project Manager is to attend construction progress meetings which will be held at the construction site by the Architect, Engineer, and General Contractor.

### **2.2 CONTRACTOR'S RESPONSIBILITIES**

- A. Provide a complete copy all structural shop drawings to the Structural Testing/Inspection Agency.
- B. Arrange the preconstruction meeting to discuss quality issues.
- C. Notify the Structural Testing/Inspection Agency sufficiently in advance of operations to allow assignment of personnel and scheduling of tests.
- D. Cooperate with Structural Testing/Inspection Agency and provide access, including equipment with operator, to work. Access equipment includes, but is not limited to, man lifts, excavation equipment, etc.
- E. Provide samples of materials to be tested in required quantities.
- F. Provide storage space for Structural Testing/Inspection Agency's exclusive use, such as for storing and curing concrete testing samples. If required by Special Inspector, General Contractor shall provide cure box with electricity, water, and blankets for curing concrete specimens.
- G. Provide labor to assist the Structural Testing/Inspection Agency in performing tests/inspections. Labor includes, but is not limited to, construction of masonry prisms, etc.
- H. Construction and work for which Special Inspection is required shall remain accessible and exposed for special inspection purposes until the completion of the inspections and tests.
- I. All parties who are to receive inspection and testing reports shall maintain an active email account to receive reports by.



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- J. General Contractor shall create and maintain a discrepancy log on site. Log shall list each discrepancy documented by the Special Inspector; state the date of discovery and Special Inspector's report number; and provide room for the Special Inspector to sign and date when said discrepancy is corrected. No work containing discrepancy shall be covered prior to having reinspection and approval by the Special Inspector.
- K. Neither the observation of the Architect/Structural Engineer in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by persons other than the Architect/Structural Engineer shall relieve the Contractor from his obligation to perform the work in accordance with the Contract Documents.

### 2.3 SPECIAL INSPECTOR'S RESPONSIBILITIES

- A. Cooperate with the Contractor and provide timely service.
- B. Notify Contractor of minimum advance notice for each type of inspection/test.
- C. Upon arriving at the construction site, sign in and notify the Contractor of presence.
- D. Select the representative samples that are to be tested/inspected.
- E. Perform tests/inspections as outlined in Contract Documents, the applicable codes, and as directed by the Structural Engineer.
- F. Keep records of all inspections.
- G. Furnish inspection reports to the Architect, Structural Engineer, and General Contractor weekly as construction progresses.
  - 1. Each report shall include photographs of the project status and the typical work inspected and documented in that subject report. These general photographs are in addition to the required photograph at discrepancies.
- H. Inform General Contractor and / or Fabricator of all discrepancies immediately for correction.
  - 1. Document in writing correction of discrepancies.
  - 2. Highlight discrepancies within the report.
    - a. The report shall include a text description of each discrepancy. Description shall convey the discrepancy location on the project and the issue.
    - b. The report shall include a photograph of each discrepancy observed in the field and/or in the shop. Photograph shall be labeled to convey location on project and the issue shown. (Photographs of material strength tests for concrete and/or masonry are not required, unless otherwise instructed.)
    - c. The report shall document the date that each discrepancy was initially discovered.

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- d. Inspection related discrepancies shall be reinspected by the Special Inspector along the course of the project and prior to concealment by other work. Subsequent reports shall document date that prior discrepancy was confirmed to be corrected.
- 3. If discrepancies are not corrected, the discrepancies shall be brought to the attention of the Code Official and the Structural Engineer prior to the completion of that phase of the work.
- I. Leave copies of field notes with the Contractor prior to leaving the construction site. Field notes shall include the message given to the Contractor, date, time of message, name of Contractor's representative informed, type and location of work or materials tested/inspected, whether the work or materials complies with Contract Documents and name of the Structural Testing/Inspection Agency's representative.
- J. Immediately notify General Contractor, Architect, and Structural Engineer by separate letter if work yet to be inspected is found on site that is either being covered by other work or was to receive continuous inspection.
- K. Structural Testing/Inspection Agency shall not alter requirements of Contract Documents, approve or reject any portion of the work, or perform duties of the Contractor.
- L. Submit a final report of inspections documenting completion of **all** required Special Inspections and correction of any discrepancies noted in inspections to the Structural Engineer. Final report shall be prepared by, sealed, and signed by the Special Inspector and shall include a complete list of materials and work inspected during the course of the project. One copy of said report is to be provided to the Contractor for his records.

## 2.4 INSPECTION OF FABRICATORS

- A. Inspect the fabrication of structural load-bearing members where such work is being performed on the premises of the Fabricator's shop.
  - 1. Fabricators shall be exempt from special inspection when a Qualified Certification Authority has periodically reviewed and approved Fabricator's written procedural and quality control manuals and fabrication practices. Subject to compliance with Kentucky Building Code requirements, Qualified Certification Authorities providing certification which may be applicable to Project include, but are not limited to, the following:
    - a. Pre-engineered Metal Building System Fabricators - IAS Inspection Programs for Manufacturers of Metal Building Systems, AC472.
- B. Verify that the Fabricator maintains and review for completeness Fabricator's detailed fabrication and quality control procedures which provide a basis for control of the workmanship and ability to conform to the approved construction documents and reference standards. Review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work.

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- C. Perform special inspections at Fabricator's shop as outlined in this specification for each type of construction.

## 2.5 INSPECTION OF STEEL CONSTRUCTION

- A. Provide special inspection of the fabrication of steel structural elements and assemblies in accordance with the *Inspection of Fabricators*.
- B. Verify that certification numbers on bolt, nut, and washer containers correspond to the identification numbers on mill test reports and that manufacturer's symbol and grade markings appear on all bolts and nuts. Also verify that bolts, nuts, and washers are being properly cared for at the site.
- C. Verify that identification markings on structural steel members conform to ASTM standards specified on the approved construction documents.
- D. Verify that identification markings on weld filler materials conform to ASTM standards specified on the approved construction documents. Also verify that weld filler material is being properly cared for.
- E. Verify that all anchor rods and other embedments which are to support structural steel are of proper diameter, grade, type, length, and extent of embedment prior to placement of concrete.
- F. Test and inspect high-strength bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  - 1. Verify that fasteners are of correct grade, type, diameter, length, and shear plane locations for the joint detail.
  - 2. Verify that connecting elements meet requirements for faying surface and hole preparation.
  - 3. Provide pre-installation verification testing of fastener assemblies and methods.
    - a. Utilize a tension calibrator to confirm the suitability of the complete fastener assembly for pretensioned installation and confirm the procedure and proper use by the bolting crew of the pretensioning method to be used.
    - b. Ensure that joint plies are brought to snug-tight condition prior to pretensioning operation.
    - c. Confirm fastener component is not turned by the wrench preventing rotation.
    - d. Confirm that fasteners are pretensioned progressing systematically from the most rigid part towards the free edges.
  - 4. Verify that fastener assemblies with required washers are placed in all holes and are positioned as required.
    - a. Verify that direct-tension indicator gaps comply with ASTM F 959, Table 2.

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- b. Verify that twist-off-type tension-control assemblies have been properly tightened.
    5. Perform periodic inspection of bearing type connections.
    6. Perform continuous inspection of slip-critical type connections.
  - G. Inspect and test welds during fabrication (where applicable) and erection of structural steel, and studs/anchors as follows:
    1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
      - a. Confirm that welding procedure specifications are available.
      - b. Confirm that contractor has instituted a *Welder Identification System*.
    2. Periodically inspect weld procedures and welders according to the requirements of AWS D1.1 and AISC 360.
      - a. Confirm that there is no welding over cracked tack welds.
      - b. Confirm that environmental conditions are being properly considered (wind speed, precipitation, and temperature).
      - c. Confirm that welding procedure specifications are being followed (equipment settings, travel speed, material useage, shielding type and flow rate, preheating requirements, maintenance of interpass temperature, and proper welder positioning).
      - d. Confirm welding techniques (interpass and final cleaning, each pass within profile limitations, and that each pass meets quality requirements).
    3. Use non-destructive testing according to AWS D1.1-2000, Section 6.11, on all welds that appear to have excessive inclusions, porosities, cracks, and incomplete penetrations as described by AWS D1.1-2000, or have the questionable weld removed and rewelded.
    4. Perform continuous observation on the first two welds installed by each welder and subsequent non-destructive testing according to AWS D1.1-2000, Section 6.11, on all (100%) complete penetration and/or partial penetration groove welds and on all splices of main members where those splices are required.
      - a. Confirm joint preparation.
      - b. Confirm dimensions (alignment, root opening, root face, and bevel).
      - c. Confirm cleanliness of welds and base material (condition of steel surfaces).
      - d. Confirm tacking (tack weld quality and location).
      - e. Confirm backing type and fit (as applicable) and removal subsequent to weld placement.
      - f. Perform Ultrasonic Testing in accordance with AWS D.1.1.

5. Perform continuous inspection according to AWS D1.1-2000, Section 6.9 (visual inspection) on all multi-pass fillet welds and on all single-pass fillet welds larger than 5/16".
    - a. Confirm dimensions (alignment, gaps at root, root size, length), spacing, orientation, and locations.
    - b. Confirm cleanliness of welds and base material (condition of steel surfaces).
    - c. Confirm tacking (tack weld quality and location).
    - d. Confirm visual acceptance criteria (crack prohibition, weld/base fusion, crater cross section, weld profiles, weld size, undercut, and porosity).
  6. Perform periodic inspection according to AWS D1.1-2000, Section 6.9 (visual inspection) on all single-pass fillet welds smaller than 5/16".
    - a. Confirm dimensions (alignment, gaps at root, root size, length), spacing, orientation, and locations.
    - b. Confirm cleanliness of welds and base material (condition of steel surfaces).
    - c. Confirm tacking (tack weld quality and location).
    - d. Confirm visual acceptance criteria (crack prohibition, weld/base fusion, crater cross section, weld profiles, weld size, undercut, and porosity).
  7. Observe and document repair activities.
- H. Inspect all steel frame connection details for compliance with approved construction documents and approved steel erection shop drawings.
1. Verify completeness and construction of all bracing, stiffening, and connections.
  2. Verify location, completeness, accuracy, and joint details of all members.

## 2.6 INSPECTION OF CONCRETE CONSTRUCTION

- A. Provide special inspection of the fabrication of concrete structural elements and assemblies in accordance with the *Inspection of Fabricators*.
- B. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
- C. Periodically verify the use of the proper design mix.
- D. Verify use of proper grade and ASTM designation of reinforcing steel.
- E. Perform periodic inspection on placement, spacing, clear cover, number, and splice lap lengths of reinforcing steel.
- F. Perform continuous inspection according to AWS D1.4-1998 on all welding of reinforcing steel.

- G. Monitor concrete quality by means of site and laboratory tests. The Inspection Agency is authorized to reject plastic concrete not conforming to specifications. Immediately inform the Contractor, the Architect and the Structural Engineer of inadequacies in concrete quality. Sampling and testing for quality control during concrete placement shall include the following:
1. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
    - a. 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.
    - b. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
    - c. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture..
    - d. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each set of composite sample.
    - e. Compression Test Specimen: ASTM C 31; one set of four standard 6" diameter by 12" or five standard 4" diameter by 8" cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
    - f. Compressive-Strength Tests: ASTM C 39; test one specimen at 7 days, two 6"x12" or three 4"x8" specimens tested at 28 days, and one specimen retained in reserve for later testing if required. Additional cylinder tests (such as at 14 days) for contractor convenience and scheduling shall be paid for by the Contractor. A compressive-strength test shall be the average compressive strength from a set of specified number specimens obtained from same composite sample and tested at age indicated.
    - g. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
    - h. 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 the in-place concrete.
    - i. 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.
  2. Test results shall be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain the Project identification name and

number, date of concrete placement, name of concrete testing and inspecting agency, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- H. Perform continuous inspection of concrete placement for all walls, piers, and footings to verify proper application techniques. Perform periodic inspection of concrete placement for all slab on grade to verify proper application.
- I. Perform periodic inspection of concrete curing procedures to verify maintenance of specified curing temperature, protection, and techniques.
- J. Test the F-number tolerances of concrete slabs in accordance with the provisions set forth by ASTM Committee E6.21.10. All tests shall be performed within three working days after concrete placement and prior to any form removal.
  - 1. All slab areas shall be tested for F-number tolerances. Quantity of test readings for each area shall be per ASTM E1155.
- K. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- L. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
  - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 2.7 INSPECTION OF SOILS

- A. Inspect the existing site soil conditions, fill placement, and load-bearing requirements for compliance with the recommendations of the approved geotechnical investigation report.
- B. Where the site is specified to be undercut by the geotechnical investigation report, verify all unsuitable soils, debris, rock and other materials have been removed from below building footprint.
  - 1. Verify that topsoil has been stripped and removed from building footprint.
  - 2. Verify all existing uncontrolled fills, soft and unsuitable soils have been removed from below applicable foundation elements. Test native material at base of cut to ensure that unsuitable material has been completely removed; notify Architect if unacceptable material remains after completion of specified undercut.

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3. For soil bearing foundations, verify that expansive clays and bedrock have been completely removed to allow sufficient soil cushion depth as specified.
  4. At foundations bearing on existing fill or shale soils, perform Dynamic Cone Penetrometer testing at each spread footing on foundation excavation is complete to ensure bearing capacity is within the recommended net allowable.
- C. Observe proofrolling of the building pad areas prior to commencement of fill / subbase placement, and during fill placement (if required.)
- D. Prior to placement of any engineered fill, determine that the site has been prepared in accordance with the recommendations of the approved geotechnical investigation report.
1. Test samples from proposed borrow on- and off- site sources of fill for compliance with the approved materials listing and other requirements of the geotechnical report and the specifications. Clay soils shall be checked for acceptable plasticity index prior to moving on site.
- E. During placement and compaction of the engineered fill material, verify that the material being used, maximum lift thickness, and in-place dry density comply with the recommendations of the approved geotechnical report.
1. Soil fills shall be exempt from special inspection when total fill placement is less than 12 inches deep.
  2. Testing agency to inspect and test subgrades and each fill or backfill layer.
- F. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- G. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 6938, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of building slab, but in no case fewer than 3 tests.
  2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

**END OF SECTION 01 41 10**



## **SECTION 03 03 00 – STRUCTURAL EXCAVATION AND BACKFILL**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Structural Excavation and Backfill includes:
  - 1. Preparing subgrades for slabs on grade.
  - 2. Excavating and backfilling for building foundations from subgrade.
  - 3. Over-excavation and structural backfill to achieve adequate support for foundations.
  - 4. Subsurface drainage backfill for foundation walls.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section "Structural Special Inspection."
  - 2. Division 1 Section "Temporary Facilities and Controls."
  - 3. Division 3 Section "Cast-in-Place Concrete."
  - 4. Division 31 Section "Earth Moving."
  - 5. Division 33 Section "Subdrainage."

#### **1.3 DEFINITIONS**

- A. Backfill: Soil material or controlled low-strength material (flowable fill) used to fill an excavation.
- B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- C. Drainage Course: Free-draining aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- D. Excavation: Removal of material encountered above bearing elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation (Over-excavation): Excavation below bearing elevations or beyond indicated lines and dimensions as directed by Special Inspector and confirmed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - 2. Bulk (Mass) Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

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3. **Unauthorized Excavation:** Excavation below bearing elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- E. **Fill:** Soil materials used to raise existing grades.
  - F. **Rock:** Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 3/4 cu. yd. for footing excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
    1. **Excavation of Footings:** Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
  - G. **Structures:** Buildings, footings, foundations, retaining walls, slabs, or other man-made stationary features constructed above or below the ground surface as shown on the structural drawings.
  - H. **Subgrade:** Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
  - I. **Utilities:** On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### **1.4 SUBMITTALS**

- A. **General:** Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.
- B. **Material Test Reports:** For each on-site and borrow soil material proposed for fill and backfill as follows:
  1. Classification according to ASTM D 2487.
  2. Laboratory compaction curve according to ASTM D 698.

### **PART 2 - PRODUCTS**

#### **2.1 SOIL MATERIALS**

- A. **General:** Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. **Satisfactory Soils:** Soil Classification Groups GW, GP, GM, GC, SW, SP, SM, SC, CH, and CL according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials,

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vegetation, and other deleterious matter. No concentration of large fragments is permitted unless approved by Geotechnical Engineer and Architect.

1. Plasticity Index: Less than 30.
  2. Swell potential: Less than 50 psf.
  3. Maximum dry density of at least 100 pounds per cubic foot.
- C. Unsatisfactory Soils: Soil Classification Groups ML, OL, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
  2. Shot rock, asphalt, and coal fragments.
  3. Organics content shall be less than 5%. Limit total depth of soil fills with organic contents over 4% to 24".
- D. Subbase Material (Dense Graded Aggregate): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting Kentucky Transportation Cabinet Standard Specification for dense graded aggregate; with at  $\frac{3}{4}$ " maximum nominal size aggregate and not more than 13 percent passing a No. 200 sieve.
- E. Drainage Course and Drainage/Wall Backfill (Crushed Stone): Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; meeting Kentucky Transportation Cabinet Standard Specification for #57 stone; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### **3.2 DEWATERING**

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

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1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### **3.3 EXCAVATION, GENERAL**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches outside of concrete forms other than at footings.
    - b. 12 inches outside of concrete forms at footings.
    - c. 24 inches below bottom of footings where footings specified to be soil bearing.
    - d. 6 inches outside of minimum required dimensions of concrete cast against grade.
    - e. 6 inches beneath bottom of concrete slabs-on-grade.

### **3.4 STRUCTURAL EXCAVATION**

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  2. Recompress areas loosened by excavation operations prior to reinforcing steel placement.
  3. Remove loose soil, debris, and excess surface water from the bearing surface prior to concrete placement.
- B. Over-excavate all soft and deleterious material below foundations as directed by Special Inspector and backfill back to foundation bearing elevation with approved fill material.
- C. For foundations classified as soil bearing on the structural drawings, undercut and maintain similar bearing material type and depths.
  1. Remove all rock within 24 inches below bottom of foundation and replace with approved engineered soil backfill.

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2. In mass earth fills 4 feet or deeper, overexcavate both existing and new fills below footing to an elevation where depth of fill is 4 feet or less, and backfill with approved cementitious material to footing bearing.

### **3.5 SUBGRADE INSPECTION**

- A. Notify Architect when excavations have reached required subgrade.
- B. If Special Inspector determines that unsatisfactory soil is present, notify Architect and receive direction. Once received, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. A loader scraper is also permitted. Do not proof-roll wet or saturated subgrades.
  1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### **3.6 UNAUTHORIZED EXCAVATION**

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 1500 psi, may be used when approved by Architect.
  1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### **3.7 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### **3.8 BACKFILL, GENERAL**

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.
- C. Do not backfill below footings with crushed stone where building foundations classified as soil bearing on the structural drawings.

### **3.9 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact engineered fill material in layers to required elevation.
- C. Place fill on subgrades free of mud, frost, snow, or ice.

### **3.10 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight. Maintain the moisture content as such.

### **3.11 COMPACTION OF SOIL/GRAVEL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill gravel (KYTC #57 stone) in layers not more than 8 inches in loose depth and tamp in place. Use hand-operated tampers (plate compactors) where grade differential, at time of tamping, is more than 12-inches on each side of wall or where backfill area extent or accessibility does not facilitate the use of heavy compaction equipment.

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- C. Place backfill gravel and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- D. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - 1. Scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
  - 2. When the fill depth will exceed 10 feet, the excess lower portion shall be compacted to at least 100 percent.

### **3.12 CEMENTITIOUS FILL**

- A. Place fill on subgrades free of mud, frost, snow, or ice.
- B. Place and consolidate in accordance to the recommendations of the Geotechnical Report.

### **3.13 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### **3.14 SUBBASE UNDER CONCRETE SLABS-ON-GRADE**

- A. Place subbase on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact subbase under cast-in-place concrete slabs-on-grade as follows:
  - 1. Place subbase 6 inches or less in compacted thickness in a single layer.
  - 2. Place subbase that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 3. Compact each layer of subbase to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

### **3.15 FIELD QUALITY CONTROL**

- A. General: The Owner will employ a testing agency which meets the requirements of ASTM E329 to perform tests and to submit test reports. Failure to detect any defective

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materials shall not prevent later rejection when such defect is discovered, or obligate the Architect or Owner for final acceptance.

1. See Section 01 41 10 – Structural Special Inspections for testing and inspection to be performed.
  2. Test results will be reported in writing to the Architect, Engineer, and General Contractor within 24 hours after tests.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent backfill or foundation placement only after test results for previously completed work comply with requirements.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### **3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.
1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

**END OF SECTION 03 03 00**



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

### **PART 1 – GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes. This Section applies to concrete work shown on the structural drawings. See Division 32 for site concrete.
- B. Cast-in-place concrete includes the following:
  - 1. Lean concrete mudmats and backfill.
  - 2. Foundations and footings.
  - 3. Slabs-on-grade.
  - 4. Foundation walls.
  - 5. Equipment pads and bases.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section “Structural Special Inspection.”
  - 2. Division 3 Section “Structural Excavation and Backfill” for preparation and excavation of foundations and stone drainage fill.
  - 3. Division 7 Section “Thermal and Moisture Protection.”
- D. Coordination: Unless other satisfactory agreements are specifically entered into by contractors concerned, all miscellaneous iron and steel, sleeves, anchors, etc., required by work of other contractors, will be furnished and installed by such other contractors with the cooperation of this contractor.

#### **1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### **1.4 ACTION SUBMITTALS**

- A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

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- B. Design Mixtures: For each concrete mixture with laboratory test reports for the following data. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Method used to determine the proposed mix design (per ACI 301, Section 4).
  2. Gradation and quantity of fine and coarse aggregates.
  3. Proportions of all ingredients including all admixtures added either at the time of batching or at the job site. Indicate amounts of mixing water to be withheld for later addition at Project site.
  4. Water/cement ratio and water/cementitious ratio.
  5. Slump – ASTM C143.
  6. Certification and test results of the total water soluble chloride ion content of the design mix – FHWA RD-77 or AASHTO T 260-84.
  7. Air content of freshly mixed concrete by the pressure method, ASTM C231, or the volumetric method, ASTM C173.
  8. Unit weight of concrete – ASTM C138.
  9. Strength at 7- and 28-days for structural concrete– ASTM C39. Document strength on basis of previous field experience or trial mixtures, per ACI 301 Section 4. Submit strength test records, mix design materials, conditions, and proportions for concrete used for record of tests, standard calculation, and determination of required average compressive strength.
  10. Complete and include Structural Engineer's standard mix design submittal form for each mix. A blank copy is included at the end of this section.
- C. Steel Reinforcement Shop Drawings: Fabrication and placing drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include special reinforcing required for openings through concrete structures.
1. Computer generated electronic structural construction document files (ACAD) will be made available to the Contractor. The Contractor will be required to sign the Engineer's standard release of liability form prior to receiving the drawing files. Rules for use of said files shall be as defined in the CRSI "Code of Standard Practice" Sections 4.19 and 6.4.1.
  2. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.
- D. Product Data: For proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, vapor retarder/barrier, construction joint slip dowels, joint systems, mechanical reinforcing splice couplers, curing compounds, dry-shake finish materials, and others if requested by Architect.
- E. Drawings showing proposed construction and/or contraction joint locations if the General Contractor chooses to revise joints shown in the construction documents.

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## 1.5 INFORMATIONAL SUBMITTALS

- A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.
- B. Laboratory test reports for concrete materials or material certificates in lieu of material laboratory test reports. Material certificates shall be signed by Manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
- C. Survey of the as-built locations of anchor rods, foundation bolts, and other embedded items shall be submitted to the Architect, Engineer, and General Contractor/Construction Manager.
- D. Written notification that the concrete in the footings, piers, walls, or other bearing support has attained, on the basis of an appropriate ASTM standard test method of field-cured samples, a minimum of 75% of the intended minimum compressive design strength.

## 1.6 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Each contractor having reference to ACI Documents shall maintain copies of same on project site.

### AMERICAN CONCRETE INSTITUTE

- 1. ACI 117-10 – Specifications for Tolerances for Concrete Construction and Materials.
- 2. ACI 211.1-91 – Standard Practice for Selecting Proportions Normal, Heavyweight and Mass Concrete (Reapproved 2009).
- 3. ACI 301-10 – Specification for Structural Concrete.
- 4. ACI 302.1R-04 – Guide for Concrete Floor and Slab Construction.
- 5. ACI 304.2R-96 – Placing Concrete by Pumping Methods (Reapproved 2008).
- 6. ACI 305R-10 – Guide to Hot Weather Concreting.
- 7. ACI 306R-10 – Guide to Cold Weather Concreting.
- 8. ACI 308R-01 – Guide to Curing Concrete (Reapproved 2008).
- 9. ACI 309R-05 – Guide for Consolidation of Concrete.
- 10. ACI 311.1R-07 – ACI Manual of Concrete Inspection.
- 11. ACI 318-11 – Building Code Requirements for Structural Concrete and Commentary.
- 12. ACI 347-04 – Guide to Formwork for Concrete.
- 13. SP-66 – ACI Detailing Manual.

### CONCRETE REINFORCING STEEL INSTITUTE (CRSI):

- 1. CRSI – Manual of Standard Practice.
- 2. CRSI 63 – Recommended Practice for Placing Reinforcing Bars.
- 3. CRSI 65 – Recommended Practice for Placing Bar Nomenclature.

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- B. Qualifications of Workers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper execution of the work required by this Division.
- C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section “Project Meetings” and the following:
  - 1. At least 35 days prior to start of the concrete construction schedule, the contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete construction.
  - 2. The contractor shall require responsible representatives of every party who are concerned with the concrete work to attend the conference, including but not limited to, the following:
    - a. Contractor’s superintendent – Laboratory responsible for the concrete design mix – Laboratory responsible for field quality control – Concrete subcontractor – Ready-mix concrete producer – Admixture manufacturer(s) – Concrete pumping contractor – Special Inspector – Polishing Installer.
  - 3. The Architect and the Owner’s Representative may be present at the conference. The Contractor/Construction Manager shall notify the Architect at least five days prior to the scheduled date of the conference.
  - 4. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within five days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes: Owner’s representative – Resident engineer – Consultant engineer.
- E. Contractor shall be responsible for conducting a survey of the as-built locations of anchor rods, foundation bolts, and other embedded items. Survey to include embed placement, bolt projection, and top of foundation elevation. Survey to be conducted by a Professional Land Surveyor.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver steel reinforcement and concrete to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel reinforcement off ground by using pallets, platforms, dunnage, or other supports and spacers.

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- C. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

## **PART 2 - PRODUCTS**

### **2.1 FORM MATERIALS**

- A. Forms for Exposed (Smooth) Finish Concrete: Exterior-grade high-density overlay (Class 1 or better), medium-density overlay (Class 1 or better with mill-release agent treated and edge sealed), or Structural1 or Class 1 (B-B or better, mill oiled and edge sealed) plywood panels complying with DOC PS1; or new metal-framed and metal faced panels; or other acceptable panel-type materials to provide continuous, straight, and smooth exposed surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Forms for Unexposed, Rough-Formed Finish Concrete: Plywood, lumber, metal or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Non-staining dressed wood, metal, PVC, or rubber strips;  $\frac{3}{4}$  by  $\frac{3}{4}$  inch, minimum, and as shown on Drawings; in longest practical lengths.
- D. Form-Release Agent: Commercially formulated form-release agent with a maximum volatile organic compounds (VOCs) not to exceed those allowable by jurisdictional regulations, that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties (Standard): Factory-fabricated, adjustable-length, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of plastic concrete on forms, prevent form deflection, and to prevent spalling of concrete upon removal.
  - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of the 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.
- F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum  $\frac{1}{4}$  inch thick.
- G. Form Joint Sealant: Elastomeric sealant complying with ASTM C920, Type M or S, Grade NS, that adheres to form joint substrates.
- H. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.

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## 2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Welded Wire Fabric: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- D. Fabric Supports: Chairs for spacing, supporting welded wire fabric in place. Use continuous wire chairs complying with CRSI specifications.
  - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

## 2.3 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150, Type I. One brand of cement shall be used throughout Project duration unless otherwise acceptable to Engineer.
  - 2. Fly Ash: ASTM C 618, Class F or C, except maximum loss on ignition: 3%.
  - 3. Slag Cement: ASTM C 989, Grade 100 or 120.
  - 4. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag, Type IP, portland-pozzolan, Type IL, portland-limestone, or Type IT, ternary blended cement.
- C. Normal-Weight Aggregates: ASTM C 33 Class 3S coarse aggregate or better, graded, and as specified. Provide aggregates from a single source for exposed concrete.
  - 1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances considered deleterious or that cause spalling or surface discoloration due to oxidation.
  - 2. Fine Aggregate to be free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94 and potable.

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- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and 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 C 494, Type A.
  2. Retarding Admixture: ASTM C 494, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
  4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
  5. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
  6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
  7. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.
  8. Air-Entraining Admixture: ASTM C 260.
- F. Controlled Low Strength Material (CLSM) Performance Additive
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - a. Darafill or Darafill Dry, GCP Applied Technologies, Inc.
    - b. MasterMatrix VMA 362, BASF Corporation.
    - c. RUSS-FLO, RussTech Admixtures, Inc.

## 2.4 RELATED MATERIALS

- A. Anchor Rods, Bolts, Nuts, and Washers: As follows:
1. Non-High Strength Rods (Straight, Headed or Threaded) for heavy structural steel, PEMB, and precast concrete elements: ASTM F1554 Grade 36 and heavy hex carbon-steel nuts.
  2. Non-High Strength Rods (L-hooked) for wood sill or ledger: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers. All with hot-dip zinc galvanized coating per ASTM A153, Class C.
  3. Plate Washers: ASTM A36.
- B. Construction joint slip dowels: steel rod or plate in a plastic insert to allow contraction of the concrete while preventing vertical differential displacement.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - a. #4x1'-6" long, Speed Dowel by Sika Greenstreak.
    - b. 1/4" plate, Diamond Dowel by PNA, Inc.
    - c. 1/4" plate, Speed Plate by Sika Greenstreak.
- C. Slab Pourstop with Keyway: galvanized steel, vinyl, or plastic forming pourstop with integral keyway for use with slabs on grade.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

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- a. Key-Loc Joint System, Cardinal Manufacturing Company, Inc.
- D. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or non-impregnated, flexible, synthetic foam with standard bonding agent to hold in place.
- E. Sheet Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:
  1. Polyolefin/Resin sheet not less than 15 mils thick conforming to ASTM E 1745 Class A. Maximum water vapor permeance when tested in accordance with Test Method ASTM E154, Sections 7, 8, 11, 12, and 13 (based on ASTM E96) or ASTM F1249 of 0.01 perms. Minimum tensile strength when tested to ASTM D882 of 76 lbs-force/inch.
    - a. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
      - 1) Perminator Vapor-Mat with Perminator Tape Seal. W.R. Meadows, Inc.
      - 2) Stego Wrap with Stego Tape Seal. Stego Industries, LLC.
      - 3) Viper Vaporcheck II with manufacturer's recommended tape seal. Insulation Solutions, Inc.
      - 4) Vaporblock VB15 with Vapor Bond Plus Tape Seal. Raven Industries, Engineered Films Division.
      - 5) Xtreme with Xtreme Tape Seal. Tex-Trude, LP.
- F. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- G. Cartridge Injection Acrylic Adhesive (for reinforcing dowels): two-component material for use in concrete. Anchor to be approved for use with cracked concrete per AC308.
  1. Acrylic resin adhesive, suitable for use on dry or damp surfaces. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - a. HIT HY 200 System, Hilti.
    - b. AC 100 System, Powers.
    - c. AT-XP System, Simpson/Strong-Tie.
  2. Epoxy adhesive, suitable for use on oversized, cored, and wet holes and in submerged applications. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - a. EPCON G5 System, ITW Red Head.
    - b. HIT RE500 V3 System, Hilti.
    - c. PE 1000+, Powers.
    - d. SET-XP Epoxy System, Simpson/Strong-Tie.



## 2.5 LIQUID FLOOR TREATMENTS

- A. Penetrating Concrete Sealer and Liquid Densifier: The sealer shall be a lithium based compound which penetrates concrete surfaces providing an increase in abrasion resistance and a reduction in the surface absorption of liquids. Sealer shall be a clear liquid that dries transparent.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - a. Pentra-hard Finish, Dayton Superior.
    - b. Ultraguard, The Euclid Chemical Co.

## 2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. General: All non-dissipating compounds shall be certified by curing compound manufacturer to not interfere with bonding of floor covering. Where liquid floor treatment or colored stain system is used, provide material recommended by the manufacturer of the treatment for use in a compatible, integrated system.
- E. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete for temporary protection from rapid moisture loss.
  - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
    - a. BASF Corporation.
    - b. ChemMasters, Inc.
    - c. Dayton Superior.
    - d. Euclid Chemical Company.
    - e. Kaufman Products, Inc.
    - f. L&M Construction Chemicals, Inc.
    - g. Lambert Corporation.
    - h. Metalcrete Industries.
    - i. Sika Corporation.
    - j. SpecChem, LLC.
    - k. W. R. Meadows, Inc.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

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1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - a. BASF Corporation.
  - b. ChemMasters, Inc.
  - c. Dayton Superior.
  - d. Euclid Chemical Company.
  - e. Kaufman Products, Inc.
  - f. L&M Construction Chemicals, Inc.
  - g. Lambert Corporation.
  - h. SpecChem, LLC.
  - i. W. R. Meadows, Inc.
  
- G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
  1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
    - a. ChemMasters, Inc.
    - b. Dayton Superior.
    - c. Euclid Chemical Company.
    - d. Kaufman Products, Inc.
    - e. L&M Construction Chemicals, Inc.
    - f. Lambert Corporation.
    - g. SpecChem, LLC.
    - h. W. R. Meadows, Inc.

## 2.7 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field data methods, or both, according to ACI 301. Use an independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures. Trial batch and field experience tests shall have been performed within 12 months of submittal date. Use mix design submittal form included at the end of this section.
  1. Do not use the same testing agency for field quality control testing.
  
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Architect. The approved mix designs shall be used throughout this project unless changes are approved by the Architect/Engineer prior to use.
  
- C. Cementitious Materials: Supplier shall coordinate surface treatment compatibility with cementitious materials. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

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1. Fly Ash: 20 percent for Type F or 25% for Type C.
  2. Combined Fly Ash and Pozzolan: 25 percent.
  3. Slag Cement: 50 percent.
  4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete as required for placement and workability and in all pumped concrete, architectural concrete, and concrete required to be watertight.
  2. Use accelerating and retarding admixtures at Contractor's discretion to control set time when required by extreme temperatures or humidity, or other adverse placement conditions. Use accelerating admixture in concrete slabs placed at ambient temperatures below 35 deg F.
- E. The minimum compressive strength measured 28 days after placement ( $f'_c$ ), minimum cementitious content, slump, maximum water/cementitious content ratio (W/C), and air content of the concrete for each portion of the structure shall be as follows:
1. Class 1. Lean Concrete Mudmats and Backfill. Normal-weight concrete.
    - a. Minimum Compressive Strength: 1,500 psi.
    - b. Minimum Cementitious Material: 200 lbs/cy.
    - c. Slump Limit: N/A.
    - d. Air Content: Natural.
  2. Class 2. Footings. Normal-weight concrete.
    - a. Minimum Compressive Strength: 3,000 psi.
    - b. Minimum Cementitious Material: 470 lbs/cy.
    - c. Maximum W/C Ratio: 0.50.
    - d. Slump Limit: Minimum of 4 inches and maximum of 6 inches, plus or minus 1 inch.
    - e. Air Content: Natural.
  3. Class 3. Piers and Walls. Normal-weight concrete.
    - a. Minimum Compressive Strength: 4,000 psi.
    - b. Minimum Cementitious Material: 550 lbs/cy. With an approved water-reducing agent, minimum cement content may be reduced by 47 pounds of cement per cubic yard.
    - c. Maximum W/C Ratio: 0.48.
    - d. Water Reducing Admixture: Optional.
    - e. Slump Limit: Maximum 4 inches or 8 inches after adding admixture to 2-to-3-inch slump concrete, plus or minus 1 inch.
    - f. Air Content: Natural.

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4. Class 4. Interior Slab on Grade and Equipment Bases. Normal-weight concrete.
  - a. Minimum Compressive Strength: 4,000 psi.
  - b. Minimum Cementitious Material: 505 lbs/cy.
  - c. Maximum W/C Ratio: 0.48.
  - d. Water Reducing Admixture: Mandatory.
  - e. Slump Limit: Maximum 8 inches after adding water reducing admixture to 2-to-3-inch slump concrete, plus or minus 1 inch.
  - f. Air Content: Maximum 3 percent.
  
5. Class 5. Exterior horizontal concrete exposed to weather or deicer chemicals,. Normal-weight concrete.
  - a. Minimum Compressive Strength: 5,000 psi.
  - b. Minimum Cementitious Material: 564 lbs/cy.
  - c. Maximum W/C Ratio: 0.40.
  - d. Water Reducing Admixture: Optional.
  - e. Slump Limit: 4 inches or not more than 8 inches after adding admixture to 2-to-3-inch slump concrete, plus or minus 1 inch.
  - f. Air Content: 5.5 percent for 1 ½-inch maximum aggregate.  
 6.0 percent for 1-inch maximum aggregate.  
 6.0 percent for ¾-inch maximum aggregate.  
 7.0 percent for ½-inch maximum aggregate.
  
- F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

## 2.8 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
  1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
  
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
  1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

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2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

### **3.2 FORMWORK INSTALLATION**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of correct size, shape, lines, alignment, elevation, position, level, plumb, and dimension and indicated. Maintain formwork construction tolerances and surface irregularities within limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  1. Class A, 1/8 inch tolerances for smooth-formed concrete surfaces exposed to view.
  2. Class D tolerances for earth formed foundation elements. Tolerance applies as a variation inward towards reinforcing only. No tolerance limit away from reinforcing applies.
  3. Class C, 1/2 inch tolerances for other concrete surfaces.
- D. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspections where interior area of formwork is inaccessible before and during concrete placement. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

- H. Form openings, chases, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, and other features required in the Work. Chamfer exposed corners and edges at exterior corners and edges of permanently exposed concrete and as indicated, to produce uniform smooth, straight lines and tight edge joints.
- I. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- J. Earthen forms may be used for footings and foundation elements when ground is stable and capable of resisting erosion and fluid pressure of wet concrete without sloughing. All tolerances and clear covers shall be maintained. Excavation shall be clean of all loose soil and mud along bottom and sides.
- K. Use selected materials to obtain required finishes.
- L. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
  - 1. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed.
  - 2. Do not spray reinforcing with form oil.
  - 3. Coat steel forms with a nonstaining, rust-preventative material. Do not use rust-stained steel form-facing material.

### **3.3 INSTALLING EMBEDDED ITEMS**

- A. Place and secure anchorage devices, anchor rods, and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, templates, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303. Column anchor rods shall be set in a rigid template and securely braced to formwork or ground prior to placing concrete. Anchor rods may not be "wet set" in plastic concrete.
  - 2. Install dovetail anchor slots in concrete structures as indicated.
  - 3. Install reglets to receive sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
  - 4. Aluminum conduit shall not be installed in concrete.

### 3.4 REMOVING AND REUSING FORMS

- A. Formwork not supporting weight of concrete, such as sides of walls, piers, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must first be sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations shall be maintained.
  - 1. Remove forms only if shores and other vertical supports have been arranged to permit removal without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent as specified for new formwork.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets.
  - 1. Do not use patched forms for exposed concrete surfaces except as acceptable to Architect.

### 3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with Concrete Reinforcing Steel Institute's (CRSI) "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Deliver reinforcement to job site bundled, tagged and marked. Use waterproof tags indicating bar size, length, and mark corresponding to placing drawings.
- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- D. When permitted, field bend bars cold, except during cold weather when moderate heating is necessary to avoid brittle failures.
- E. Accurately position, support, and secure all bar reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum coverages as indicated for concrete protection.
  - 1. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations.
  - 2. Walls with reinforcing mats on each face shall have bent U-bar spacers tied to each mat to hold spacing between mats. U-bar spacers shall be minimum #3 bars spaced a maximum of 6 feet on center horizontally and vertically with a row of bars placed at the top of any wall over 4 feet tall.
  - 3. All walls shall have chairs or bolsters placed between reinforcing mat(s) and both form faces spaced a maximum of 6 feet on center to maintain clear cover.

- F. Install welded- wire fabric reinforcement in longest practicable lengths on fabric supports spaced to minimize sagging. Lap edges and ends of adjoining pieces at least one full mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace outermost cross wires of lace splices with wire to prevent lifting of the ends during concrete placement.
  - 1. Chair welded wire fabric slab reinforcement with continuous chairs spaced a maximum of 32 inches on center. Provide additional chairs as required. Lift welded wire fabric back into position between chairs where depressed during concrete placement. Lifting welded wire fabric into position during concrete placement without the use of chairs is not permitted.
- G. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- H. Construction tolerances shall be in accordance with ACI 117 and the following:
  - 1. For member depths 12" and smaller, tolerance on concrete cover shall be the smaller of  $-3/8"$  and  $-(1/3)*[\text{specified cover}]$ .
  - 2. For member depths larger than 12", tolerance on concrete cover shall be the smaller of  $-1/2"$  and  $-(1/3)*[\text{specified cover}]$ .
  - 3. Tolerance for longitudinal location of bends and ends of reinforcement:
    - a. At discontinuous ends of brackets and corbels,  $\pm 1/2"$ .
    - b. At discontinuous ends of other members,  $\pm 1"$ .
    - c. At other locations,  $\pm 2"$ .

### 3.6 PLACING ADHESIVE SYSTEM

- A. General: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Holes may be dry, damp or wet. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
  - 1. Drill holes with rotary impact hammer drills using carbide-tipped bits and core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
  - 2. Cored Holes: Where anchors are to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Acrylic Adhesive Anchors shall not be installed in core drilled holes.
  - 3. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling.
  - 4. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.
  - 5. Perform anchor installation in accordance with manufacturer instructions.



### 3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints in Reinforced Structure and Foundations: Locate and install construction joints so they do not impair strength or appearance of the structure, at locations indicated or otherwise as acceptable to Architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of slabs.
  - 2. Form continuous keyways as indicated. Embed keys at least 1-1/2 inches into concrete. Provide keyways 1/3 the member thickness, or 3 1/2" minimum, in walls, footings, and between walls and footings centered in the member thickness unless shown otherwise.
  - 3. Locate horizontal joints in walls and columns at underside of slabs, and at the top of footings.
  - 4. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Construction Joints in Slab on Grade: Provide slip dowels (as shown on drawings) for construction joints in field of slabs on grade less than 6" thickness. Provide continuous keyways at least 1 1/2 inches deep by 1 1/2" wide or slip dowels (as shown on drawings) in construction joints in slabs on grade 6" or thicker. Provide continuous keyways at least 1 1/2 inches deep by one third the slab thickness centered in the construction joint of all formed concrete slabs.
  - 1. Bulkheads designed and accepted for this purpose shall be used for doweled joints. Use manufactured plastic sleeves as indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint for non-sleeved dowels.
  - 2. Prefabricated pourstop with keyway may be used for simultaneous placement of adjacent slab panel at Contractor's option, where approved by Architect. Use leave-in-place joint system which is compatible with floor finish or treatment system.
  - 3. Where construction joints at doorways that align with both faces of bearing wall are specified, utilize preformed pourstop with keyway in lieu of slip dowels.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as piers, foundation walls, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips flush with top of slab to prevent contact or bonding between the slab and the adjoining member. Use strips with perforated strips that remove the top portion to be not less than 1/2 inch or more than 1 inch below finished concrete surface where 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.
  4. At locations where drawings do not specifically call for premolded filler, provide bond breaker between slab and vertical surface. The vapor retarder may be turned up and used for this purpose.
  5. Provide ¼" expansion joint between slab and all door jambs (at end of walls in opening).
  6. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."
- E. Contraction (Control) Joints in Slabs-on-Grade: Construct weakened-plane contraction joints, sectioning concrete into areas as indicated, and to a depth equal to at least one-fourth depth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groove-tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction 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 contraction cracks.
  3. Contraction joints may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
  4. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).
  5. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

### 3.8 VAPOR RETARDER INSTALLATION

- A. Sheet vapor retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions. Place sheeting in position with longest dimension parallel with direction of pour.
1. Extend film fully over slab area to the full perimeter of the slab. Turn film up 2" onto surrounding wall/column/piers/etc. and seal to vertical element with continuous mastic or tack tape capable of adhering to concrete and masonry. Film and tape shall not extend above finished floor.
    - a. Where obstructed by impediments (such as dowels, or any other site condition requiring early termination of the vapor retarder). At the point of termination, seal vapor barrier to the foundation wall, footing, or slab itself. Use manufacturer's recommended accessories for such non-standard terminations.
  2. Lap joints 6 inches and seal with manufacturer's recommended mastic or pressure-sensitive tape.
  3. Apply seam tape to a clean and dry film only.

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- B. Seal around all penetrations (including all conduit and pipes) through film with manufacturer's recommended mastic or pressure-sensitive tape. Cut slit around penetrations to place initial layer of film.
  - 1. For small penetrations, tape film directly to the penetrating element.
  - 2. For penetrations larger than 2", create collar for penetration of 12" wide by 1 ½ times the penetration's circumference with fingers cut half the width of the film. Wrap the collar around the penetration, tape the collar onto the strip of film, and tape the fingers at each edge/slit to the initial layer of film.
- C. Avoid the use of non-permanent stakes driven through film. If non-permanent stakes are driven through film, repair and seal as recommended by film manufacturer.
- D. Repair damaged areas of film material of similar (or better) permeance, puncture resistance, and tensile strength.

### 3.9 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified. Concrete delivery tickets shall show:
  - 1. Batch number.
  - 2. Mix by number with cement content in pounds and maximum size aggregate.
  - 3. Admixtures.
  - 4. Air content.
  - 5. Slump.
  - 6. Time dispatched and discharged.
  - 7. Date.
  - 8. Contractor.
  - 9. Ready Mix Supplier.
  - 10. Project Name and Address.
  - 11. Volume of Concrete.
- C. Do not add water to the concrete mix during delivery, at Project site, or during placement unless approved by the General Contractor's representative, noted on the delivery ticket with the amount of water, and signed by the General Contractor's representative. The maximum water/cement ratio of an approved mix design may not be exceeded.
  - 1. When the ambient air temperature is between 80 and 90 degrees Fahrenheit, one (1) gallon of water per cubic yard of concrete may be added at the job site to compensate for water evaporation during transit.
  - 2. When the ambient air temperature exceeds 90 degrees Fahrenheit, two (2) gallons of water per cubic yard of concrete may be added at the job site to compensate for water evaporation during transit.
  - 3. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- D. Discharge concrete within 1 ½ hours after water has been added to the cement, unless a longer time has been authorized by the Architect/Engineer. During hot weather or other conditions contributing to a quick stiffening of the concrete, the Architect/Engineer may require discharge in less than 1 ½ hours.
- 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. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation. Do not allow concrete to drop more than 5 feet or from a height which allows concrete to fall against reinforcing.
  - 1. Deposit concrete in forms in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints. Do not subject concrete to any procedure that will cause segregation. Deposit concrete as near as possible to the final position to avoid segregation.
  - 2. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix 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. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in proper position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- G. Cold-Weather Placement: When air temperature is expected to fall below 40 degrees Fahrenheit (4 deg C) within the first 72 hours after concrete placement, comply with provisions of ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When mean daily air temperature is expected to fall below 40 deg F (4 deg C) for more than three successive days after concrete placement, uniformly heat

water and aggregates before mixing to obtain a concrete mixture temperature at point of placement as follows:

- a. Not less than 55 deg F (13 deg C) or more than 75 deg F (24 deg C) for concrete sections less than 12 inches in the least dimension (width or thickness).
  - b. Not less than 50 deg F (10 deg C) or more than 70 deg F (21 deg C) for concrete sections 12 inches or greater in the least dimension (width or thickness).
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- H. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305.1 and as specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
  3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
  4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.
- I. Pumping Concrete: Grout used to prime a pump shall not be placed in the forms of any concrete exposed to view in the final structure.

### 3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is an as-cast concrete surface having texture imparted by form-facing material used. Repair and patch tie holes, honeycombing over ½ in depth, and other defective areas. Remove fins and other projections exceeding ¼ inch in height by rubbing down, chipping, or grinding off.
- B. Smooth-Formed Finish / Grout-Cleaned Finish: Provide a smooth-formed / grout-cleaned finish on formed concrete surfaces exposed to view in public spaces and exterior. This is an as-cast concrete surface obtained with selected form-facing material arranged in an orderly and symmetrical manner with a minimum of seams. Special care should be taken to avoid consolidation problems, honeycombing, fins, or projections. Repair and patch tie holes, honeycombing over 1/8" in depth, and other defective areas. Remove fins and other projections exceeding 1/8" in height by rubbing down or grinding off until completely removed and smoothed.

1. Perform grout-cleaned finish immediately after stripping forms and no later than 3 days after initial casting of concrete.
  2. Combine 1 part portland cement to 1 part fine sand by volume, and a 50:50 mixture of bonding agent and water. Blend standard portland cement and white portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
  3. Thoroughly wet concrete surfaces to prevent absorption of water from the grout. Apply grout uniformly to initially coat surfaces and fill small holes. Immediately after applying the grout, float the surface with a cork or other suitable float, scouring the wall vigorously. While the grout is still plastic the surface shall be finished with a sponge rubber float to remove all excess grout. Finishing shall be done at the time when grout will not be pulled from holes or depressions. Next allow the surface to dry thoroughly, then vigorously rub with clean burlap to completely remove any dried grout and so that there is no visible film of grout remaining. The entire cleaning operation for any area must be completed on the day that it is started. Keep damp by fog spray over covered burlap for at least 36 hours after rubbing.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo; and where indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units.

2. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied floor covering system.
3. Finish surface to specified tolerances for floor flatness and floor levelness measured according to ASTM E 1155. Minimum local values shall be 2/3 of the specified composite F-number. Unless otherwise shown or noted on the drawings, comply with the following table:

<b>Slabs on Grade</b>		
Composite Flatness F(F)	Composite Levelness F(L)	Typical Use
35	25	All Slabs on Grade

- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
  1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
  1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Surface Cleaning: Where concrete surface is to left exposed or sealed with thin film or penetrating coating, burnish or burn to remove all protruding synthetic fiber reinforcing.
- G. Exposed Concrete Slabs: Slabs exposed to view in the public spaces shall be free from free of trowel marks and uniform in texture and appearance. Sharply defined low and high spots are prohibited and cause for rejection by Architect. Grinding and patching to correct discrepancies will be prohibited unless acceptable to Architect. Use new, clean blankets and other protections that will not discolor or dull the finish.

### 3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Coordinate sizes and locations of concrete bases with actual equipment to be provided.
  - 1. Construct concrete bases 3 1/2 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 3. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Finish all mechanical housekeeping pads to a finished tolerance of 1/8" in 10 feet.

### 3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Compatibility: Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- C. For cold-weather protection during curing, comply with ACI 306.1 and the following:
  - 1. All freshly placed concrete shall be kept from freezing for the following periods:
    - a. 3 days for all concrete with an air entraining admixture.
    - b. 4 days for all concrete without an air entraining admixture.
  - 2. A cumulative curing time of seven days at a minimum surface temperature of 50 degrees F (10 degrees C) shall be provided or until concrete has attained 75% of its design strength. This shall be followed by cooling of concrete in a gradual transition to surrounding conditions. The temperature drop during this period shall not be at a rate exceeding 2 degrees F per hour until the outside or surrounding temperature is reached.
  - 3. When concrete is placed under conditions of cold weather concreting (defined as a period when the mean daily temperature drops below 40 degrees F for more than three successive days), take additional precautions as specified in "Cold Weather Concreting" by the American Concrete Institute (ACI Report 306) when placing, curing, monitoring and protecting the fresh concrete.
- D. For hot-weather protection during curing, comply with ACI 301 and the following:
  - 1. When concrete is placed under conditions of hot weather concreting, provide extra protection of the concrete against excessive placement temperatures and excessive drying throughout the placing and curing operations. Hot weather is



- defined as air temperature which exceeds 80 degrees F or any combination of high temperature, low humidity and/or high wind velocity which causes a rate of evaporation in excess of 0.2 pounds per square foot per hour as determined by Figure 2.1.5 of ACI Report 305. Hot weather curing is required if these conditions occur within a 24 hour period after completion of concrete placement.
2. Forms, reinforcing and the air shall be cooled by water fog spraying immediately before placing concrete.
  3. Immediately following screeding, protect concrete by applying the specified evaporation retarder in accordance with the recommendations of the manufacturer.
- E. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- F. Formed Surfaces: Cure formed concrete surfaces, including walls, piers, and other similar surfaces, by moisture curing with forms in place for 7 days or until forms are removed. If forms are removed within the first 7 days, continue moisture curing without forms for the balance of the 7 day curing period.
1. For vertical surfaces, after the concrete has hardened and while the forms are still in place, the form ties shall be loosened and water shall be applied to run down the inside of the form to keep the concrete wet.
  2. After formwork has been removed from vertical surfaces, keep surface continuously wet by water spray or water-saturated absorptive cover.
- G. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
1. Cure interior and exterior slab surfaces exposed to deicing salts and slabs where the finish flooring is not compatible with curing compounds by Moisture Curing.
  2. Cure slab surfaces to receive hardwood flooring or sports rubber systems by Moisture Curing.
- H. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides

and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
  - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
  - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.14 LIQUID FLOOR TREATMENT APPLICATION

- A. General: Prepare, apply, and finish penetrating liquid floor treatment according to 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. Rinse with water; remove excess material until surface is dry. 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 according to manufacturer's written instructions.
- C. Penetrating Concrete Sealer and Liquid Densifier
  1. Apply penetrating concrete sealer and liquid densifier to all exposed concrete floor surfaces other than mechanical rooms.

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2. Apply curing compound and penetrating concrete sealer/liquid densifier in a multi-step integrated system in accordance with manufacturer's instructions and this specification.
3. Ensure application equipment is clean and free of previously used materials.
4. At the completion of final troweling and when the surface will not be marred, apply a manufacturer approved curing agent at coverage rate recommended by manufacturer.
  - a. With approval by manufacturer, sealer/densifier may be used at a minimum coverage rate of 500 square feet (maximum) per gallon. Do not allow material to puddle on the surface.
  - b. Curing compound shall be applied with a short nap roller to apply a uniform film.
5. At completion of construction, prepare surface and apply final treatment.
  - a. Scrape away all debris for a smooth surface.
  - b. Clean and prepare surfaces to receive treatment in accordance with manufacturer's instructions ensuring that all stains, oil, grease, form release agents, dust and dirt removed prior to application.
  - c. Remove remnant of curing and sealing compounds with manufacturer recommended solvent.
  - d. Utilizing a high speed buffer/polisher with 400 grit swirled resin over nylon scuff pad, clean and burnish the floor surface to a Concrete Polishing Association of America (CCPA) Class A Cream finish with minimal surface cut / aggregate exposure.
  - e. Saturate the surface with undiluted concrete densifier and chemical hardener by sprayer, squeegee or broom. Do not allow material to puddle on surface.
  - f. Keep the surface wet with concrete densifier and chemical hardener for a minimum of 30 minutes. (A range of 30-60 minutes may be required depending on temperature and conditions.). Ensure areas are kept wet at all times with concrete densifier and chemical hardener.
  - g. Once the surface begins to gel and become slippery, immediately spray the surface with a light water mist.
  - h. Scrub the surface with a broom or mechanical scrubber to increase the penetration of the concrete densifier and chemical hardener.
  - i. Continue to work the concrete densifier and chemical hardener into the surface for another 5-10 minutes or until it becomes gelled and slippery for a second time.
  - j. Thoroughly flush the surface with water and agitate the surface with a broom to aid in removal of the excess concrete densifier and chemical hardener.
  - k. Remove all excess material with a mop then squeegee.
  - l. Thoroughly squeegee the surface dry.

### 3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

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- 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, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water. Use only enough liquid as required 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. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried.
  2. Cut tie rods and bolts flush with the surface and drill out to minimum depth of 1 inch below the surface.
  3. Fill through wall tie holes with nonmetallic, shrinkage-resistant grout to within 1/2" of wall face using a grout bag or other similar means to completely fill the void. Fill any remaining tie hole, including holes from snap-off type form ties, with patching mortar or cone plugs secured in place with bonding agent.
  4. 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. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  5. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair methods not specified above may be used, subject to acceptance of Architect.

### 3.16 QUALITY CONTROL

- A. The Owner will employ an independent testing and inspection agency which meets the requirements of ASTM E329 to perform inspections and tests and to prepare test reports. The agency will monitor concrete quality by means of site and laboratory tests. They will be authorized to reject plastic concrete not conforming to specifications. Failure to detect any defective materials shall not prevent later rejection when such defect is discovered, or obligate the Architect or Owner for final acceptance.
1. See Section 01 41 10 – Structural Special Inspections for testing and inspection to be performed.
  2. Test results will be reported in writing to the Architect, Engineer, ready-mix producer and General Contractor within 24 hours after tests.
  3. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect.
- B. The Special Inspector will provide testing of the floor slab F-number tolerances conducted in accordance with the provisions set forth by ASTM E 1155. All tests shall be performed within three working days after concrete placement and prior to any form removal. If in-place floor slabs do not comply with the minimum values shown, the Contractor shall propose remedial measures to bring the surfaces of the floors into compliance. These measures might include grinding, planing, surface repair, retopping, or removal and replacement. Remedial measures shall be approved by the Architect/Engineer prior to the Contractor's commencement of the work.
- C. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

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### **3.17 PROTECTION**

- A. The General Contractor shall provide for protection of exposed slab surfaces both before and after treatment by liquid floor treatments. General Contractor shall coordinate all other construction activities to ensure slab surfaces are not damaged or stained.
- B. Use protective methods and materials, including temporary covering, recommended in writing by installer's manufacturer.
- C. Do not allow contaminants including acids, oils, resins, etc. to contact surface. Provide continuous scuff-preventing pads covered in lapped and sealed water and oil resistant film.
- D. Do not place any material onto surface that may cause etching, scuffing, chips, or scratches. Provide protection boards below scaffolding legs. Do not allow tracked vehicles on surface.

**END OF SECTION 03 30 00**

# BROWN + KUBICAN, PSC

## STRUCTURAL ENGINEERS

### CONCRETE MIX DESIGN SUBMITTAL FORM

Project: \_\_\_\_\_  
 City, State: \_\_\_\_\_  
 General Contractor: \_\_\_\_\_  
 Concrete Contractor: \_\_\_\_\_  
 Mix Design Number: \_\_\_\_\_  
 Concrete Strength (Class): \_\_\_\_\_  
 Use (describe): \_\_\_\_\_

#### Design Mix Information

Based on Standard Deviation Analysis  Check one  
 Based on Trial Mix Laboratory Test Data

#### Design Characteristics

Density  pcf  
 Strength  psi (28 days)  
 Air  %  
 Slump  inches

*If trial mixes are used, the Mix Design is proportioned to achieve  $f'_{cr} = f'_c + 1200$  psi  
 (1400 psi for strength higher than 5000 psi at 28 days)*

#### Materials

	Type	Source	Specific Gravity	Weight (lb.)	Absolute Vol. (cu. ft.)
cement					
flyash					
silica fume					
coarse aggregate					
fine aggregate					
water					
other ( )					
Total					27.0 cu. ft.

Water/Cementitious Ratio (W/C) = \_\_\_\_\_ % (lbs. water /lbs. cementitious)

Admixtures

	Manufacturer	Dosage (oz./cwt)
water reducer		
air entraining agent		
high range water reducer		
non-corrosive accelerator		
other ( )		

Slump before high range water reducer = \_\_\_\_\_ inches  
 Slump after high range water reducer = \_\_\_\_\_ inches

Standard Deviation Analysis (field experience records)

Number of test cylinders evaluated: \_\_\_\_\_ Standard deviation (s): \_\_\_\_\_  
 k-factor:

Number of Tests	k
15	1.16
20	1.08
25	1.03
≥30	1.00

Required avg. compressive strength (≤5000 psi: Max[f'c + 1.34ks, f'c + 2.33 ks – 500])  
 (>5000 psi: Max [f'c + 1.34ks, 0.9f'c + 2.33ks]): \_\_\_\_\_

Actual avg. compressive strength: \_\_\_\_\_  
 (refer to ACI 301 for standard deviation calculation – attach copies of laboratory test reports)

Trial Mix Laboratory Test Data

	Mix #1		Mix #2		Mix #3	
Age	Date	Compressive Strength	Date	Compressive Strength	Date	Compressive Strength
7 days		psi		psi		psi
7 days		psi		psi		psi
28 days		psi		psi		psi
28 days		psi		psi		psi
28 days average	NA	psi	NA	psi	NA	psi

(refer to ACI 301 for trial mix procedure – attach copies of laboratory test reports)

Required Attachments

	Please check
Coarse aggregate gradation report	<input type="checkbox"/>
Fine aggregate gradation report	<input type="checkbox"/>
Laboratory test reports (strength tests)	<input type="checkbox"/>
Admixture compatibility certification letters	<input type="checkbox"/>

Ready Mix Supplier

Name and Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Phone: \_\_\_\_\_ Miles from project: \_\_\_\_\_ Date: \_\_\_\_\_



## **SECTION 05 50 00 - METAL FABRICATIONS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Hoist Beams.
4. Metal bollards.
5. Security Grilles.
6. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 13 34 19 Metal Building Systems.

#### **1.2 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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### 1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Grout.
- 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. Provide Shop Drawings for the following:
  - 1. Steel framing and supports for mechanical and electrical equipment.
  - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 3. Hoist Beams.
  - 4. Metal bollards.
  - 5. Security Grilles.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

### 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## **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 A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304 or Type 316L.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 or Type 316L.
- E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Galvanized steel, ASTM A 653/A 653M, with G90 coating; 0.108-inch nominal thickness.
  - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, 0.0966-inch minimum thickness; unfinished.
- H. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- I. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- J. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- K. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- L. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

### **2.2 FASTENERS**

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.

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3. Provide stainless-steel fasteners for fastening nickel silver.
  - B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
  - C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
  - D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 (A1).
  - E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
    1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
  - F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  - G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
  - H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
    1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
    2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
  - I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.3 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Division 09 "Painting".

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- B. 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.
- C. 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.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. 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 (20 MPa).

## **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 (1 mm) 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.

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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. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## **2.5 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. 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.
1. Fabricate units from slotted channel framing where indicated.
  2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

## **2.6 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.

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1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

## **2.7 METAL BOLLARDS**

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Prime bollards with zinc-rich primer.

## **2.8 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.

## **2.9 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.

## **2.10 FINISHES, GENERAL**

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## **2.11 STEEL AND IRON FINISHES**

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M 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 Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  1. Shop prime with universal shop primer.

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- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. 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.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## **2.12 ALUMINUM FINISHES**

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

## **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.



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- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
  2. Extruded Aluminum: Two coats of clear lacquer.

### **3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

### **3.3 INSTALLING METAL BOLLARDS**

- A. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and  $\frac{3}{4}$  inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

### **3.4 INSTALLING BEARING AND LEVELING PLATES**

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### **3.5 ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

**END OF SECTION 05 50 00**

## **SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Wood blocking and nailers.
  2. Wood furring .
  3. Wood sleepers.
  4. Utility shelving.
  5. Plywood backing panels.

#### **1.2 DEFINITIONS**

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
  4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

#### **1.4 INFORMATIONAL SUBMITTALS**

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

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1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

## **1.5 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## **PART 2 - PRODUCTS**

### **2.1 WOOD PRODUCTS, GENERAL**

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

### **2.2 WOOD-PRESERVATIVE-TREATED MATERIALS**

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
  1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

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- D. Application: Treat items indicated on Drawings, and the following:
1. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

## **2.3 FIRE-RETARDANT-TREATED MATERIALS**

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
1. Treatment shall not promote corrosion of metal fasteners.
  2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
1. Plywood backing panels.

## **2.4 MISCELLANEOUS LUMBER**

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
  2. Nailers.
  3. Furring.
  4. Grounds.
  5. Utility shelving.

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- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Mixed southern pine or southern pine; SPIB.
  - 3. Spruce-pine-fir; NLGA.
  - 4. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
- C. Utility Shelving: Lumber with 19 percent maximum moisture content of any of the following species and grades:
  - 1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  - 2. Mixed southern pine or southern pine No. 2 grade; SPIB.
- D. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:
  - 1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
  - 2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
  - 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 grade; NeLMA, NLGA, WCLIB, or WWPA.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

## **2.5 PLYWOOD BACKING PANELS**

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

## **2.6 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.

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- C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5 or stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## **2.7 METAL FRAMING ANCHORS**

- A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
  - 1. Use for wood-preservative-treated lumber and where indicated.

## **2.8 MISCELLANEOUS MATERIALS**

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

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

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- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
- I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### **3.2 WOOD BLOCKING AND NAILER INSTALLATION**

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

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### **3.3 WOOD FURRING INSTALLATION**

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

### **3.4 PROTECTION**

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

**END OF SECTION 06 10 53**



## **SECTION 06 64 00 - PLASTIC PANELING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Plastic sheet paneling.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

#### **1.3 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

#### **2.2 PLASTIC SHEET PANELING**

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
  - 1. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 200 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 2. Nominal Thickness: Not less than 0.075 inch.

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3. Size: Provide panels in lengths sufficient to install in one piece from floor to ceiling, without horizontal seams.
4. Surface Finish: Smooth.
5. Color: White.

## **2.3 ACCESSORIES**

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
  1. Color: White.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Adhesive: As recommended by plastic paneling manufacturer.
- D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- C. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
  1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
  2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

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### **3.3 INSTALLATION**

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

**END OF SECTION 06 64 00**

## **SECTION 07 21 00 - THERMAL INSULATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Extruded polystyrene foam-plastic board.

B. Related Requirements:

1. Section 07 21 30 "Metal Building System Insulation" for thermal insulation for pre-engineered metal building.
2. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
3. Section 13 34 19 "Metal Building Systems" for pre-engineered metal building system.

#### **1.2 ACTION SUBMITTALS**

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

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
  2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
  3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

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## **PART 2 - PRODUCTS**

### **2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD**

- A. Extruded Polystyrene Board, Type VI Slab Insulation: ASTM C 578, Type VI, 40-psi minimum compressive strength; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- B. Acceptable manufacturers include, but are not limited to, the following:
  - 1. DiversiFoam Products.
  - 2. Dow Chemical Company.
  - 3. Owens Corning.

### **2.2 ACCESSORIES**

- A. Insulation for Miscellaneous Voids:
  - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
  - 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### **3.2 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

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- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### **3.3 INSTALLATION OF SLAB INSULATION**

- A. On foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

### **3.4 PROTECTION**

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

**END OF SECTION 07 21 00**

## **SECTION 07 21 30 – METAL BUILDING SYSTEM INSULATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Pre-engineered metal building insulation system.
- B. Related Requirements:
  - 1. Section 13 34 19 “Metal Building Systems”.

#### **1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site, in conjunction with conference for Metal Building System.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Manufacturers’ data sheets for each product to be used, marked to indicate compliance with requirements.
  - 2. Roof installation instructions.
  - 3. Wall installation instructions.
- B. Shop Drawings: Indicate:
  - 1. Liner fabric layout.
  - 2. Strap system layout.
  - 3. Locations of attachments and connections, general details, anchorages, seam and perimeter details, and details required for a complete installation.
- C. Samples for Verification: For each finished product specified, minimum 6” x 6”.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Manufacturers’ Certificate: Certify products meet or exceed specified requirements.
- B. Sample Warranties: For insulation system components.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For cleaning and repair of vapor barrier fabric.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A company specializing in manufacturing product systems as specified in this section with minimum five years documented experience.
- B. Installer Qualifications: A company specializing in performing work as specified in this section with minimum five years documented experience.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Unload and store products indoors and protect from moisture and damage.
- B. Store products in manufacturers' unopened packaging until ready for installation.

## **1.8 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when weather conditions permit products to be installed according to manufacturers' written instructions and warranty requirements.

## **1.9 WARRANTY**

- A. Warranty on insulation system components:
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. 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. Thermal Design, Inc.; Simple Saver System.
  - 2. Owens Corning Insulating Systems, LLC; OptiLiner Banded Liner System.
- B. Source Limitations: Use only insulation system components approved by the system manufacturer.



## 2.2 SYSTEM DESCRIPTION

- A. A complete insulation system designed for pre-engineered metal building. System shall include batt insulation, vapor barrier/liner fabric, thermal breaks (roof and wall), straps, tapes, fasteners and other components for a complete system.
- B. In addition to perimeter exterior walls, provide Liner Fabric on both sides of framed, interior 8" wall between Maintenance Bay and remainder of building, along Column Line 2.

## 2.3 PERFORMANCE REQUIREMENTS

- A. Thermal Performance for Opaque Elements: Thermal performance shall comply with the requirements of ASHRAE 90.1-2010. Provide either the following maximum U-factors or the minimum R-values when tested according to ASTM C 1363 or ASTM C 518:
  - 1. Roof:
    - a. U-Factor: 0.055, max.
    - b. R-Value: R-19 + R-11 liner system, with thermal blocks.
  - 2. Walls:
    - a. U-Factor: 0.084, max.
    - b. R-Value: R-25 liner system, with thermal breaks.

## 2.4 MATERIALS

- A. Unfaced Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; with a flame-spread index of 25 or less.
  - 1. Roof Insulation: Two layers, R-19 plus R-11.
  - 2. Wall Insulation: One layer, R-25.
- B. Vapor Barrier/Liner Fabric: System manufacturers' standard product, complying with the following:
  - 1. ASTM C 1136, Types 1 through Type VI.
  - 2. Water vapor perm rating: not greater than 0.02 perm when tested according to ASTM E 96.
  - 3. Air permeability rating not greater than .004 cfm/sf under pressure differential of 0.3 inches water gauge when tested in accordance with ASTM E 2178.
  - 4. Flame Spread Index of 25 or less and Smoke Developed Index of 50 or less when tested in accordance with ASTM E 84.

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5. Manufactured in large custom pieces by extrusion welding from roll goods and fabricated to substantially fit defined building area with minimum practicable job site sealing.
  - a. Provide with factory double, extrusion welded seams. Stapled seams or heat-melted seams are not acceptable.
  - b. Factory-folded to allow for rapid installation.
6. Color: White.
7. Vapor Barrier Tape: Double sided, pressure-sensitive tape of type recommended by manufacturer for sealing joints and penetrations in vapor barrier.
8. Vapor Barrier Adhesive/Sealant: Manufacturers' standard adhesive for system use.
9. Patch Tape: Single sided, adhesive backed sealant tape 3 inches wide.
10. Metal Straps: Manufacturers' standard product, formed, metallic-coated steel, exposed face colored to match Liner Fabric.
11. Thermal Breaks:
  - a. Walls; closed cell polyethylene foam tape, .125 inches thick x 3 inches wide.
  - b. Roof; thermal spacer blocks, extruded polystyrene, 1 inch thick.
12. Fasteners: Manufacturers' standard, heads colored to match Liner Fabric, with sealing washers.
13. Wall Insulation Hangers: Manufacturers' standard product to support batt insulation in wall cavity.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that building structure including all bracing and any concealed building systems are completed and accepted prior to installing liner system and insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. General:
  1. Install insulation system in strict compliance with manufacturers' installation instructions and approved shop drawings.
  2. Prepare surfaces using methods recommended by the manufacturer.
  3. Install in exterior spaces without gaps or voids. Trim insulation neatly to fit spaces. Do not compress insulation. Insulate miscellaneous gaps and voids.
  4. Fit insulation tight around mechanical and electrical services within plane of insulation.
- D. Roof Insulation Installation.

1. Straps: Install straps in the pattern and spacings per shop drawings, tension to required value.
2. Vapor barrier fabric:
  - a. Install fabric in one-piece custom fabricated pieces to fit defined building areas with minimum practicable job site sealing.
  - b. Install fabric in accordance with manufacturers' instructions.
  - c. Trim edges and seal along structural frames.
  - d. All seams must be completely sealed. Any seam shall be located over a continuous framing member and shall be continuously secured with a metal strap and tape.
3. Insulation:
  - a. Place insulation in two layers at the required thickness for the R-value specified.
  - b. Place base layer between purlins on the vapor barrier fabric without gaps or voids.
  - c. Place top layer over and perpendicular to the purlins without gaps or voids, as roof panels are installed.
  - d. Place thermal blocks on top of purlins.
4. Seal roof fabric to the wall fabric, structural framing members and elsewhere as required to provide continuous vapor barrier.

E. Wall Insulation Installation.

1. Insulation, exterior walls:
  - a. Install thermal break to exterior surface of girts as wall panels are applied.
  - b. Install insulation hangers in accordance with manufacturers' instructions.
  - c. Cut insulation to fit between girts and install to hangers.
  - d. Fill all voids completely with insulation, at the required thickness for the R-value specified.
2. Vapor barrier fabric:
  - a. Install fabric in one-piece custom fabricated pieces to fit defined building areas with minimum practicable job site sealing.
  - b. Install fabric in accordance with manufacturers' instructions.
  - c. Secure fabric at roof by lapping over eave strap and installing fasteners through eave strap to each roof strap, permanently clamping the wall fabric in place.
  - d. Secure fabric at base with horizontal strap fastened to base angle.
  - e. Install vertical straps along each column and at spacing required by manufacturer, but not greater than 5'-0".
  - f. All seams must be completely sealed. Any seam shall be located over a continuous framing member and shall be continuously secured with a metal strap.
  - g. Install straps continuous around the perimeter of any framed wall opening or penetration, to secure wall fabric.
  - h. In addition to exterior walls, install fabric over both sides of interior, 8" framed wall along Column Line 2. Wall framing and insulation by others.

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3. Seal wall fabric to the roof fabric, to the base angle, structural framing members, around openings and penetrations, and as required to provide continuous vapor barrier.

### **3.2 CLEANING AND PROTECTION**

- A. Protect system products until completion of installation. Repair or replace damaged products before completion of installation.
- B. Clean dirt or exposed sealant from exposed face of vapor barrier fabric.
- C. Remove scraps and debris from job site.

**END OF SECTION 07 21 30**

## **SECTION 07 26 00 - VAPOR RETARDER FACINGS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Fire-retardant, reinforced vapor retarders for exposed use as insulation liner/facing.
  - 2. Accessories.
- B. Related Requirements:
  - 1. Section 07 12 30 "Metal Building System Insulation".
  - 2. Section 09 29 00 "Gypsum Board" for acoustic insulation installed in framed walls.

#### **1.2 ACTION SUBMITTALS**

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

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

### **PART 2 - PRODUCTS**

#### **2.1 FIRE-RETARDANT, REINFORCED VAPOR RETARDERS**

- A. Fire-Retardant, Vapor Retarder Facing: Sheet with outer layers of film laminated to an inner reinforcing layer and weighing not less than 14 lb/1000 sq. ft., with maximum permeance rating of 0.021 perm.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Lamtec WMP-VR-R Plus or a comparable product by one of the following, or other approved manufacturers:
    - a. Raven Industries.
    - b. Reef Industries.
  - 2. Facing: Lamtec WMP-VR-R PLUS.

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- a. Composition: 0.0015 inch white polypropylene film, reinforcing layer, and 0.0005 inch metallized polyester film.
  - 1) Reinforcement: 4x4 tri-directional fiberglass scrim.
  - 2) Color: White.
- b. Performance:
  - 1) Water Vapor Permeance: 0.02 perm per ASTM E 96, Procedure A.
  - 2) Mullen Burst: 100 psi
  - 3) Tensile Strength: 35 lbs/inch in the machine direction and 35 lbs/inch in the cross-machine direction.
- c. Compliance: ASTM C 1136; ASTM C 991; ASTM E 84; ASTM E 96; ASTM C 1258; ASTM C 1338; and UL 723.

## 2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with sealing washers. Color to match facing.
- D. Metal Straps: Grade 50 Structural Steel per ASTM C 653. 1" wide x .020" x continuous length. Galvanized, primed and painted on the exposed side. Color; white.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

### 3.2 INSTALLATION OF VAPOR RETARDER FACING ON FRAMING

- A. Place vapor retarder facings on all framed walls where glass fiber insulation is not concealed by gypsum board or plywood sheathing. Facing is to be placed on walls where concealed by metal liner panels.
- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, and metal straps. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation. Install continuous from base of wall to top of wall, with no horizontal seams.

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- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. Secure facing at roof with horizontal metal strap at wall head track. Secure at wall base with horizontal metal strap at wall sill track.
- E. Secure facing with metal straps vertically along each column, at vertical seams, and spaced at 4'-0" o.c., max.
- F. Seal wall facing to the roof facing, to the base sill track, structural framing members, around openings and penetrations, and as required to provide continuous vapor barrier.
- G. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- H. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### **3.3 PROTECTION**

- A. Protect vapor retarder facings from damage until completion of installation. Clean dirt and stains from exposed face.

**END OF SECTION 07 26 00**

## **SECTION 07 72 53 - SNOW GUARDS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Rail-type, seam-mounted snow guards for use on Metal Building System standing-seam metal roof panels.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.
- B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
1. Include details of rail-type snow guards.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each type of snow guard, for tests performed by manufacturer and witnessed by a qualified testing agency.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
1. Temperature Change: 120 deg Fambient; 180 deg Fmaterial surfaces.
- B. Structural Performance:
1. Snow Loads: As indicated on Drawings.



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## 2.2 RAIL-TYPE SNOW GUARDS

### A. Seam-Mounted, Rail-Type Snow Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Alpine SnowGuards, a division of Vermont Slate & Copper Services, Inc.
  - b. LMCurbs.
  - c. S-5! Attachment Solutions; Metal Roof Innovations, Ltd.
  - d. Sno-Gem, Inc.
  - e. Snow Management Systems.
  - f. TRA SNOW & SUN, INC.
2. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with two rails.
  - a. Basis of Design: Sno-Gem, 1" Bar Gem Clamp with MEC Bracket:
    - 1) Rails to be 1" round or square, manufacturer's standard.
    - 2) Brackets to be attached with non-penetrating set screws.
3. Accessories: Provide Sno-Gem, Barricade Plate, to prevent ice and snow from passing below rails.
4. Material and Finish: Aluminum; mill.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
  1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean and prepare substrates for bonding snow guards.
- B. Prime substrates according to snow guard manufacturer's written instructions.

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### **3.3      INSTALLATION**

- A.    Install snow guards according to manufacturer's written instructions.
  
- B.    Attachment for Standing-Seam Metal Roofing:
  - 1.    Do not use fasteners that will penetrate metal roofing, or fastening methods that void metal roofing finish warranty.
  - 2.    Seam-Mounted, Rail-Type Snow Guards: Stainless-steel or aluminum clamps attached to vertical ribs of standing-seam metal roof panels.

**END OF SECTION 07 72 53**

## **SECTION 07 92 00 - JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Silicone joint sealants.
  - 2. Nonstaining silicone joint sealants.
  - 3. Urethane joint sealants.
  - 4. Mildew-resistant joint sealants.
  - 5. Butyl joint sealants.
  - 6. Latex joint sealants.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified testing agency.
- B. Sample Warranties: For special warranties.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

#### **1.5 FIELD CONDITIONS**

- A. Do not proceed with installation of joint sealants under the following conditions:

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1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## **1.6 WARRANTY**

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  2. Disintegration of joint substrates from causes exceeding design specifications.
  3. Mechanical damage caused by individuals, tools, or other outside agents.
  4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## **PART 2 - PRODUCTS**

### **2.1 JOINT SEALANTS, GENERAL**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

### **2.2 NONSTAINING SILICONE JOINT SEALANTS**

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

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- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

### **2.3 URETHANE JOINT SEALANTS**

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
- C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.

### **2.4 MILDEW-RESISTANT JOINT SEALANTS**

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

### **2.5 LATEX JOINT SEALANTS**

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

### **2.6 BUTYL JOINT SEALANTS**

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

### **2.7 JOINT-SEALANT BACKING**

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## **2.8 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.

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3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Plastic paneling.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

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- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### **3.4 CLEANING**

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### **3.5 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### **3.6 JOINT-SEALANT SCHEDULE**

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Joints between concrete foundation walls and paving materials.
    - c. Joints between different materials listed above.
    - d. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, M, P, 50, T, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.



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- b. Joints between metal panels.
    - c. Joints between different materials listed above.
    - d. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    - e. Control and expansion joints in ceilings and other overhead surfaces.
    - f. Other joints as indicated on Drawings.
  2. Joint Sealant: Silicone, nonstaining, S, NS, 100/50, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
  1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Other joints as indicated on Drawings.
  2. Joint Sealant: Urethane, S, P, 25, T, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
  1. Joint Locations:
    - a. Vertical joints on exposed surfaces of concrete.
    - b. Other joints as indicated on Drawings.
  2. Joint Sealant: Urethane, S, NS, 25, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
  1. Joint Locations:
    - a. Joints between metal panels.
    - b. Perimeter joints between metal panels/trim and frames of doors, windows and louvers.
    - c. Other joints as indicated on Drawings.
  2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

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1. Joint Locations:
    - a. Control/expansion joints in gypsum board.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    - c. Perimeters of gypsum board ceilings and soffits.
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Acrylic latex.
  3. Joint-Sealant Color: White and paintable.
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Plastic paneling joints.
    - c. Joints between countertops and backsplashes and between countertops/walls and backsplashes/walls.
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
  3. Joint-Sealant Color:
    - a. White for all china plumbing fixtures and at plastic paneling joints.
    - b. Clear between countertops, backsplashes and walls.
- H. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
    - a. Aluminum thresholds.
    - b. Sill plates.
    - c. Other joints as indicated on Drawings.
  2. Joint Sealant: Butyl-rubber based.
  3. Joint-Sealant Color: Gray.

**END OF SECTION 07 92 00**

## **SECTION 081113 - HOLLOW METAL DOORS AND FRAMES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes hollow-metal work.
- B. Related Requirements:
  - 1. Section 087100 "Door Hardware".

#### **1.2 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

#### **1.3 COORDINATION**

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate modifications to existing hollow metal frames and/or doors which are to receive new hardware/doors.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.
  - 7. Details of accessories.

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8. Details of moldings, removable stops, and glazing.
  9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Subject to compliance with requirements, provide products by one of the following, or an approved equivalent:
  1. Amweld International, LLC.
  2. Ceco Door Products; an Assa Abloy Group company.
  3. Curries Company; an Assa Abloy Group company.
  4. Hollow Metal Inc.
  5. Karpen Steel Custom Doors & Frames.
  6. Mesker Door Inc.
  7. MPI Group, LLC (The).
  8. Premier Products, Inc.
  9. Republic Doors and Frames.
  10. Steelcraft; an Ingersoll-Rand company.

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- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

## 2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

## 2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- A. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
  - 1. Physical Performance: Level B according to SDI A250.4.
  - 2. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.042 inch.
    - d. Edge Construction: Model 2, Seamless.
    - e. Core: One of the following; Polystyrene, Polyurethane or Polyisocyanurate.
  - 3. Frames:
    - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
    - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
    - c. Construction: Full profile welded.
  - 4. Exposed Finish: Prime.

## 2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.

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1. Physical Performance: Level B according to SDI A250.4.
2. Doors:
  - a. Type: As indicated in the Door and Frame Schedule.
  - b. Thickness: 1-3/4 inches.
  - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
  - d. Edge Construction: Model 2, Seamless.
  - e. Core: Manufacturer's standard polystyrene, polyurethane, or polyisocyanurate core at manufacturer's discretion.
    - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
3. Frames:
  - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
  - b. Construction: Full profile welded.
4. Exposed Finish: Prime.

## 2.5 BORROWED LITES

- A. Hollow-metal frames of metallic-coated steel sheet, minimum thickness of 0.042 inch.
- B. Construction: Full profile welded.

## 2.6 FRAME ANCHORS

- A. Jamb Anchors:
  1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
  3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
  1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

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## 2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Glazing: Comply with requirements in Section 088000 "Glazing."

## 2.8 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
  - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
  - 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
  - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
  - 4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
  - 5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.

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6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
    - b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
    - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.



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1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## **2.9 STEEL FINISHES**

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## **2.10 ACCESSORIES**

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

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- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
  - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
  - 4. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  - 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Steel Doors:

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- a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
  - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
  - c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
  - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

### **3.4 ADJUSTING AND CLEANING**

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

**END OF SECTION 081113**

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## **SECTION 08 31 13 - ACCESS DOORS AND FRAMES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Access doors and frames for walls.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

#### **2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - 1. Access Panel Solutions.
  - 2. Acudor Products, Inc.
  - 3. Alfab, Inc.
  - 4. Babcock-Davis.
  - 5. Cendrex Inc.
  - 6. Jensen Industries; Div. of Broan-Nutone, LLC.
  - 7. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
  - 8. Larsen's Manufacturing Company.
  - 9. Maxam Metal Products Limited.
  - 10. MIFAB, Inc.
  - 11. Milcor Inc.
  - 12. Nystrom, Inc.
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

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C. Flush Access Doors with Exposed Flanges:

1. Basis-of-Design Product: Milcor, Style M, Model 3202-034.
2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Wall.
4. Door Size: 24" W x 36" H.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
  - a. Finish: Factory finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Latch.

D. Hardware:

1. Latch: Cam latch operated by screwdriver.

## 2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

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## **2.5 FINISHES**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
  - 1. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

### **3.2 ADJUSTING**

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

**END OF SECTION 08 31 13**

## **SECTION 08 51 13 - ALUMINUM WINDOWS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes aluminum windows for exterior locations.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Shop Drawings: For aluminum windows.
  - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.
- D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.
- B. Sample Warranties: For manufacturer's warranties.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

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## 1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
    - c. Faulty operation of movable sash and hardware.
    - d. Deterioration of materials and finishes beyond normal weathering.
    - e. Failure of insulating glass.
  2. Warranty Period, minimum:
    - a. Window: **10** years from date of Substantial Completion.
    - b. Glazing Units: **10** years from date of Substantial Completion.
    - c. Aluminum Finish: **10** years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

### 2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Window Certification: AAMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
1. Minimum Performance Class: AW.
  2. Minimum Performance Grade: 50.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor: 0.45 Btu/sq. ft. x h x deg F.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40.
- E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a minimum CRF of 45.



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- F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F ambient; 180 deg F material.
- G. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
- H. Outside-Inside Transmission Class (OITC): Rated for not less than 30 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

### 2.3 ALUMINUM WINDOWS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide EFCO Series HX32/Series FX32 with subsill extension (Manufacturers standard or break metal to match conditions). Acceptable manufacturers include, but are not limited to:
  - 1. Columbia.
  - 2. Kawneer North America; an Alcoa company
  - 3. Lexcam.
  - 4. Thermal Windows, Inc.
  - 5. Tubelite.
  - 6. Winco.
  - 7. YKK AP America Inc.
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
  - 1. Single hung.
  - 2. Fixed.
- C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
  - 1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- D. Insulating-Glass Units: ASTM E 2190.
  - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.
  - 2. Lites: Two.

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3. Overall Unit Thickness: 1 inch.
  4. Minimum Thickness of Each Glass Lite: 6 mm.
  5. Outdoor Lite: Tinted fully tempered float glass.
  6. Tint Color: Gray.
  7. Interspace Content: Argon.
  8. Indoor Lite: Fully tempered float glass.
  9. Low-E Coating: Pyrolytic or sputtered on second or third surface.
  10. Visible Light Transmittance: 40 percent minimum.
- E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal. Sashes shall be "inside glazed" allowing for replacement from the building interior.
- F. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- G. Hung Window Hardware:
1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
  2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
  3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
- H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

## 2.4 ACCESSORIES

- A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.
- B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

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## 2.5 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
  - 1. Type and Location: Half, outside for single-hung sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
  - 1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
- C. Glass-Fiber Mesh Fabric: 18-by-14 or 18-by-16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656/D 3656M.
  - 1. Mesh Color: Manufacturer's standard.

## 2.6 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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## **2.8 ALUMINUM FINISHES**

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 50 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from full range of industry colors and color densities.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

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### **3.3 ADJUSTING, CLEANING, AND PROTECTION**

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
  - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

**END OF SECTION 08 51 13**

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## **SECTION 08 71 00 - DOOR HARDWARE**

### **PART 1 GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Hardware for swinging Hollow Metal Door Openings.
- B. Related Sections:
  - 1. Section 08 11 13 – Hollow Metal Doors and Frames

#### **1.02 REFERENCES**

- A. Use the following references to properly detail, schedule, furnish and install finish hardware items.
  - 1. NFPA 80 – Standard for Fire Doors and Other Opening Protectives (2007)
  - 2. DHI Installation Guide for Doors and Hardware (1984)
  - 3. DHI Sequence and Format for the Hardware Schedule (1996)
  - 4. ANSI/BHMA A156.4 – Door Controls – Closers (2013)
  - 5. ANSI/BHMA A156.2 – Bored and Preassembled Locks and Latches (2011)
  - 6. ANSI/BHMA A156.18 – Materials and Finishes (2012)

#### **1.03 SUBMITTALS**

- A. Schedule:
  - 1. Provide submittals in accordance with General and Supplemental Conditions.
  - 2. Provide hardware schedule in vertical format on 8-1/2-inch by 11-inch paper or electronic format. Conform to DHI publication Sequence and Format for Hardware Schedule using Architect's door numbers and hardware set numbers.
- B. Product Data: Provide one set of manufacturer's catalog and technical data for each hardware item used, highlighting design, function, fasteners, accessories, and options to facilitate review with each hardware schedule submitted.
- C. Templates: Provide two sets of manufacturer's templating information for mortised and template hardware upon receipt of approved hardware schedule to the door and frame supplier(s). Include requirements for internal reinforcements required for surface mounted hardware.
- D. Keying Schedule: Arrange meeting with Owner, Architect and finish hardware supplier to determine keying requirements immediately upon receipt of finish hardware schedule.

#### **1.04 CLOSEOUT SUBMITTALS**

- A. Furnish operations and maintenance manual in accordance with General and Supplemental Conditions and as follows:

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1. Furnish one copy of manual at date of Substantial Completion in a 2-1/2-inch thick binder labeled with project information, date and name and contact information for the hardware supplier.
2. Include in manual:
  - a. Copy of approved hardware schedule, including door numbers and locations. Highlight fire rated door to aid in annual fire door inspection.
  - b. Copy of approved keying schedule.
  - c. Catalog data for each product.
  - d. Parts list for locksets, exit devices, and door closers.
  - e. Installation templates and instructions.
  - f. Warranty information.
  - g. Name, address, and phone number of local representatives for each manufacturer.

#### **1.05 MAINTENANCE MATERIAL SUBMITTALS**

##### **A. Extra Materials:**

1. Screws and Fasteners: Fifty of each screw and fastener required for general maintenance of hinges, locks, closers, exit devices, and sealing systems.
2. Deliver to Owner remaining finish hardware fasteners and special installation tools upon completion of Project.

#### **1.06 QUALITY ASSURANCE**

##### **A. Supplier:**

1. Furnish hardware from recognized supplier who has warehousing facility within 150 miles of project location, and who has actively supplied hardware for similar projects in the vicinity for a minimum of five years.
2. Supplier shall employ an Architectural Hardware Consultant (AHC), as certified by Door and Hardware Institute, on staff full time to administer and supervise project.

**B. Installer:** Install hardware using installers who have actively installed commercial door hardware for a minimum of five years, and are familiar with hardware installation of type required on this Project.

##### **C. Pre-Installation Meeting:**

1. Prior to installation of hardware, arrange for manufacturer's representatives of locksets, door closers, and exit devices to hold a jobsite meeting to instruct the installing personnel on the proper installation of their products.
2. Send a letter of compliance, indicating when this meeting was held, and who was in attendance, to the Architect and Owner.

##### **D. Fire Rated Door Openings:**

1. Comply with NFPA 80.
2. Furnish nationally recognized testing agency label or stamp on hardware for labeled openings.

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3. Only labeled locks or latches or fire exit hardware can be used on fire rated openings.
4. Where UL requirements conflict with Drawings or Specifications, furnish hardware conforming to the UL requirements.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

#### **A. Delivery:**

1. Jointly check in hardware, upon delivery to jobsite, against approved hardware schedule with hardware supplier. Record shortage or damage and replace or repair as necessary.
2. Deliver hardware to be installed during fabrication of doors and frames, to manufacturer.

#### **B. Storage:**

1. Store hardware in a secure, dry, temperature controlled room on shelving to protect against loss, theft and damage.
2. Store items too long for shelving on pallet, off the floor.

#### **C. Marking and Packaging:**

1. Deliver hardware to jobsite in manufacturer's original packaging marked to correspond with approved hardware schedule with Architect's door numbers and hardware sets.
2. Mark all locksets, exit devices, cylinders, auxiliary hardware and key switches with keyset symbol.
3. Replace any wet or damaged packaging with new.

### **1.08 WARRANTY**

#### **A. Furnish warranties in accordance with General and Supplemental Conditions.**

Extended or limited warranties shall be as follows:

1. Furnish minimum ten year factory warranty on door closers, against defects in material and workmanship, from date of substantial completion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

#### **A. The following manufacturers are acceptable for use on this project. Provide like items of hardware from one of the manufacturers listed.**

- |                          |                            |
|--------------------------|----------------------------|
| 1. Hinges                | Stanley, Bommer, Hager     |
| 2. Continuous Hinges     | Stanley, ABH, Select       |
| 3. Locks and Latchsets   | Best                       |
| 4. Cylinders and Cores   | Best                       |
| 5. Surface Door Closers  | Stanley, LCN, Norton       |
| 6. Exit Devices          | Von Duprin, Sargent, Dorma |
| 7. Overhead Stop/holders | ABH, Glynn Johnson, Rixson |
| 8. Protection Plates     | Trimco, Burns, Hiawatha    |
| 9. Wall/Floor Stops      | Trimco, Burns, Don-Jo      |



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10. Thresholds and Gasketing  
 11. Silencers

National Guard, Reese, Pemko  
 Trimco, Burns, Hiawatha

- B. Submit requests for substitution in accordance with Instructions to Bidders requirements and as follows:
1. Provide catalog data with product information highlighted or bubbled to facilitate review. Product must meet or exceed level or design intended and/or function established by specified products.

## 2.02 MATERIALS

- A. Screws and Fasteners:
1. Provide manufacturer's recommended fasteners of proper type, material and finish.
  2. Provide self-tapping screws for sweeps and stop applied weatherstripping.
  3. Utilize through-bolts for the attachment of door closers and exit devices on non-reinforced doors only. Finish: match door face.
  4. Exposed screw heads: Phillips-head type.
- B. Hinges:
1. Type:
    - a. Five-knuckle, full mortise, ball bearing.
    - b. Furnish heavy weight hinges on heavy doors and doors expected to have high frequency use.
  2. Quantity:
    - a. One pair of hinges for all doors up to 5 feet high. Furnish one additional hinge for every 2'-6" in height or fraction thereof.
  3. Size:
    - a. For 1-3/4-inch thick doors up to 3 feet wide: 4 1/2-inches high
    - b. For 1-3/4-inch thick doors over 3 feet wide: 5-inches high
    - c. For all doors over 1-3/4-inches thick: 5-inches high
    - d. Size in width shall minimally clear door trim.
  4. Application:
    - a. NRP (non-removable pin) at exterior doors and reverse bevel doors with locking hardware.

5. Acceptable manufacturers and types:

Type	Stanley	Hager	Bommer
Standard Weight	FBB179	BB1279	BB5000
Heavy Weight	FBB168	BB1168	BB5004
Standard Weight	FBB191	BB1191	BB5002
Heavy Weight	FBB199	BB1199	BB5006

- C. Continuous Hinges:
1. Configuration appropriate for type, inset, and thickness of door. Coordinate with door manufacturer.
  2. Meet UL fire label listing requirements at UL rated openings. Include fire pins as required by manufacturer.

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3. Acceptable manufacturers and types:

Door Type	Stanley	ABH	Select
Aluminum	662HD	A240HD	SL24HD

D. Locksets:

1. Cylindrical Locks:

- a. Conform to ANSI/BHMA A156.2, Series 4000 Operational Grade 1.
- b. Latchbolt with appropriate throw for fire rated doors and pairs of doors in accordance with manufacturers listing.
- c. Lock functions as specified in hardware schedule.
- d. Lever design: 15D
- e. Backset: 2-3/4-inch
- f. Strike single door: ANSI 4-7/8-inch with proper lip length to minimally clear trim.
- g. Strike pair of doors: flat lip strike sized to fit flush with face of door.
- h. Furnish wrought strike box.
- i. Acceptable manufacturers and types:

Best
9K Series

2. Cylinders:

- a. Provide mortise and rim cylinders and cores from same manufacturer as locksets for all locksets, exit devices, cylinder dogging, key switches and auxiliary hardware.
- b. Appropriate cam and blocking rings for proper installation.

E. Keys & Keying

1. Cylinders: 7-pin, interchangeable core and keyed into a BEST factory registered Masterkey System.
2. Provide construction cores and keys during construction period. Construction control and operating keys and cores are not part of permanent keying system or furnished on same keyway (or key section) as permanent keying system.
3. Permanent Keys and Cores: Prepare permanent cores and keys in accordance with keying schedule. Provide Masterkeys and other Security Keys.
4. Furnish keys in the following quantities:
  - a. 4 each Masterkeys per new Masterkey set.
  - b. 2 each Change keys each keyed core.
  - c. 4 each Construction masterkeys.
  - d. 2 each Construction Control keys.
5. Permanent cores will be delivered to the Owner for installation.
6. Return construction cores to Hardware Supplier.

F. Exit Devices:

1. UL-listed for fire at fire door assemblies, and UL listed for panic at non-rated door assemblies.
2. Size exit devices to proper door width and height.
3. LBR (less bottom rod) where scheduled to eliminate use of floor mounted strikes.
4. Cylinders for exit devices with cylinder dogging or locking trim.
5. Strike: as recommended by manufacturer.

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6. Lever design: To match lockset trim.
7. Acceptable manufacturers and types:

Von Duprin	Dorma	Sargent
98 Series	9000 Series	19-GL-80 Series

G. Surface Door Closers:

1. Conform to ANSI/BHMA A156.4 Grade 1.
2. Heavy duty cast iron or aluminum body closers.
3. Furnish manufacturers recommended size, arms and configuration for door and frame application required.
4. Furnish brackets, spacers, support shoes, and plates for complete and proper installation.
5. DA (delayed-action) at toilet room doors and as scheduled.
6. Acceptable manufacturers and types:

Stanley	LCN	Norton
CLD-4550 Series	4050 Series	7500 Series

H. Overhead Door Stop:

1. Provide overhead stop or overhead stop/holder for interior doors as specified. Provide overhead stop for interior doors and at any door that swings more than 120 degrees before striking a wall, open against equipment, casework, sidelights, and/or where conditions do not allow a wall stop or a floor stop presents a tripping hazard.
2. Where overhead holders are specified provide friction type at doors without a closer and positive type at doors with a closer.
3. Acceptable manufacturers:

ABH	Rixson	Glynn Johnson
1000SL Series	6 Series	100 Series

I. Protection Plates:

1. Where bottom rail allows, furnish 10-inch high kick plates and 10-inch high mop plates.
2. Material: 0.050-inch thick stainless steel plates with four beveled edges.
3. Width: 2-inch less door width on stop (push) side and 1-inch less door width on face (pull) side.
4. Both sides of doors where specified.
5. Countersink screw heads at wood doors.
6. Acceptable manufacturer and types:

Trimco	Burns	Hiawatha
KO050	KP50	KP

J. Door Stops:

1. Provide convex, cast, wall stops unless turn piece or push button on lockset handle makes contact with stop. Where contact is made provide concave wall stop.
2. Provide wedge type wall stop with push/pull trim.
3. Where wall stops cannot be used, provide dome type floor stops of the proper height.
4. Furnish fastener suitable for wall condition.

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5. Acceptable manufacturers and types:

Type	Trimco	Burns	Don-Jo
Wall-Convex	1270CX	560	1412
Wall-Concave	1270CV	565	1413

K. Thresholds and Gasketing:

1. Thresholds:

- a. Returned closed ends at openings where threshold extends beyond frame face.
- b. Neoprene inserts at panic type thresholds.
- c. Acceptable manufacturers and types:

Type	Pemko	National Guard	Reese
Panic	2005	896	S483A

2. Gasketing:

- a. Rigid jamb weatherstrip with replaceable silicone insert.
- b. Include self-adhesive two-sided tape in addition to manufacturers standard fastener.
- c. Meeting-stile gasketing required at exterior pairs of doors and doors in smoke partitions.
- d. Acceptable manufacturers and types:

Type	Pemko	National Guard	Reese
Rigid	296CR	137S	403C

3. Door Sweep:

- a. Provide door bottom sweep with adjustable screw holes.
- b. Provide sweep with neoprene inserts at exterior out-swing doors.
- c. Acceptable manufacturers and types:

Type	Pemko	National Guard	Reese
Sweep	315CN	200	323A

L. Silencers:

1. Grey rubber silencers with injector tool.
2. Three silencers at single doors and two silencers at pairs.
3. Acceptable manufacturers and types:

Type	Trimco	Burns	Hiawatha
HM Frames	1229A	500	601

## 2.03 KEY CONTROL

- A. Key cabinet: wall mounted with minimum thirty hooks, expandable.
1. One non-removable security tag and one snap-on link duplicate tag per hook.
  2. Furnish tools, instructions sheets and accessories required to complete installation.
  3. Owner/Owner's representative will place keys in cabinet and complete index furnished with key system.
  4. Acceptable manufacturers:

Lund	Telkee	MMF
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## 2.04 FINISHES

- |    |                               |            |                                |
|----|-------------------------------|------------|--------------------------------|
| A. | Conform to ANSI/BHMA A156.18. |            |                                |
| 1. | Exterior Hinges               | 630        | Satin Stainless Steel          |
| 2. | Interior Hinges               | 626 or 652 | Satin Chrome                   |
| 3. | Locks and Latches             | 626        | Satin Chrome                   |
| 4. | Exit Devices                  | 630        | Satin Stainless Steel          |
| 5. | Door Closers                  | 689        | Spray Painted Aluminum         |
| 6. | Push/Pulls                    | 630        | Satin Stainless Steel          |
| 7. | Protection Plates             | 630        | Satin Stainless Steel          |
| 8. | Stops and Holders             | 630        | Satin Stainless Steel          |
| 9. | Thresholds/Gasket             | AL         | Anodized Mil Finished Aluminum |

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify doors and frames are plumb, square, level and true and free from defects that would prevent proper installation of finish hardware.
- B. Verify power is run to doors requiring electrified hardware.
- C. Wash down masonry walls and complete painting and staining of doors and frames prior to installation of hardware.
- D. Complete finish flooring at doorways.
- E. Correct conditions that inhibit a proper installation before continuing with work.

### 3.02 INSTALLATION

- A. Install hardware in compliance with the DHI publication, Installation Guide for Doors and Hardware.
- B. Drill and countersink items not factory prepared for fasteners.
- C. Mount closers on room-side of corridor doors, inside of exterior doors, and stair-side of stairway doors. Use necessary arms, brackets, spacers and plates to accommodate auxiliary hardware and special applications.
- D. Install fire door assemblies to maintain clearances at door edge to frame and meeting edge of pairs of doors in compliance with NFPA 80, providing 1/8-inch clearance at the hinge edge, lock edge, head and between pairs. Provide maximum 3/4-inch undercut at door bottom. Where panic thresholds are used, undercut door to allow 1/8-inch clearance between door and threshold.
- E. Trim, cut, and notch thresholds and saddles neatly to minimally fit the profile of the door frame. Set thresholds in bed of mastic sealant, forming tight seal between threshold and surface to which set.

- F. Use only fasteners furnished by manufacturer for installation as recommended by manufacturer.
- G. Install blocking material for all wall mounted door stops at height appropriate to contact door trim.
- H. Install weather-strip prior to installation of door closers and exit devices. Do not cut or notch weather-strip.

### **3.03 FIELD QUALITY CONTROL**

- A. Verify doors open and close smoothly without rubbing or catching and have positive latching where scheduled. Verify fire rated doors are installed with clearances in compliance with NFPA 80.
- B. Test electrified hold open devices tied into fire alarm system to confirm release upon activation of fire alarm. Test electrified hardware and access control to verify systems operate as directed in mode of operation. Where hardware is found to be inoperable, repair or replace with new.

### **3.04 ADJUSTING AND CLEANING**

- A. Upon substantial completion, make final adjustments to door closers and other items of hardware after balance of heating and ventilating equipment to ensure doors close and latch properly.
- B. Clean and polish all exposed hardware surfaces in accordance with manufacturer's recommended procedures.
- C. Clean or repair pencil or tool marks from adjacent surfaces damaged or soiled by work of this Section.
- D. Recycle cardboard boxes and paper products used in packaging and transport of finish hardware.

### **3.05 PROTECTION**

- A. Remove hardware prior to painting or finishing door and frame. Wrap or mask exposed hardware that cannot be removed until date of substantial completion to avoid exposure to paint, solvents, and abuse.
- B. Repair or replace hardware damaged during construction at least two weeks prior to date of substantial completion.

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### 3.06 SCHEDULES

- A. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
- B. Where items of hardware aren't definitely or correctly specified, are required for completion of the Work, a written statement of such omission, error, or other discrepancy to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

#### SET #01 - Exterior

Doors: 01

1 Continuous Hinge	662HD UL EPT	AL	ST
1 Exit Device	HD-QEL-98-NL x 990NL	630	VO
1 Rim Cylinder	12E-72 STD	626	BE
1 Power Supply	PS902-RS		VO
1 Power Transfer	EPT-2		VO
1 Door Closer w/Stop	CLD-4550 CS SN	689	SD
1 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
1 Gasketing	137 NA		NA
1 Door Sweep	200 NA		NA
1 Threshold	425HD 1/4-20 MS/LA	AL	NA

Exit device with latch retraction by access control or key override. Dogging by hex key or latch retraction. Access control device, control board and power supply provided by Others.

#### SET #01.1 - Exterior

Doors: 09, 13, 14

1 Continuous Hinge	662HD UL	AL	ST
1 Exit Device	98-DT x 990DT	630	VO
1 Door Closer w/Stop	CLD-4550 CS SN	689	SD
1 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
1 Gasketing	137 NA		NA
1 Door Sweep	200 NA		NA
1 Threshold	425HD 1/4-20 MS/LA	AL	NA

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### SET #02 - Office

Doors: 02, 03

3 Hinges	FBB179 4 1/2 X 4 1/2	26D	ST
1 Office Lockset	9K3-7AB15D STD LM S3	626	BE
1 Convex Wall Bumper	1270CX	626	TR
1 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
1 Kick Plate	KO050 10" x 1" LDW B4E	630	TR
3 Door Silencers	1229A	GREY	TR

### SET #03 – Restroom/Shower

Doors: 04

3 Hinges	FBB191 4 1/2 X 4 1/2	26D	ST
1 Privacy Set	9K3-0L15D S3	626	BE
1 Door Closer	CLD-4551 STD SN SRI	689	SD
1 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
1 Kick Plate	KO050 10" x 1" LDW B4E	630	TR
1 Concave Wall Bumper	1270CV	626	TR
3 Door Silencers	1229A	GREY	TR

### SET #04 – Restroom

Doors: 06, 07

3 Hinges	FBB179 4 1/2 X 4 1/2	26D	ST
1 Privacy Set	9K3-0L15D S3	626	BE
1 Door Closer	CLD-4551 STD SN	689	SD
1 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
1 Kick Plate	KO050 10" x 1" LDW B4E	630	TR
1 Concave Wall Bumper	1270CV	626	TR
3 Door Silencers	1229A	GREY	TR

### SET #05 - Closet

Doors: 05

3 Hinges	FBB179 4 1/2 X 4 1/2	26D	ST
1 Passage Set	9K3-0N15D S3	626	BE
1 Convex Wall Bumper	1270CX	626	TR
3 Door Silencers	1229A	GREY	TR



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### SET #06 - Mechanical

Doors: 08

3 Hinges	FBB179 4 1/2 X 4 1/2 NRP	26D	ST
1 Classroom Lockset	9K3-7R15D STD LM S3	626	BE
1 Door Closer	CLD-4551 H-EDA SN	689	SD
1 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
1 Convex Wall Bumper	1270CX	626	TR
3 Door Silencers	1229A	GREY	TR

### SET #07 - Maintenance Bay

Doors: 11, 12

3 Hinges	FBB191 4 1/2 X 4 1/2 NRP	26D	ST
1 Classroom Lockset	9K3-7R15D STD LM S3	626	BE
1 Door Closer w/Stop	CLD-4550 CS SN	689	SD
1 Kick Plate	KO050 10" x 1" LDW B4E	630	TR
1 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
1 Gasketing	137 NA		NA
1 Door Sweep	200 NA		NA
1 Threshold	425HD 1/4-20 MS/LA	AL	NA

### SET #08 - Storage

Doors: 10

6 Hinges	FBB179 4 1/2 X 4 1/2 NRP	26D	ST
2 Flush Bolt	3917-12	626	TR
1 Classroom Lockset	9K3-7R15D STD LM S3	626	BE
2 Kick Plate	KO050 10" x 2" LDW B4E	630	TR
2 Kick Plate	KO050 10" x 1" LDW B4E	630	TR
2 Floor Stops	1209HA	630	TR
1 Dustproof Strike	3910	630	TR
2 Door Silencers	1229A	GREY	TR

### SET #09 - Overhead Doors

Doors: 15, 16, 17, 18

NOTE: All Hardware by Overhead Door Mfg.

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**SET #10 - Padlock**

Doors: N/A

2 Padlocks	21B722	626	BE
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Provide BEST removable core cylinder. Deliver padlocks to Owner for keying.

**SET #11 – Key Control**

Doors: N/A

1 Key Control System	1200		LUND
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**END OF SECTION 08 71 00**

## **SECTION 08 80 00 - GLAZING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Glass for doors.
  - 2. Glazing sealants and accessories.

#### **1.2 DEFINITIONS**

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.
- E. KBC: Kentucky Building Code.

#### **1.3 COORDINATION**

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

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## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-E coatings.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating glass and glazing sealants, for tests performed by a qualified testing agency.
- D. Sample Warranties: For special warranties.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## **1.8 FIELD CONDITIONS**

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

## **1.9 WARRANTY**

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of

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insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Subject to compliance with requirements, provide products by one of the following manufacturers, or an approved equivalent.
  1. Guardian Industries Corp.
  2. Oldcastle BuildingEnvelope™.
  3. Pilkington.
  4. PPG Industries, Inc.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
  1. Obtain tinted glass from single source from single manufacturer.
  2. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the KBC and ASTM E 1300.
  1. Design Wind Pressures: As indicated on Drawings.
    - a. Wind Design Data: As indicated on Drawings.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

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- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
  2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
  3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
  4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

### 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Glazing Manual."
  2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Provide glass and/or glazing products in compliance with the Kentucky Building Code, whether indicated in the specified products or not.
- C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label complying with the Kentucky Building Code. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.
- E. Thickness: Where glass thickness is indicated, it is a minimum.
- F. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

### 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

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- B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

## **2.5 INSULATING GLASS**

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  - 2. Spacer: Manufacturer's standard spacer material and construction.
  - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## **2.6 GLAZING SEALANTS**

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

## **2.7 GLAZING TAPES**

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 804.3 tape, where indicated.
  - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

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## **2.8 MISCELLANEOUS GLAZING MATERIALS**

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

## **2.9 FABRICATION OF GLAZING UNITS**

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



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### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

### **3.4 TAPE GLAZING**

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### **3.5 GASKET GLAZING (DRY)**

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

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### **3.6 CLEANING AND PROTECTION**

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### **3.7 MONOLITHIC GLASS SCHEDULE**

- A. Glass Type GL-1: Clear fully tempered float glass.
  - 1. Minimum Thickness: 6 mm.
  - 2. Safety glazing required.

### **3.8 INSULATING GLASS SCHEDULE**

- A. Glass Type GL-2: Low-E-coated, tinted insulating glass.
  - 1. Basis-of-Design Product: Guardian, SunGuard High Performance Neutral Gray.
  - 2. Overall Unit Thickness: 1 inch (25 mm).
  - 3. Minimum Thickness of Each Glass Lite: 6 mm.
  - 4. Outdoor Lite: Tinted fully tempered float glass.
  - 5. Tint Color: Gray.
  - 6. Interspace Content: Argon.
  - 7. Indoor Lite: Fully tempered float glass.
  - 8. Low-E Coating: Pyrolytic or sputtered on second or third surface.
  - 9. Winter Nighttime U-Factor: 0.35 maximum.
  - 10. Summer Daytime U-Factor: 0.35 maximum.
  - 11. Visible Light Transmittance: 40 percent minimum.
  - 12. Solar Heat Gain Coefficient: 0.35 maximum.
  - 13. Safety glazing required.

**END OF SECTION 08 80 00**

## **SECTION 092216 - NON-STRUCTURAL METAL FRAMING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
  2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

#### **1.2 ACTION SUBMITTALS**

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

### **PART 2 - PRODUCTS**

#### **2.1 FRAMING SYSTEMS**

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645.
1. Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: 0.033 inch.
    - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure

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above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.033 inch.
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.033 inch.
  - 2. Depth: 7/8 inch unless noted otherwise.
- G. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: 3/4 inch.
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- H. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

## 2.2 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch-wide flanges.
  - 1. Depth: 1-1/2 inches.
- E. Furring Channels (Furring Members):

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1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
  2. Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.033 inch.
    - b. Depth: As indicated on Drawings.
  3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base-Metal Thickness: 0.033 inch.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Grid System.
    - c. USG Corporation; Drywall Suspension System.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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### **3.2 PREPARATION**

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

### **3.3 INSTALLATION, GENERAL**

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, wall-mounted TV brackets or similar construction. See Drawings for all locations.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### **3.4 INSTALLING FRAMED ASSEMBLIES**

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
  - 2. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

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2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- E. Direct Furring:
1. Screw to wood framing.
  2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
  2. Carrying Channels (Main Runners): 48 inches o.c.
  3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.



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- a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

**END OF SECTION 09 22 16**

## **SECTION 092900 - GYPSUM BOARD**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Interior gypsum board.
  2. Sound attenuation blankets.
  3. Accessories.

#### **1.2 ACTION SUBMITTALS**

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

#### **1.3 DELIVERY, STORAGE AND HANDLING**

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### **1.4 FIELD CONDITIONS**

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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## **PART 2 - PRODUCTS**

### **2.1 GYPSUM BOARD, GENERAL**

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### **2.2 INTERIOR GYPSUM BOARD**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or comparable products by a nationally recognized manufacturer:
1. American Gypsum.
  2. CertainTeed Corp.
  3. Georgia-Pacific Gypsum LLC.
  4. Lafarge North America Inc.
  5. National Gypsum Company.
  6. PABCO Gypsum.
  7. Temple-Inland.
  8. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
  2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch, Type X.
  2. Long Edges: Tapered.
  3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

### **2.3 TRIM ACCESSORIES**

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  2. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. Expansion (control) joint.

### **2.4 JOINT TREATMENT MATERIALS**

- A. General: Comply with ASTM C 475/C 475M.

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- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.

## 2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Unfaced Sound Attenuation Blankets (Acoustic Batt Insulation): ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool or rock wool, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

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- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 APPLYING AND FINISHING PANELS, GENERAL**

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide ¼ to ½ inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- H. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
  - 1. Install unfaced blankets in all framed wall construction, full height of wall.
  - 2. Blankets not concealed by gypsum board will be concealed by vapor retarder facings, per Section 072130 and/or Section 072600.
  - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

### **3.3 APPLYING INTERIOR GYPSUM BOARD**

- A. Install interior gypsum board in the following locations:
  - 1. Type X: Horizontal and vertical surfaces unless otherwise indicated.

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2. Moisture- and Mold-Resistant Type: Horizontal and vertical surfaces of toilet rooms and shower rooms.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
  - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners unless otherwise indicated.
  2. LC-Bead: Use at exposed panel edges.

### 3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

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- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

### **3.6 PROTECTION**

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 09 29 00**

## **SECTION 095113 - ACOUSTICAL PANEL CEILINGS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

#### **1.2 ACTION SUBMITTALS**

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

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling 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. Suspended ceiling components.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Size and location of initial access modules for acoustical panels.
  - 4. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Access panels.
  - 5. Perimeter moldings.
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- E. Field quality-control reports.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For finishes to include in maintenance manuals.



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## **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
  - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

## **1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## **1.8 FIELD CONDITIONS**

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and the following:
  - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restrain: Comply with ASTM E 580.
  - 2. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies – Seismic Zones 3 and 4.
  - 3. Kentucky Building Code, current edition.

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- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
  - 2. Smoke-Developed Index: 50 or less.

## 2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
  - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
  - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

## 2.3 ACOUSTICAL PANELS

- A. Basis of Design Product: Subject to compliance with requirements, provide "Fine Fissured" by Armstrong World Industries or comparable product by one of the following:
  - 1. Chicago Metallic Corporation.
  - 2. Celotex.
  - 3. USG Interiors, Inc.
  - 4. CertainTeed Corp.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
  - 1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
  - 2. Pattern: CD (perforated, small holes and fissured).
- C. Color: White.

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- D. LR: Not less than 0.80.
- E. NRC: Not less than 0.70.
- F. CAC: Not less than 35.
- G. Edge/Joint Detail: Square.
- H. Thickness: 3/4 inch.
- I. Modular Size: 24 by 24 inches.
- J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

#### **2.4 METAL SUSPENSION SYSTEMS, GENERAL**

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.
- E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

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## **2.5 METAL SUSPENSION SYSTEM**

- A. Basis of Design Product: Subject to compliance with requirements, provide "Prelude XL" by Armstrong World Industries with Armstrong's Seismic Rx Suspension System (EST-1308) or comparable product by one of the following:
1. Chicago Metallic Corporation.
  2. Celotex.
  3. USG Interiors, Inc.
  4. CertainTeed Corp.
- B. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized according to ASTM A 653/A 653M, G60 coating designation; with prefinished, cold-rolled, 15/16-inch-wide aluminum caps on flanges.
1. Structural Classification: Heavy-duty system.
  2. Face Design: Flat, flush.
  3. Face Finish: Painted white.
  4. Accessories: Provide Seismic Rx components, including BERC clips.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### **3.3 INSTALLATION**

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

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- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  10. (For systems other than Armstrong Seismic Rx) Install seismic struts, stabilizer bars, or other manufacturer's proprietary system components as required to meet Seismic Category D requirements (Zones 3 and 4).
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

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- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. Install panels in a basket-weave pattern.
  - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

### **3.4 CLEANING**

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION 09 51 13**

## **SECTION 096513 - RESILIENT BASE AND ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient molding accessories.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

#### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

#### **1.5 FIELD CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.

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- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## **PART 2 - PRODUCTS**

### **2.1 THERMOPLASTIC-RUBBER BASE**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AB; American Biltrite.
  - 2. Allstate Rubber Corp.
  - 3. Armstrong World Industries, Inc.
  - 4. Burke Mercer Flooring Products, Division of Burke Industries Inc.
  - 5. Flexco.
  - 6. Johnsonite; A Tarkett Company.
  - 7. Mondo Rubber International, Inc.
  - 8. Nora Systems, Inc.
  - 9. Roppe Corporation, USA.
  - 10. VPI, LLC, Floor Products Division.
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
  - 1. Group: I (solid, homogeneous).
  - 2. Style and Location:
    - a. Style B, Cove: All locations as scheduled.
- C. Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed.
- H. Colors: As selected by Architect from full range of industry colors.

### **2.2 VINYL MOLDING ACCESSORY**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.



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2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
  3. Flexco.
  4. Johnsonite; A Tarkett Company.
  5. Musson Rubber Company.
  6. Roppe Corporation, USA.
- B. Description: Vinyl transition strips.
- C. Profile and Dimensions: Provide profile suitable for conditions listed.
1. Resilient sheet/VCT to concrete subfloor.
- D. Locations: Provide transitions strips at all transitions between flooring materials.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

### **2.3 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
1. Adhesives shall have a VOC content of 50 g/L or less.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of resilient products indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

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- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### **3.3 RESILIENT BASE INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 4 inches in length.
    - a. Miter corners to minimize open joints.

### **3.4 RESILIENT ACCESSORY INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

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### **3.5 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

**END OF SECTION 09 65 13**

## **SECTION 09 91 00 - PAINTING**

### **1.1 SUMMARY**

- A. This Section includes, but is not limited to, surface preparation and the application of paint systems on the following interior and exterior substrates:
1. Concrete.
  2. Steel.
  3. Galvanized metal.
  4. Aluminum (not anodized or otherwise coated).
  5. Gypsum board.

### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches square.
  2. Step coats on Samples to show each coat required for system.
  3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

### **1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

### **1.4 EXTRA MATERIALS**

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

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1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

## 1.5 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide Glidden Professional / Devoe Coatings or comparable products by one of the following:
  1. Sherwin-Williams Company (The).
  2. Benjamin Moore & Co.
  3. Coronado Paint.
  4. Porter Paints.
  5. PPG Architectural Finishes, Inc.
  6. Farrell-Calhoun

### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
- B. Colors:
  1. As selected by Architect from manufacturer's full range.
  2. The selection of colors and placement of colors for interior painted surfaces shall be unlimited, allowing for accent walls in rooms and allowing for selection of ultra deep tones.

### 2.3 BLOCK FILLERS

- A. Concrete Masonry Unit Block Filler: Factory formulated heavy body vinyl acrylic interior/exterior block filler.
  1. **(P-1)** Glidden Concrete Coatings Block Filler Interior/Exterior Primer 3010-1200.

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- B. Heavy Duty Concrete Masonry Unit Block Filler: Factory formulated heavy duty acrylic type interior/exterior block filler.
  - 1. **(P-2)** Devoe BLOXFIL 4000 Interior/Exterior Heavy Duty Block Filler.
- C. Epoxy Concrete Masonry Unit Block Filler: High-performance, two-part, chemically cured, waterborne epoxy block filler.
  - 1. **(P-3)** Devoe TRU-GLAZE-WB 4015 High Performance Waterborne Epoxy Block Filler.

## 2.4 MASONRY/HIGH PERFORMANCE PRIMERS

- A. Concrete and Masonry Primer: Premium quality, waterborne acrylic, direct-to-metal/masonry primer.
  - 1. **(P-4)** Devoe DEVFLEX-4020PF Direct to Metal Primer and Flat Finsh.
- B. Concrete and Masonry Primer: High performance, two-package, chemically cured, waterborne epoxy primer.
  - 1. **(P-5)** Devoe TRU-GLAZE-WB-4030 Waterborne Epoxy Primer.

## 2.5 PRIMERS/SEALERS

- A. Interior Latex Primer: Factory formulated professional quality latex primer.
  - 1. **(P-6)** Glidden High Hide Interior Primer Sealer 100-1200.
- B. Interior/Exterior Multi-Purpose Primer: Factory formulated, professional quality acrylic primer.
  - 1. **(P-7)** Glidden GRIPPER Interior/Exterior Primer Sealer 3210-1200.
- C. Exterior Primer: Factory formulated acrylic multi-purpose primer.
  - 1. **(P-8)** Glidden HYDROSEALER Primer Sealer 6001.

## 2.6 METAL PRIMERS

- A. Ferrous Metal Primer: Factory formulated, rust inhibitive, quick drying alkyd type metal primer.
  - 1. **(P-9)** Devoe DEVGUARD 4160 Multi-Purpose Tank and Structural Primer.
- B. Galvanized Metal Primer: Factory formulated, flexible, high-adherent alkyd type galvanized metal primer.

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1. **(P-10)** Devoe DEVGUARD 4120-1000 Multi-Purpose Metal and Galvanized Primer.
- C. Ferrous/Galvanized Metal Primer: High performance, chemically cured, rust-inhibitive epoxy metal primer.
  1. **(P-11)** Devoe DEVRAN 205 Universal Epoxy Primer.

## 2.7 WOOD PRIMERS

- A. Interior Wood Primer: Factory formulated professional quality solvent based wood primer.
  1. **(P-12)** Glidden Woodwork Penetrating Interior Primer Sealer 1120-1200.
- B. Exterior Wood Primer: Factory formulated solvent based exterior primer.
  1. **(P-13)** Glidden Stain Stomper Exterior Primer Sealer 2110-1200.

## 2.8 LATEX PAINTS

- A. Interior Latex (Flat): Factory formulated professional quality interior flat paint.
  1. **(F-1)** Glidden 1210 Ultra-Hide latex flat interior wall paint.
- B. Interior Latex (Eggshell): Factory formulated professional quality interior wall and trim paint.
  1. **(F-2)** Glidden ULTRA-HIDE 150 Interior Eggshell Paint 1412.
- C. Interior Latex (Semigloss): Factory formulated professional quality interior wall and trim paint.
  1. **(F-3)** Glidden ULTRA-HIDE 150 Interior Semi-Gloss Paint 1416.
- D. Exterior (Satin): Superior performance, high quality acrylic exterior finish.
  1. **(F-4)** Glidden FORTIS 450 Exterior Satin Paint 6403.
- E. Exterior (Semigloss): Superior performance, high quality acrylic exterior finish.
  1. **(F-5)** Glidden FORTIS 450 Exterior Semi-Gloss Paint 6407.

## 2.9 ALKYD PAINTS

- A. Interior Alkyd (Eggshell): Factory formulated professional quality interior alkyd finish for walls and trim.

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1. **(F-6)** Glidden Alkyd Eggshell Paint 1512.
- B. Interior Alkyd (Semigloss): Factory formulated professional quality interior alkyd finish for walls and trim.
  1. **(F-7)** Glidden Alkyd Semi-Gloss Paint 1516.
- C. Exterior Alkyd (Semigloss): Factory formulated professional quality exterior alkyd finish for walls and trim.
  1. **(F-8)** Glidden Alkyd Exterior Semi-Gloss Paint 2516.

## 2.10 STAINS / VARNISHES

- A. Wood Stain: Professional quality interior linseed oil resin stain.
  1. **(F-9)** WOOD PRIDE Professional Wood Finishes. Oil-Based Wood-Finishing Semi-Transparent Stain 1700.
- B. Wood Varnish, (Satin): Professional quality interior satin polyurethane finish.
  1. **(F-10)** WOOD PRIDE Professional Wood Finishes. Polyurethane Satin Finish 1902.
- C. Wood Varnish, (Gloss): Professional quality interior gloss polyurethane finish.
  1. **(F-11)** WOOD PRIDE Professional Wood Finishes. Polyurethane Gloss Finish 1908.

## 2.11 DRY FOG/FALL COATINGS

- A. Interior Alkyd Dry Fog/Fall: Factory formulated high-hiding interior dryfall coating.
  1. **(F-12)** Glidden Solventborne Direct-to-Galvanized Metal Interior Flat Dry Fall 1370-1200.

## 2.12 HIGH PERFORMANCE ARCHITECTURAL COATINGS

- A. Waterborne epoxy coating: High performance, two-part chemically-cured waterborne semi-gloss epoxy coating.
  1. **(F-13)** Devoe TRU-GLAZE-WB 4406 Waterborne Epoxy Semi-Gloss Coating.
- B. Waterborne epoxy coating: High performance, two-part chemically-cured tile-like epoxy coating.
  1. **(F-14)** Devoe TRU-GLAZE 4508 High Performance Architectural Epoxy Gloss Coating.



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- C. Acrylic Coating: Premium quality single-part waterborne acrylic semi-gloss high traffic enamel.
  - 1. **(F-15)** Devco DEVFLEX 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
- D. Fire-retardant paint: Class "A" interior water-based flat latex fire retardant paint manufactured in accordance with Federal Specification TT-P-001932 Coating shall "puff-up" (intumesce) in the presence of heat/flame creating a protective foam-like layer that insulates substrate from heat/flame.
  - 1. **(F-16)** Flame-Control Coatings LLC, Flame Control 20-20A intumescent fire-retardant paint.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Concrete: 12 percent.
  - 2. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

#### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

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1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
  2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Aluminum Substrates: Remove surface oxidation.
- H. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- I. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
1. Use applicators and techniques suited for paint and substrate indicated.
  2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  4. Do not use paint over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions detrimental to formation of a durable paint film.
  5. Provide finish coats that are compatible with primers used.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

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- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. The number and coats and film thickness are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as required by the manufacturer.
- E. Minimum coating thickness: Apply paint materials no thinner than the manufacturer's recommended spreading rate to achieve dry film thickness indicated.
- F. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
  - 1. Mechanical Work:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Tanks that do not have factory-applied final finishes.
    - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
    - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
  - 2. Electrical Work:
    - a. Conduit.
    - b. Electrical equipment that is indicated to have a factory-primed finish for field painting.

### **3.4 CLEANING AND PROTECTION**

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

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### 3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
  - 1. Concrete walls/columns: High Performance Architectural Epoxy Coating System.
    - a. Prime Coat: P-5.
    - b. Intermediate Coat: F-13.
    - c. Topcoat: F-13.
- B. Concrete Substrates, Traffic Surfaces:
  - 1. Concrete Floors: High Performance Architectural Coating System.
    - a. First Coat: F-14.
    - b. Topcoat: F-14.
- C. Steel Substrates:
  - 1. Structural Steel (exposed): Alkyd System.
    - a. Prime Coat: P-9.
    - b. Intermediate Coat: F-7.
    - c. Topcoat: F-7.
  - 2. Miscellaneous Ferrous Metals and Sheet Metal: Alkyd System.
    - a. Prime Coat: P-9.
    - b. Intermediate Coat: F-7.
    - c. Topcoat: Interior latex F-7.
- D. Galvanized-Metal Substrates:
  - 1. Hollow Metal Doors/Frames and Guardrails/Handrails: Alkyd System.
    - a. Prime Coat: P-10.
    - b. Intermediate Coat: F-7.
    - c. Topcoat: F-7.
  - 2. Structural Steel (exposed): Alkyd System.
    - a. Prime Coat: P-10.
    - b. Intermediate Coat: F-6.
    - c. Topcoat: F-6.
  - 3. Miscellaneous Ferrous Metals and Sheet Metal: Alkyd System.
    - a. Prime Coat: P-7.
    - b. Intermediate Coat: F-6.
    - c. Topcoat: Interior latex F-6.

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- E. Gypsum Board Substrates:
1. Ceilings, Smooth or Textured: Latex System.
    - a. Prime Coat: P-6.
    - b. Intermediate Coat: F-1.
    - c. Topcoat: F-1.
  2. Ceilings in wet areas (showers): High Performance Architectural Coating System (Acrylic).
    - a. Prime Coat: P-4.
    - b. Intermediate Coat: F-15.
    - c. Topcoat: F-15.
  3. Soffits/Bulkheads (below 10 feet above finished floor): Latex System.
    - a. Prime Coat: P-6.
    - b. Intermediate Coat: F-2.
    - c. Topcoat: F-2.
  4. Walls: Latex System.
    - a. Prime Coat: P-6.
    - b. Intermediate Coat: F-2.
    - c. Topcoat: F-2
  5. Walls: High Performance Architectural Coating System (Acrylic).
    - a. Prime Coat: P-4.
    - b. Intermediate Coat: F-15.
    - c. Topcoat: F-15.
  6. Walls: High Performance Architectural Coating System (Epoxy).
    - a. Prime Coat: P-7.
    - b. Intermediate Coat: F-13.
    - c. Topcoat: F-13
- F. Mechanical and Electrical Substrates: Including piping, ducts, conduits and hangars.
1. Galvanized Piping: Alkyd System.
    - a. Prime Coat: P-10.
    - b. Intermediate Coat: F-8.
    - c. Topcoat: F-8.
  2. Ductwork/Sheet Metal (exposed):
    - a. Prime Coat: F-12.

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- b. Topcoat: F-12.
- 3. Grilles / Registers / Diffusers:
  - a. Prime Coat: Factory Prime Coat
  - b. Intermediate Coat: F-8
  - c. Topcoat: F-8.

### **3.6 EXTERIOR PAINTING SCHEDULE**

#### **A. Steel Substrates:**

- 1. Hollow Metal Doors/Frames and Guardrails/Handrails: Alkyd System.
  - a. Prime Coat: P-9.
  - b. Intermediate Coat: F-8.
  - c. Topcoat: F-8.
- 2. Structural Steel (exposed): Alkyd System.
  - a. Prime Coat: P-9.
  - b. Intermediate Coat: F-8.
  - c. Topcoat: F-8.
- 3. Miscellaneous Ferrous Metals and Sheet Metal: Alkyd System.
  - a. Prime Coat: P-9.
  - b. Intermediate Coat: F-8.
  - c. Topcoat: F-8.
- 4. Pipe supports, hangers: Epoxy System.
  - a. Prime Coat: P-11.
  - b. Intermediate Coat: F-14.
  - c. Topcoat: F-14.

#### **B. Galvanized-Metal Substrates:**

- 1. Hollow Metal Doors/Frames and Guardrails/Handrails: Alkyd System.
  - a. Prime Coat: P-9.
  - b. Intermediate Coat: F-8.
  - c. Topcoat: F-8.
- 2. Miscellaneous Ferrous Metals and Sheet Metal: Alkyd System.
  - a. Prime Coat: P-9.
  - b. Intermediate Coat: F-8.
  - c. Topcoat: F-8.

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3. Pipe supports, hangers: Epoxy System.
  - a. Prime Coat: P-11.
  - b. Intermediate Coat: F-14.
  - c. Topcoat: F-14.

**END OF SECTION**

## **SECTION 10 11 00 - VISUAL DISPLAY UNITS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Visual display board assemblies.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
- B. Shop Drawings: For visual display units.
1. Include plans, elevations, sections, details, and attachment to other work.
  2. Show locations of panel joints.
  3. Include sections of typical trim members.
- C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:
1. Fabric swatches of fabric facings for tackboards.
  2. Include accessory Samples to verify color selected.
- D. Product Schedule: For visual display units.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For visual display units to include in maintenance manuals.



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## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

## **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.

### **2.3 TACKBOARD ASSEMBLIES**

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. AARCO Products, Inc.
  - 2. ADP Lemco, Inc.
  - 3. Best-Rite Manufacturing.
  - 4. Claridge Products and Equipment, Inc.
  - 5. Egan Visual Inc.
  - 6. Ghent Manufacturing, Inc.
  - 7. Marsh Industries, Inc.; Visual Products Group.
  - 8. NewLine.
  - 9. Platinum Visual Systems; a division of ABC School Equipment, Inc.
  - 10. PolyVision Corporation; a Steelcase company.
  - 11. Tri-Best Visual Display Products.

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- B. Visual Display Board Assembly: Factory fabricated.
  - 1. Assembly: tackboard.
  - 2. Corners: Square.
  - 3. Width: As indicated on Drawings.
  - 4. Height: 48 inches.
  - 5. Mounting Method: Direct to wall.
- C. Tackboard Panel: Polyester-fabric-faced tackboard panel on core indicated.
  - 1. Color and Pattern: As selected by Architect from full range of industry colors.
- D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; 1 ½ inches wide on exposed face.
  - 1. Aluminum Finish: Clear anodic finish.

## 2.4 TACKBOARD PANELS

- A. Tackboard Panels:
  - 1. Facing: Vinyl fabric factory laminated to 1/16-inch-thick cork sheet.
  - 2. Core: 3/8-inch-thick fiberboard.

## 2.5 MATERIALS

- A. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
- B. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.
- C. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, burlap weave; weighing not less than 13 oz./sq. yd.; with surface-burning characteristics indicated.
- D. Fiberboard: ASTM C 208 cellulosic fiber insulating board.
- E. Extruded Aluminum: ASTM B 221, Alloy 6063.
- F. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

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- G. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Division 09 and recommended in writing by visual display unit manufacturer for intended substrate.

## **2.6 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **2.7 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

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### **3.3 INSTALLATION**

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.
- C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
  - 1. Mounting Height; 6'-8" above finished floor to top of units.

### **3.4 CLEANING AND PROTECTION**

- A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

**END OF SECTION 10 11 00**

## **SECTION 10 14 23 - PANEL SIGNAGE**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Room-identification signs.

#### **1.2 DEFINITIONS**

- A. Accessible: In accordance with the accessibility standard.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
  - 1. Include representative Samples of available typestyles and graphic symbols.
- D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.
- B. Sample Warranty: For special warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For signs to include in maintenance manuals.

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## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer of products.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

### 2.2 SIGNS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
  - 1. Ace Sign Systems, Inc.
  - 2. Advance Corporation; Braille-Tac Division.
  - 3. Allen Industries, Inc.
  - 4. Allen Markings International.
  - 5. APCO Graphics, Inc.
  - 6. ASE, Inc.
  - 7. Best Sign Systems Inc.
  - 8. Bunting Graphics, Inc.
  - 9. Clarke Systems.
  - 10. Cornerstone.
  - 11. Diskey Sign Company.
  - 12. Fossil Industries, Inc.
  - 13. InPro Corporation.
  - 14. Mohawk Sign Systems.
  - 15. Nelson-Harkins Industries.
  - 16. Poblocki Sign Company, LLC.

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17. Seton Identification Products.
18. Supersine Company (The); Division of Stamp-Rite, Inc.
19. Vista System.
20. Vomar Products, Inc.

B. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: InTac ADA Ready signage by ASI Sign Company.
2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to backing sheet to produce composite sheet.
  - a. Composite-Sheet Thickness: 0.125 inch minimum.
  - b. Surface-Applied Graphics: Applied paint and raised tactile letters and Grade 2 Braille.
  - c. Color(s): As selected by Architect from manufacturer's full range.
3. Sign-Panel Perimeter: Finish edges smooth.
  - a. Edge Condition: Square cut.
  - b. Corner Condition in Elevation: Square.
4. Mounting: Surface mounted to wall with adhesive or two-face tape.
5. Text and Typeface: Accessible raised characters and Braille, integral to sign surface, Helvetica and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.

### 2.3 PANEL-SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.
- C. PVC Sheet: Manufacturer's standard, UV-light stable, PVC plastic.
- D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

### 2.4 ACCESSORIES

- A. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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- B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

## **2.5 FABRICATION**

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

## **2.6 GENERAL FINISH REQUIREMENTS**

- A. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.



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- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.
- C. Mounting Methods:
  - 1. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
  - 2. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

### **3.3 ADJUSTING AND CLEANING**

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

**END OF SECTION 10 14 23**

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## **SECTION 10 28 00 - TOILET AND BATH ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Public-use washroom accessories.
  2. Custodial accessories.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include the following:
1. Construction details and dimensions.
  2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  3. Material and finish descriptions.
  4. Features that will be included for Project.
  5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
  2. Identify products using designations indicated.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

#### **1.5 QUALITY ASSURANCE**

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from 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.

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## 1.6 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

## 1.7 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

### 2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Bobrick or comparable product by one of the following:

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1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
5. Tubular Specialties Manufacturing, Inc.

B. Hat and Coat Hook:

1. Basis-of-Design Product: Bobrick B-6827.
2. Mounting: Flanges with concealed fasteners.
3. Material and Finish: Stainless steel, No. 4 finish (satin).
4. Locations: Provide one hook for each door into a single toilet room.

C. Grab Bar:

1. Basis-of-Design Product: Bobrick B-6806 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
  - a. Finish: Smooth, No. 4 finish (satin).
4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

D. Sanitary-Napkin Disposal Unit , Recessed Mounted:

1. Basis-of-Design Product: Bobrick B-353.
2. Mounting: Recessed.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Mirror Unit:

1. Basis-of-Design Product: Bobrick B-165 Series.
2. Frame: Stainless-steel channel.
  - a. Corners: Mitered and mechanically interlocked.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
  - a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: As indicated on Drawings.

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### **2.3 FABRICATION**

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

### **3.2 ADJUSTING AND CLEANING**

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

**END OF SECTION 10 28 00**

## **SECTION 10 44 16 - FIRE EXTINGUISHERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with brackets to ensure proper fit and function. Use same designations indicated on Drawings.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

#### **1.5 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

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## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

### **2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS**

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ansul Incorporated, Tyco International.
    - b. Badger Fire Protection.
    - c. Buckeye Fire Equipment Company.
    - d. J.L. Industries, Inc.
    - e. Kidde Residential and Commercial Division.
    - f. Larsen's Manufacturing Company.
  - 2. Valves: Nickel-plated, polished-brass body.
  - 3. Handles and Levers: Stainless steel.
  - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
- C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 10-A:120-B:C, 20-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

### **2.3 MOUNTING BRACKETS**

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ansul Incorporated, Tyco International.
  - b. Badger Fire Protection.
  - c. Buckeye Fire Equipment Company.
  - d. J.L. Industries, Inc.
  - e. Kidde Residential and Commercial Division.
  - f. Larsen's Manufacturing Company.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine fire extinguishers for proper charging and tagging.
  1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

**END OF SECTION 10 44 16**



## **SECTION 10 51 13 - METAL LOCKERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Knock-down standard lockers.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of metal locker.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Show locker trim and accessories.
  - 3. Include locker identification system and numbering sequence.
- C. Samples: For each color specified, in manufacturer's standard size.
- D. Product Schedule: For lockers. Use same designations indicated on Drawings.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

#### **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

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1. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
  - a. Identification plates.
  - b. Hooks.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

## **1.7 FIELD CONDITIONS**

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

## **1.8 COORDINATION**

- A. Coordinate sizes and locations of concrete bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

## **1.9 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation of latches and other door hardware.
  2. Damage from deliberate destruction and vandalism is excluded.
  3. Warranty Period for Knock-Down Metal Lockers: 2 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

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## 2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

## 2.3 KNOCKED-DOWN STANDARD LOCKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Standard Lockers by Republic Storage Company or comparable product by one of the following:
1. ArtMetal Products.
  2. DeBourgh Mfg. Co.
  3. List Industries.
  4. Lyon Workspace Products.
  5. Penco Products.
- B. Locker Arrangement: 12 by 18 by 60 inch single-tier.
- C. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
1. Doors less than 12 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.
  2. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
  3. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch nominal-thickness steel sheet; welded to inner face of doors.
  4. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
  5. Door Style: Vented panel as follows:
    - a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier lockers.
- D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
  2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
  3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.
- E. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded

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into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

- F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
  - 1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
- G. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
  - 1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
    - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
    - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- H. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.
- I. Hooks: Manufacturer's standard ball-pointed type hooks, aluminum or steel; zinc plated.
- J. Continuous Sloping Tops: Fabricated from 0.036-inch nominal-thickness steel sheet.
  - 1. Closures: Vertical-end type.
- K. Filler Panels: Fabricated from 0.036-inch nominal-thickness steel sheet.
- L. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.
- M. Materials:
  - 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- N. Finish: Baked enamel or powder coat.
  - 1. Color: As selected by Architect from manufacturer's full range.

## 2.4 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
  - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
  - 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. Equipment: Provide each locker with an identification plate and the following equipment:
  - 1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
- D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.
- E. Accessible Lockers: Fabricate as follows:
  - 1. Locate bottom shelf no lower than 15 inches above the floor.
  - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.
- F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
- G. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- H. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

## 2.5 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
  - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. 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 INSTALLATION**

- A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
  - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
  - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
- B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment:
  - 1. Attach hooks with at least two fasteners.
  - 2. Attach door locks on doors using security-type fasteners.
  - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
    - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
  - 1. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
  - 2. Attach sloping-top units to metal lockers, with closures at exposed ends.
  - 3. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

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### **3.3 ADJUSTING**

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

### **3.4 PROTECTION**

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

**END OF SECTION 10 51 13**

## **SECTION 10 70 00 – ALUMINUM CANOPIES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Work in this section includes: Extruded aluminum overhead hanger rod style canopies.

#### **1.2 PERFORMANCE REQUIREMENTS**

- A. Canopy must conform to local building codes.

#### **1.3 ACTION SUBMITTALS**

- A. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store all canopy components in protected areas.

#### **1.5 PROJECT CONDITIONS**

- A. Confirm dimensions prior to preparation of shop drawings when possible.

#### **1.6 WARRANTY**

- A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of canopies that fail in material or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including framework.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: Twenty years from date of Final Completion.



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## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Basis-of-Design: Subject to compliance with requirements provide products by one of the following:
1. Mapes Canopies.
  2. Peachtree Protective Covers.
  3. Tennessee Valley Metals, Inc.

### **2.2 MATERIALS**

- A. Decking shall consist of 3" extruded flat soffit .078 decking.
- B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6.
- C. Hanger rods and attachment hardware shall be powder coated.
- D. Fascia shall be standard 8" extruded J style.

### **2.3 FABRICATION**

- A. All canopies shall be shipped with materials pre-cut for field assembly.
- B. All connections shall be mechanically assembled utilizing fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
- C. Decking shall be designed with interlocking roll-formed aluminum members.
- D. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to front scupper.

### **2.4 FINISHES**

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish. Complying with AANA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color: as selected by the Architect from manufacturer's standard selections.

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### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Confirm that surrounding area is ready for the canopy installation.
- B. Installer shall confirm dimensions and elevations to be as shown on shop drawings.
- C. Erection shall be performed by an approved installer and scheduled after all concrete and roofing in the area is completed.

#### **3.2 INSTALLATION**

- A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

#### **3.3 FIELD QUALITY CONTROL**

- A. After installation, entire system shall be left in a clean condition

**END OF SECTION 11 70 00**

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## **SECTION 10 75 00 - FLAGPOLES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes ground-mounted flagpoles made from aluminum.
- B. Owner-Furnished Material: Flag.

#### **1.2 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to the following design criteria:
  - 1. Seismic Loads: Design Category B, Group III according to SEI/ASCE 7.
  - 2. Wind Loads: 90 MPH according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."
  - 3. Base flagpole design on nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
  - 1. Include section, and details of foundation system for ground-mounted flagpoles.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

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## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Flagpole; a Kearney-National Inc. company.
  - 2. Atlantic Fiberglass Products, Inc.
  - 3. Baartol Company.
  - 4. Concord Industries, Inc.
  - 5. Eder Flag Manufacturing Company, Inc.
  - 6. Ewing Flagpoles.
  - 7. Lingo Inc.; Acme Flagpole Company Division.
  - 8. Millerbernd Manufacturing Company.
  - 9. Morgan-Francis; Division of Original Tractor Cab Co., Inc.
  - 10. PLP Composite Technologies, Inc.
  - 11. Pole-Tech Company Inc.
  - 12. U.S. Flag & Flagpole Supply, LP.
  - 13. USS Manufacturing Inc.

### 2.2 FLAGPOLES

- A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
  - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
  - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
  - 3. Provide self-aligning, snug-fitting joints.
- B. Exposed Height: 30 feet.
- C. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16 inch.

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- D. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch- nominal wall thickness. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch- diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
1. Provide flashing collar of same material and finish as flagpole.
  2. Provide steel ground protectors extending 12 inches aboveground and 6 inches belowground for steel flagpoles where flashing collars are not provided.

## 2.3 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
1. 0.063-inch spun aluminum with gold anodic finish.
- B. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
1. Halyard Flag Snaps: Provide two chromium-plated bronze swivel snap hooks per halyard.
    - a. Provide with neoprene or vinyl covers.
  2. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have two eyes for inserting both runs of halyards. Provide two flag clips per halyard.
    - a. Product: Subject to compliance with requirements, provide "Quiet Halyard" flag clasp by Lingo.

## 2.4 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- C. Sand: ASTM C 33, fine aggregate.
- D. Elastomeric Joint Sealant: Single-component nonsag urethane joint sealant complying with requirements in Section 079200 "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

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## **2.5 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **2.6 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Gold Anodic Finish: AAMA 611, AA-M32C22A43 Class I, 0.018 mm or thicker; gold color.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- D. Place concrete, as specified in Section 033000 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.
- E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

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### **3.3 FLAGPOLE INSTALLATION**

- A. General: Install flagpoles where shown and according to Shop Drawings and manufacturer's written instructions.
- B. Ground Set: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure. Install flagpole, plumb, in foundation tube.
  - 1. Foundation Tube: Place tube seated on bottom plate between steel centering wedges and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

**END OF SECTION 10 75 00**

## **SECTION 111310 – MANUAL CHAIN HOISTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes manually operated overhead chain hoist and trolley combination.

#### **1.2 ACTION SUBMITTALS**

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

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Sample warranties.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data, parts list.
- B. Certificate of Inspection and Test, attesting the hoist was inspected and subjected to a load test in accordance with the current version of ASME B30.16.

#### **1.5 QUALITY ASSURANCE**

- A. ASME Standards:
  - 1. ASME B30.11.
  - 2. ASME B30.16
  - 3. ASME B30.17
  - 4. ASME HST-2M.
- B. OSHA Regulations.
- C. Seismic Restraints: Comply with requirements of Kentucky Building Code, where applicable.

#### **1.6 WARRANTY**

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: minimum two years from date of Substantial Completion.



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## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT**

#### **A. Manual Chain Hoists:**

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. Chester, model 1311-5.
  - b. Harrington, model NTH050.
  - c. Ingersoll Rand, model THV050
2. Description: Low headroom, Army type trolley hoist, rated 0.5 ton through 5 ton, US or Metric ton:
  - a. Load Capacity: 5 ton, US or Metric.
  - b. Hook: Designed for 360 degree swivel, with spring-loaded latch.
  - c. Chain: Grade 100 load chain.
  - d. Lift: 15 feet.
  - e. Wheels: Manufacturer's standard, designed to fit either flat or tapered beam. Wheels shall roll on sealed ball bearings with lifetime lubrication.
  - f. Flange adjustment: accommodate 5" to 7" flange width.
  - g. Finish: Manufacturer's standard.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install equipment level and plumb, according to manufacturer's written instructions.

### **3.2 CLEANING AND PROTECTING**

- A. After completing installation of equipment, repair damaged finishes.
- B. Clean and adjust equipment as required to produce ready-for-use condition.
- C. Protect equipment from damage during remainder of the construction period.

### **3.3 DEMONSTRATION**

- A. Train Owner's personnel to adjust, operate, and maintain equipment.

END OF SECTION 11 13 10

## **SECTION 11 31 00 - RESIDENTIAL APPLIANCES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Cooking appliances.
  2. Kitchen exhaust ventilation.
  3. Refrigeration appliances.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
  2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of appliance.
- B. Sample Warranties: For manufacturers' special warranties.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

#### **1.5 WARRANTY**

- A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period except as qualified below:
1. Warranty Period: One year from date of Substantial Completion.
- B. Electric Range: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on surface-burner elements.
1. Warranty Period: One year from date of Substantial Completion.

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- C. Refrigerator/Freezer, Sealed System: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.
  - 1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
  - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain all residential appliances from single manufacturer.
  - 1. All appliances will be the same color. Colors acceptable are white, almond, biscuit, or similar. Black or stainless steel will NOT be used.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

### **2.3 RANGES**

- A. Electric Range: Freestanding range with one oven and complying with AHAM ER-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. Amana; a division of Whirlpool Corporation.
    - b. Electrolux Home Products (Frigidaire).
    - c. General Electric Company (GE Appliances).
    - d. General Electric Company (Hotpoint).
    - e. Jenn-Air; a division of Whirlpool Corporation.
    - f. KitchenAid; a division of Whirlpool Corporation.
    - g. LG Electronics.
    - h. Maytag; a division of Whirlpool Corporation.
    - i. Samsung.
    - j. Sears Brands LLC (Kenmore).
    - k. Whirlpool Corporation.

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2. Width: 30 inches.
3. Electric Burner Elements: Four.
  - a. Coil Type: Manufacturer's standard.
4. Oven Features:
  - a. Capacity: 5.0 cu. ft..
  - b. Operation: Baking and pyrolytic self-cleaning or catalytic continuous cleaning.
  - c. Broiler: Located in top of oven.
  - d. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
  - e. Electric Power Rating:
    - 1) Oven(s): Manufacturer's standard.
    - 2) Broiler: Manufacturer's standard.
  - f. Controls: Digital panel controls and timer display, located on splash panel at rear of rangetop.
5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 240 V, 60 Hz, 3 phase, 40 A.
7. Material: Porcelain-enameled steel with manufacturer's standard cooktop.
  - a. Color/Finish: White/almond/biscuit.

## 2.4 KITCHEN EXHAUST VENTILATION

- A. Overhead Exhaust Hood:
  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. Amana; a division of Whirlpool Corporation.
    - b. Electrolux Home Products (Frigidaire).
    - c. General Electric Company (GE Appliances).
    - d. General Electric Company (Hotpoint).
    - e. Jenn-Air; a division of Whirlpool Corporation.
    - f. KitchenAid; a division of Whirlpool Corporation.
    - g. Maytag; a division of Whirlpool Corporation.
    - h. Sears Brands LLC (Kenmore).
    - i. Whirlpool Corporation.
  2. Type: Under cabinet, exhaust-hood system.
  3. Dimensions:
    - a. Width: 30 inches.

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4. Exhaust Fan: Two-speed or variable-speed fan built into hood, 190 cfm motor class at high speed, min.
  - a. Venting: Nonvented, recirculating type with charcoal filter.
  - b. Fan Control: Hood-mounted fan switch, with separate hood-light control switch.
  - c. Cfm, low speed, min.: 120.
  - d. Cfm, high speed, min.: 190.
5. Finish: Baked enamel.
  - a. Color: White/almond/biscuit.
6. Features:
  - a. Permanent, washable aluminum-mesh filter(s).
  - b. Built-in incandescent or led lighting.

## 2.5 REFRIGERATOR/FREEZERS

- A. Refrigerator/Freezer: Two-door, side-by-side refrigerator/freezer and complying with AHAM HRF-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. Amana; a division of Whirlpool Corporation.
    - b. Electrolux Home Products (Frigidaire).
    - c. General Electric Company (GE Appliances).
    - d. General Electric Company (Hotpoint).
    - e. Jenn-Air; a division of Whirlpool Corporation.
    - f. KitchenAid; a division of Whirlpool Corporation.
    - g. LG Electronics.
    - h. Maytag; a division of Whirlpool Corporation.
    - i. Samsung.
    - j. Sears Brands LLC (Kenmore).
    - k. Whirlpool Corporation.
  2. Type: Freestanding.
  3. Dimensions:
    - a. Width: 36 inches.
    - b. Depth: 33-1/4 inches.
    - c. Height: 70 inches.
  4. Storage Capacity:
    - a. Refrigeration Compartment Volume: 15 cu. ft. min.

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- b. Freezer Volume: 9 cu. ft. min.
  - c. Shelf Area: Adjustable glass or wire shelves, 22 sq. ft. min.
5. General Features:
- a. Door Configuration: Overlay.
  - b. Dispenser in door for ice and cold water.
  - c. Built-in water-filtration system.
  - d. Separate temperature controls for each compartment.
6. Refrigerator Features:
- a. Interior light in refrigeration compartment.
  - b. Adjustable, spill-proof glass shelves.
  - c. Door Storage: Adjustable, Modular compartments.
7. Freezer Features: One freezer compartment with door.
- a. Automatic defrost.
  - b. Interior light in freezer compartment.
  - c. Factory-installed, automatic icemaker and storage bin.
8. Appliance Color/Finish: White/almond/biscuit.

## 2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods will be installed.

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- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
  - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After installation, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

**END OF SECTION 11 31 00**

## **SECTION 12 32 00 - MANUFACTURED WOOD CASEWORK**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Wood-faced cabinets of stock design.
- B. Related Requirements:
  - 1. Section 12 36 61 "Solid Surfacing Countertops".

#### **1.2 DEFINITIONS**

- A. MDF: Medium-density fiberboard.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For cabinet finishes and for each type of top material indicated.

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Quality Standard: Unless otherwise indicated, comply with requirements for modular cabinets in AWI's "Architectural Woodwork Quality Standards."
  - 1. Provide AWI Quality Certification Program certificate indicating that manufactured wood casework complies with requirements.

#### **1.5 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured wood casework that fail in materials or workmanship within specified warranty period.



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1. Failures include, but are not limited to, the following:
  - a. Delamination of components or other failures of glue bond.
  - b. Warping of components.
  - c. Failure of operating hardware.
  - d. Deterioration of finishes.
2. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Wood-Faced Manufactured Casework:
    - a. Architectural Cabinet Systems; a division of Windham Millwork, Inc.
    - b. CampbellRhea; a Sagas International company.
    - c. CIF Furniture Ltd.
    - d. Fisher Hamilton L.L.C.
    - e. Kewaunee Scientific Corporation.
    - f. Mid Canada Millwork Ltd.
    - g. R. C. Smith Company.
    - h. Terrill Manufacturing Company.
    - i. TMI Systems Design Corporation.
    - j. Reynolds and Doyle.

### **2.2 MATERIALS, GENERAL**

- A. Low-Emitting Materials: Fabricate manufactured wood casework, including countertops, with adhesives and composite wood products containing no urea formaldehyde.
- B. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
- C. Hardwood Plywood: HPVA HP-1, either veneer core or particleboard core unless otherwise indicated.
- D. Softwood Plywood: DOC PS 1.
- E. Particleboard: ANSI A208.1, Grade M-2.
- F. MDF: ANSI A208.2, Grade 130.

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- G. Hardboard: AHA A135.4, Class 1 Tempered.
- H. Edgbanding for Wood-Veneered Construction: Wood veneer of same species as face veneer.

## **2.3 CABINET MATERIALS**

- A. Exposed Cabinet Materials:
  - 1. Wood Species: Maple.
  - 2. Plywood: Hardwood plywood with face veneer of species indicated, selected for compatible color and grain. Grade A exposed faces at least 1/50 inch thick.
    - a. Face Veneer Cut: Plain sliced.
  - 3. Solid Wood: Clear hardwood lumber of species indicated and selected for grain and color compatible with exposed plywood.
- B. Semiexposed Cabinet Materials:
  - 1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of any species similar in color and grain to exposed wood.
  - 2. Plywood: Hardwood plywood of any species similar in color and grain to exposed wood. Grade B faces.

## **2.4 DESIGN, COLOR, AND FINISH**

- A. Design: Provide manufactured wood casework of the following design:
  - 1. Reveal overlay with pulls.
- B. Wood Colors and Finishes: As selected by Architect from casework manufacturer's full range.

## **2.5 CASEWORK HARDWARE**

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.
  - 1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
- B. Butt Hinges: Stainless-steel, semiconcealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips.
- C. Pulls: Solid aluminum, 5" center to center pull, Amerock Monument or similar. Finish satin nickel.

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- D. Door Catches: Nylon-roller spring catch.
- E. Drawer Slides: BHMA A156.9, Type B05091.
  - 1. Box Drawer Slides: Grade 1HD-100.
- F. Drawer and Hinged Door Locks: Cylindrical (cam) type, 5-pin tumbler, complying with BHMA A156.11, Grade 1.

### **PART 3 - EXECUTION**

#### **3.1 CASEWORK INSTALLATION**

- A. Install level, plumb, and true; shim as required, using concealed shims. Where manufactured wood casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- B. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
- C. Wall Cabinets: Hang cabinets straight, level, and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, or framing, blocking, or reinforcements in walls or partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
- D. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

#### **3.2 CLEANING AND PROTECTING**

- A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.
- B. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

**END OF SECTION 12 32 00**

## **SECTION 12 36 61 - SOLID SURFACING COUNTERTOPS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Solid surface material countertops.
  - 2. Solid surface material backsplashes.
  - 3. Solid surface material end splashes.
  - 4. Solid surface material window sills and trim.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For countertop materials and sills.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
  - 1. Show locations and details of joints.
  - 2. Show direction of directional pattern, if any.
  - 3. Color samples for selection.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For fabricator.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

#### **1.5 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

#### **1.6 FIELD CONDITIONS**

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

#### **1.7 COORDINATION**

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

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## **PART 2 - PRODUCTS**

### **2.1 SOLID SURFACE MATERIALS**

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Avonite Surfaces.
    - b. E. I. du Pont de Nemours and Company.
    - c. Formica Corporation.
    - d. LG Chemical, Ltd.
    - e. Samsung Chemical USA, Inc.
    - f. Wilsonart.
  - 2. Type: Provide Standard type unless Special Purpose type is indicated.
  - 3. Colors and Patterns: As selected by Architect from manufacturer's full range including premium selections.
- B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
- C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

### **2.2 FABRICATION**

- A. Fabricate countertops/wall caps and window sills according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Premium.
- B. Countertop and Wall Cap Configuration:
  - 1. Front: Straight, slightly eased at top 1-1/2-inch laminated square edge with separate apron.
  - 2. Backsplash: Straight, slightly eased at corner.
  - 3. End Splash: Matching backsplash.
- C. Countertops: 1/2-inch-thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 1/2-inch-thick, solid surface material.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing for all instances indicated on Drawings, including countertops and wall panels.
- F. Joints: Fabricate countertops without joints.
- G. Cutouts and Holes:

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1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
  2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
- H. Window sills, aprons, miscellaneous trim: ½-inch- thick, solid surface material.

## **2.3 INSTALLATION MATERIALS**

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets and support structure by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed,

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and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.
- H. Install window sills and trip with adhesive. Install sealant around perimeter.
- I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

**END OF SECTION 12 36 61**

## **SECTION 13 34 19.1 – METAL BUILDING SYSTEMS – STRUCTURAL FRAMING**

### **PART 1 – GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes design, shop-fabrication and erection of pre-engineered steel building structural frame, as shown on drawings including plans, notes and details showing size and location of members.
- B. Work supplied but installed under other Sections:
  - 1. Division 3 Section “Cast-in-Place Concrete” for anchor bolts.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section “Structural Inspection.”
  - 2. Division 3 Section “Cast-in-Place Concrete.”
  - 3. Division 8 Section “Overhead Coiling Doors.”
  - 4. Division 8 Section “Overhead Sectional Doors.”
  - 5. Division 9 Section “Painting.”
  - 6. Division 13 Section “Pre-Engineered Building Components.”

#### **1.3 DEFINITIONS**

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.
- B. IAS: International Accreditation Service.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Engineer, fabricate, and install pre-engineered structural steel frame to withstand design loadings indicated within limits and under conditions required.
  - 1. The design of the pre-engineered building frame shall be in accordance with the 2018 Kentucky Building Code, 2<sup>nd</sup> Edition (2018 KBC) (2015 International Building Code).
  - 2. Manufacturer shall use contract drawing information indicating maximum depth, size, and spacing limitations.



3. Concentrated loads, resulting from bearing walls or other conventional structural steel framed into pre-engineered building components (designed and provide by others), are shown with diagrammatic sketches of the member, showing the placement and magnitude of the concentrated load. Pre-engineered building designer shall incorporate such loads into the design of the pre-engineered building frame.
  4. The magnitude of the structure's mass dead load ( $W$ ) for seismic calculations shall be determined by the engineer responsible for the design of the pre-engineered building structure. The pre-engineered building structure is the sole lateral force resisting system and shall be designed as such. All components of the building including , but not limited to, the exterior brick veneer and metal stud wall system, mechanical units, ceiling components, interior partitions, etc. shall be considered when calculating  $W$ .
  5. Pre-engineered building frame supplier shall design and provide connections for conventional structural steel members framed into the pre-engineered building columns.
- B. Engineering Responsibility: Engage a fabricator who uses a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.
- C. Wind loads shall be in accordance with chapter 16 of the 2018 KBC, chapters 26 through 30 of the ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, and the following:
1. Ultimate Design Wind Speed: 115 mph
  2. Nominal Design Wind Speed: 89 mph
  3. Risk Category: II
  4. Exposure category: C
  5. Enclosure Classification: Enclosed
  6. Internal Pressure Coefficient:  $\pm 0.18$
- D. Seismic loads shall be in accordance with chapter 16 of the 2018 Kentucky Building Code, chapters 11 and 12 of ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, and the following:
1. Seismic Risk Category: II
  2. Importance factor: 1.0
  3. Site Class: C
  4. Short period mapped spectral acceleration ( $S_s$ ): 0.189
  5. 1 second period mapped spectral acceleration ( $S_1$ ): 0.102
  6. Design for structural systems not complying with AISC-Seismic Provisions for Structural Steel Buildings (where allowed by the 2018 KBC) shall utilize Response Modification Coefficient, System Overstrength Factor, and Deflection Amplification Factor for "Structural Steel Systems not Specifically Detailed for Seismic Resistance" as shown in Kentucky Building Code Table 1617.6.
- E. Snow loads shall be in accordance with chapter 16 of the 2018 KBC, chapter 7 of ASCE 7-10 *Minimum Design Loads for Buildings and Other Structures*, and the following:

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1. Importance factor: 1.0
  2. Exposure factor: 1.0
  3. Thermal factor: 1.0
  4. Ground snow load: 15 psf
- F. Live loads shall be in accordance with the 2018 KBC. Live loads on roofs shall not be reduced for tributary live load reduction.
- G. Dead loads shall include the self-weight of the pre-engineered building components, any roof supported mechanical equipment, and a collateral dead load of 6 psf for dead load imposed by ceilings, lights, mechanical ductwork, etc.
- H. Building drift shall be limited to a maximum of  $H/100$ , where H equals the building height, for load combinations which include wind. Drift limitations for seismic loading shall be as defined in the Kentucky Building Code.
- I. Deflection of structural members shall be limited to the following:
1. Wind girts and wind columns: Horizontal deflection of  $L/180$  due to wind load, where L is the member length.
  2. Primary and Secondary roof framing members:  $L/120$  due to total load and  $L/180$  due to live load, where L is the member length or horizontal distance from eave to eave.
  3. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
- J. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss when subjected to a temperature range of 125 degrees F.

## 1.5 ACTION SUBMITTALS

- A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.
1. Shop drawings which show the Architect's or Engineer's title block, logo and/or seal will be rejected and returned unchecked.
  2. Computer generated electronic structural construction document files (ACAD) will be made available to the Contractor. The Contractor will be required to sign the Engineer's standard release of liability form prior to receiving the drawing files.
  3. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.
  4. Architect's and Engineer's review of the calculations is for general conformance with the contract documents. Actual calculations are the

responsibility of the Metal Building System design engineer and shall not be reviewed for content or accuracy by the Architect or Engineer.

- B. Building Permit Issuance: Contractor shall submit Anchor Bolt Plans and Reactions, calculations, and Shop Drawings to the Building Official. Submittal must be signed and sealed by a professional engineer registered in the state where the project is situated. Submittal typically must be received prior to processing of the building permit by the plans reviewer.
- C. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins.
  - 1. Provide setting drawings, templates, and directions for installation of anchor rods and other anchorages.
  - 2. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation
  - 3. Indicate design criteria and loading (wind, snow, seismic, live) as specified in section 1603 of the Kentucky Building Code on the shop drawing cover sheet.
  - 4. Provide foundation reactions for each load type.
- D. Shop Drawings detailing fabrication and erection of pre-engineered building structural components. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes
  - 1. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, openings, fasteners, and ASTM specifications for materials.
  - 2. Indicate field welds by standard AWS symbols, showing size, length, and type of each weld.
  - 3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Include erection plans and details.
  - 4. Include ASTM material specifications and grade of steel.
  - 5. Provide erection details of all field connections.
  - 6. Indicate surface preparation for primer, primer, and galvanizing to be used.
  - 7. To the extent pre-engineered building design considerations are indicated as fabricator's responsibility, provide shop drawings signed and sealed by the qualified professional engineer, registered in the State of Kentucky, responsible for their preparation. The shop drawings will be reviewed for design intent only. Engineering and detailing shall be solely the responsibility of the manufacturer and the professional engineer responsible for their preparation.
  - 8. Shop drawing resubmittals are reviewed for conformance with review marks only. Any changes or questions originating on a resubmittal shall be clearly clouded.

## 1.6 INFORMATIONAL SUBMITTALS

- A. General: Furnish submittals in quantity, format, and other Conditions of the Contract and as specified in Division 1 of the Project Manual.

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- B. Fabricator shall participate in the certified Quality Certification Program and shall submit, at the completion of fabrication, a certificate of compliance stating that the work was performed in accordance with the approved construction documents.
- C. Metal Building System Certificates: For each type of metal building system, from manufacturer.
  - 1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
    - a. Name and location of Project.
    - b. Order number.
    - c. Name of manufacturer.
    - d. Name of Contractor.
    - e. Building dimensions including width, length, height, and roof slope.
    - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
    - g. Governing building code and year of edition.
    - h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
    - i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
    - j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
  - 2. IAS Certification: Copy of IAS certification.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed pre-engineered building structure work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating pre-engineered building structure similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
  - 1. Fabricator must participate in and be accredited by the International Accreditation Service, Inc (IAS) Inspection Programs for Manufacturers of Metal Building Systems, AC472.
- C. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the State of Kentucky and who is experienced in providing

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engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

- E. Comply with applicable provisions of the following specifications and documents:
1. AISC 360 "Specification for Structural Steel Buildings."
  2. AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."
  3. AISC 341 "Seismic Provisions for Structural Steel Buildings."
  4. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  5. American Welding Society's (AWS) D1.1-2004 "Structural Welding Code – Steel."
  6. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
  7. AGA – American Galvanizers Association publication "Recommended Details for Galvanized Structures".
  8. AWS – "AWS Standard for Certification AWS Certified Welders" AWS QC7-93.
  9. AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
  10. SSPC – Steel Structures Painting Manual, Vol. 2 Systems and Specifications; Steel Structures Painting Council; 1995, Seventh Edition.
  11. SSPC-VIS 3 – Visual Standard for Power and Hand Tool Cleaned Steel; Steel Structures Painting Council; 1993.
- F. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code – Steel."

## 1.8 PROJECT CONDITIONS

- A. Shop Drawings: Comply with established column layout and grid, column base elevation, and frame type shown on the Drawings establishing foundation dimensions.
- B. Established Dimensions for Foundations: Install anchor rods per established dimensions on approved anchor-bolt plans, proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pre-engineered building structure components to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

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1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. A&S Building Systems, Inc.; Division of NCI Building Systems, L.P.
  2. American Steel Building Co., Inc.
  3. Butler Manufacturing Company; a BlueScope Steel company.
  4. Ceco Building Systems; Division of NCI Building Systems, L.P.
  5. Chief Buildings; Division of Chief Industries, Inc.
  6. Gulf States Manufacturers, Inc.; Division of Magnatrx Corp.
  7. Kirby Building Systems; Division of Magnatrx Corp.
  8. Metallic Building Company; Division of NCI Building Systems, L.P.
  9. Nucor Building Systems.
  10. Star Building Systems; an NCI company.
  11. USA, Inc.
  12. VP Buildings; a United Dominion company.

### **2.2 SYSTEM DESCRIPTION**

- A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
  2. Primary framing to be prime painted .
  3. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
  4. Lean-To: Single slope, solid-member, structural-framing system without interior columns, designed to be partially supported by gable rigid frame at higher end.

- C. Endwall Framing: Endwall framing shall include the corner columns and endwall columns and wind girts, and shall be manufactured of I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet according to the following:
1. Structural members to be prime painted.
  2. Load-bearing end-wall and rigid frame capable of supporting the tributary one-half bay design load. No additional lateral X-bracing is permitted along end wall.
- D. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, steel sheet to comply with the following:
1. Structural members to be prime.
  2. Wall girts shall be nominal 8" deep "C" or "Z" shaped members fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form edges of sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch wide flanges. Design as simple span, continuous, or partially continuous for the specified loads. Wall girts shall be fabricated to be run outside the primary frame.
  3. Roof purlins shall be manufacturer's standard depth "C" or "Z" shaped members fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form edges of sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch wide flanges. Design as simple span, continuous, or partially continuous for the specified loads.
  4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
  5. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary-frame flanges.
  6. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
  7. Base or Sill Angles: Minimum 3-by-2-inch (76-by-51-mm) zinc-coated (galvanized) steel sheet.
  8. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
  9. Secondary End-Wall Framing: Manufacturer's standard sections.
  10. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
  11. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
  12. Wind bracing shall be a system of diagonal cable bracing. Unless otherwise noted, column bases shall be designed as pinned as to not transfer moment into the foundations.

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13. Metal roofing shall be assumed to have zero capacity for diaphragm action. Cable or rod bracing shall be utilized in the plane of the roof to transfer lateral loads into the primary and secondary frames.
- E. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
- F. Column Type
  1. Straight column.
  2. Tapered column.
- G. Bay Spacing: As shown.
- H. Eave Height: As shown.
- I. Roof Slope
  1. Dual slope as shown on drawings.

## 2.3 MATERIALS

- A. All structural steel shapes shall be new, unused and perfect stock, free from millscale, rust, flake, pitting, and imperfections, without bends, kinks, and distortions.
- B. Wide Flange and Tee Shapes (Designated as W and WT): ASTM A36 or ASTM A992.
- C. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36.
- D. Plates and Bars: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.
- E. Cold-Formed Structural Steel Tubing: ASTM A500, Grade B.
- F. Structural-Steel Sheet: Hot-rolled, ASTM A 1011, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008, Structural Steel (SS), Grades 25 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70. Prime painted.
- G. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process with clear acrylic to comply with ASTM A 755.
  1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, Structural Steel (SS), Grades 33 through 80; or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G30 coating designation.



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- H. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
  - 1. Finish: Plain
- I. High-Strength Bolts, Nuts, and Washers: ASTM A325 or A490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with spline ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.
  - 1. Finish: Plain.
- J. Welding Electrodes: Comply with AWS requirements.

## **2.4 PRIMER**

- A. Primer: SSPC-Paint 15.

## **PART 3 - EXECUTION**

### **3.1 FABRICATION**

- A. General: Design components and field connections required for erection to permit easy assembly.
  - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Fabricate and assemble pre-engineered building structure in shop to greatest extent possible.
- D. Fabricate building structure components exposed to view with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
  - 1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating and shop priming.
- E. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
  2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
  3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
  4. Weld clips to frames for attaching secondary framing.
- F. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.

### 3.2 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
1. Surfaces embedded in concrete or mortar other than column bases. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  2. Surfaces to be field welded.
  3. Surfaces to be high-strength bolted with slip-critical connections.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
1. SSPC-SP 2 “Hand Tool Cleaning,” all steel except as otherwise specified.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer’s instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.0 mils (0.025 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

### 3.3 EXAMINATION

- A. Before erection proceeds, and with the erector present, verify elevations of concrete bearing surfaces and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

### 3.4 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep pre-engineered building structure secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent building structure, connections, and bracing are in place, unless otherwise indicated.

### 3.5 ERECTION

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Set pre-engineered building structure accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
- C. Maintain structural stability of frame during erection.
- D. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- E. Base 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. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- F. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- G. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
  - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
- H. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
  - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.

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2. Locate and space wall girts to suit openings such as doors and windows.
  3. Locate canopy framing as indicated.
  4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
  2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

### 3.6 QUALITY CONTROL

- A. General: The Owner will engage an independent testing and inspecting agency to perform inspections and tests and to prepare test reports. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements. Failure to detect any defective materials shall not prevent later rejection when such defect is discovered, or obligate the Architect or Owner for final acceptance.
1. See Section 01 41 10 – Structural Special Inspections for testing and inspection to be performed.
  2. Provide access for testing agency to places where structural framing work is being installed so that required inspection and testing can be accomplished.
  3. The General Contractor shall provide the testing agency a complete set of approved shop drawings.
  4. Reports will be delivered to the Architect, Engineer, and the General Contractor within one week of inspection.
  5. Deviations from requirements of the contract documents will be reported in writing to the General Contractor within 24 hours.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

### 3.7 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

**END OF SECTION 13 34 19.1**

## **SECTION 13 34 19.2 - METAL BUILDING SYSTEMS - BUILDING COMPONENTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

A. Section Includes:

1. Metal roof panels.
2. Metal wall panels.
3. Accessories.

See Section 13 34 19.1 "Metal Building Systems – Structural Framing" for Structural Steel Framing.

B. Related Requirements:

1. Section 07 21 30 "Metal Building System Insulation".
2. Section 07 72 53 "Snow Guards".
3. Section 08 11 13 "Hollow Metal Doors and Frames".
4. Section 08 51 13 "Aluminum Windows".
5. Section 10 70 00 "Aluminum Canopies".
6. Section 13 34 19.1 "Metal Building Systems – Structural Framing".
7. Section 23 34 23 "HVAC Power Ventilators".
8. Section 23 37 16 "Louvers and Vents".

#### **1.2 DEFINITIONS**

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.
- B. IAS: International Accreditation Service.

#### **1.3 COORDINATION**

- A. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### **1.4 PREINSTALLATION MEETINGS**

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

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1. Review methods and procedures related to metal building systems including, but not limited to, the following:
  - a. Condition of foundations and other preparatory work performed by other trades.
  - b. Structural load limitations.
  - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
  - d. Required tests, inspections, and certifications, including pre-installation bolt testing requirements for seismic conditions.
  - e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
  1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Metal roof panels.
    - b. Metal wall panels.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
  1. Anchor-Rod Plans: See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
  2. Structural-Framing Drawings: See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
  3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
    - a. Show roof-mounted items including pipe penetrations.
    - b. Show wall-mounted items including personnel doors, vehicular doors, windows, canopies, louvers, fans and lighting fixtures.
  4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
    - a. Flashing and trim.
    - b. Framing/support for wall-mounted items.
    - c. Gutters.

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d. Downspouts.

- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Delegated-Design Submittal: For metal building systems.
  - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer, licensed in Project jurisdiction, responsible for their preparation.
- E. Contractor shall submit "For Construction" drawings, PE sealed and signed, directly to Kentucky Department of Housing, Buildings and Construction for review at same time as submitting to Architect for review.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector and manufacturer.
- B. Welding certificates.
- C. Letter of Design Certification: As required by Section 13 34 19.1.
- D. Sample Warranties: Submittals shall be edited to match project requirements, and shall be stamped or noted "For Review Only".

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
  - 1. Accreditation: Manufacturers' facility accredited according to the International Accreditation Services' AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
  - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

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### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver components, sheets, 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.

### **1.10 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

### **1.11 WARRANTY**

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 25 years from date of Substantial Completion for panels used on exterior of building.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion.



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## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. 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. A&S Building Systems, Inc.; Division of NCI Building Systems, L.P.
  2. American Steel Building Company, Inc.
  3. Bigbee Steel Buildings, Inc.
  4. Butler Manufacturing Company; a BlueScope Steel company.
  5. Ceco Building Systems; Division of NCI Building Systems, L.P.
  6. Chief Buildings; Division of Chief Industries, Inc.
  7. Gulf States Manufacturers, Inc.; Division of Magnatrx Corp.
  8. Kirby Building Systems; Division of Magnatrx Corp.
  9. Metallic Building Company; Division of NCI Building Systems, L.P.
  10. Nucor Building Systems.
  11. Star Building Systems; an NCI company.
  12. USA, Inc.
  13. VP Buildings; a United Dominion company.
- B. Source Limitations: Obtain metal building system components, including primary and secondary framing (see Section 13 34 19.1) and metal panel assemblies, from single source from single manufacturer.

### **2.2 SYSTEM DESCRIPTION**

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type: See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
- C. End-Wall Framing: See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
- D. Secondary-Frame Type: See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
- E. Eave Height: As indicated by nominal height on Drawings.
- F. Bay Spacing: As indicated on Drawings.
- G. Roof Slope: As indicated on Drawings.
- H. Roof System: Manufacturer's standard standing-seam, vertical-rib, metal roof panels.

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- I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered rib, metal wall panels.
  - 1. Liner Panels: Tapered rib.

## 2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, licensed to practice in the project location, to design metal building system.
- B. Structural Performance:
 

See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 or ASTM E 108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
- E. Fire Propagation Characteristics: Exterior wall assemblies containing foam plastics pass NFPA 285 fire test.
- F. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
  - 1. Wind Loads: As indicated on Drawings.
- G. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 or ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- H. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.

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- I. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- J. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- K. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
  - 1. Uplift Rating: UL 90.

## 2.4 STRUCTURAL-STEEL FRAMING

See Section 13 34 19.1 "Metal Building Systems – Structural Framing".

## 2.5 METAL ROOF PANELS

- A. Standing-Seam, Vertical-Rib, Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs, with factory applied sealant; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
  - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Exterior Finish: Two-coat fluoropolymer.
    - b. Color: As selected by Architect from manufacturer's standard range (minimum 16 available options required).
  - 2. Clips: One-piece fixed or two-piece floating to accommodate thermal movement.
  - 3. Joint Type: Mechanically seamed.
  - 4. Panel Coverage: 16 inches.
  - 5. Panel Height: 2 inches.
  - 6. Basis of Design: Ceco, SuperLok roof panels.
- B. Finishes:
  - 1. Exposed Coil-Coated Finish: Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

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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.

## 2.6 METAL WALL PANELS

- A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
  1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Exterior Finish: Two-coat fluoropolymer.
    - b. Color: As selected by Architect from manufacturer's standard range (minimum 16 available options required).
  2. Major-Rib Spacing: 12 inches.
  3. Panel Coverage: 36 inches.
  4. Panel Height: 1.25 inches.
  5. Basis of Design: Ceco, PBR wall panels.
- B. Exposed-Fastener, Reverse-Rib, Metal Liner Panel: Formed with recessed, trapezoidal valleys and flat pan between valleys; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
  1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Exterior Finish: Siliconized polyester.
    - b. Color: As selected by Architect from manufacturer's standard range (minimum 16 available options required).
  2. Rib Spacing: 6 inches o.c.
  3. Panel Coverage: 36 inches.
  4. Panel Height: .75 inches.
  5. Basis of Design: Ceco, PBU wall panels.
- C. Finishes:
  1. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat,

and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a minimum dry film thickness of 0.2 mil for primer and 0.8 mil for topcoat.
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.

## 2.7 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
  1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
  2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
  3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
  4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

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3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
  2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
  2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- H. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
    - a. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
    - b. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
    - c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.

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- d. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- 2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mildry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- 3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- 4. Metal Panel Sealants:
  - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
  - b. Joint Sealant: ASTM C 920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

## 2.8 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
  - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
- D. Secondary Framing: See Section 13 34 19.1 "Metal Building Systems – Structural Framing".
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
  - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

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## **2.9 SOURCE QUALITY CONTROL**

- A. Accredited Manufacturers: Fabrication shall be performed by an IAS AC472-accredited manufacturer, accredited to perform such work without special inspection.
  - 1. After fabrication, submit copy of certificate of compliance to Architect, certifying that Work was performed according to Contract requirements.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

### **3.3 ERECTION OF STRUCTURAL FRAMING**

See Section 13 34 19.1 "Metal Building Systems – Structural Framing".

### **3.4 METAL PANEL INSTALLATION, GENERAL**

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.



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- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
  - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
    - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
  - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
  - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Locate metal panel splices over structural supports with end laps in alignment.
  - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
  - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of

gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.

### **3.5 METAL ROOF PANEL INSTALLATION**

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.
  2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
  2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
  4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
  5. Provide metal closures at peaks, rake edges, and each side of ridge caps.

### **3.6 METAL WALL PANEL INSTALLATION**

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
  2. Shim or otherwise plumb substrates receiving metal wall panels.
  3. When two rows of metal panels are required, lap panels 4 inches minimum.
  4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
  5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
  6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
  7. At wall-hung canopies, and other locations indicated, install "stacked" wall panels with panel closures, sill angles and flashing to provide weathertight installation.

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8. Install screw fasteners in predrilled holes.
  9. Install flashing and trim as metal wall panel work proceeds.
  10. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
  11. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
  12. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

### 3.7 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

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- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
  - 1. Provide elbows at base of downspouts to direct water away from building.
- E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

### **3.8 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.

### **3.9 CLEANING AND PROTECTION**

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
  - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
  - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Division 09.
- E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
  - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 13 34 19.2**

## **DIVISION 22– PLUMBING**

### **SECTION 22 00 00 -- GENERAL PROVISIONS FOR PLUMBING**

#### **PART 1 - GENERAL**

##### **1.1 GENERAL**

- A. The General Conditions, Special Conditions, Supplemental Conditions, Instructions to Bidders, and other Contract Documents apply to this branch of the work as well as to the other branches.
- B. Provide the materials (piping, equipment, equipment accessories, etc.) and labor necessary for complete and functioning plumbing systems. The Drawings and Specifications are intended to indicate complete working systems. Provide complete and properly working systems, even if all materials and labor necessary to achieve this are not specifically shown on the Drawings or specified.
- C. The Contractor shall familiarize himself with the work of all other trades, general type construction, and the relationship of his work to other sections. He shall examine all working drawings, specifications and conditions affecting his work. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, verify all dimensions in the field and advise the Engineer of any discrepancy before fabricating or performing any work.
- D. The work shall include complete testing of all equipment and piping at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment.
- E. Perform any necessary temporary work during construction.
- F. Work under this section shall conform to governing codes, ordinances and regulations of the City, County and State.
- G. The Contractor shall be responsible for any errors in fabrication, for the correct fitting, installation and erection of the various mechanical systems.

##### **1.2 COMMISSIONING**

- A. The Owner has directly contracted with a Commissioning Agency.
- B. Provide the services required by the Commissioning Agency in Division 1 Specification Sections.

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### **1.3 REDUCTION OF LEAD IN DRINKING WATER ACT**

- A. In accordance with the “Reduction of Lead in Drinking Water Act” of 2011, all potable water pipe, pipe fittings, plumbing fittings and fixtures shall have a 0.25% maximum lead content for all wetted components using a surfaced bases averaging formula. This includes all components of potable water systems as well as combined fire and domestic water systems. Products that are specified in the document as basis of design, shall comply with this regulation or be substituted with an approved equal.

### **1.4 VIBRATION ISOLATION EQUIPMENT**

- A. Installation of vibration isolation equipment and seismic bracing pertaining to plumbing systems shall be by this Contactor.

### **1.5 SUSPENSION FROM METAL DECKING**

- A. Do not use metal decking for suspension of piping or equipment. Hang items from top member of joist or provide additional structure to span between top members if needed.

### **1.6 COORDINATION BETWEEN TRADES**

- A. Demand and examine all Drawings and Specifications pertaining to the construction before installing the work described and shown under these Drawings and Specifications. Cooperate with all other Contractors in locating piping, ductwork, conduit, openings, chases and equipment in order to avoid conflict with any other Contractor's work. Give special attention to points where piping must cross ducts or other piping and where ducts, piping and conduit must fur into the walls and columns. All work installed above a lay-in ceiling must be coordinated and installed so there is a minimum of 4 inches between the top of the ceiling grid and the bottom of the installation.
- B. Make known to other trades intended positioning of materials and intended order of work. Determine intended position of work of other trades and intended order of installation.

### **1.7 DISCREPANCIES**

- A. If any discrepancies occur between the accompanying Drawings and these Specifications and Drawings and Specifications covering other Contracts, report such discrepancies to the Architect/Engineer far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of piping and equipment not installed in accordance with the above instructions, and which interferes with work and equipment of other Contractors.

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### **1.8 EXISTING PIPE AND SERVICES**

- A. Existing piping and services are located as accurately as possible from available information, but it shall be the Contractor's responsibility to locate, determine exact elevations and make required connections to such lines and services in manner approved by the Architect/Engineer.
- B. Maintain in operating condition active utilities encountered in the utility installation. Repair to the satisfaction of the Architect/ Engineer and the Owner any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

### **1.9 CONTINUOUS OPERATION AND CUTOVER**

- A. To facilitate the continuous operation of the existing utilities, no utility service shall be tapped into without prior notification of 48 hours to and approval received from the designated authority of the utility company.

### **1.10 ASBESTOS**

- A. If during the course of his work the Contractor observes the existence of asbestos, or asbestos-bearing materials, the Contractor shall immediately terminate further work on the project and notify the Owner of the condition. The Owner will, after consultation with the Engineer, determine a further course of action.

### **1.11 ACCESSIBILITY**

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- B. Extend all grease fittings to an accessible location.

### **1.12 ROUGH-IN**

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

### **1.13 PLUMBING INSTALLATIONS**

- A. Coordinate plumbing equipment and materials installation with other building components.
- B. Verify all dimensions by field measurements. Field verify existing conditions and all required measurements before fabricating any piping or equipment.

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- C. Arrange for chases, slots, and openings in other building components to allow for plumbing installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- E. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- F. Coordinate the cutting and patching of building components to accommodate the installation of plumbing equipment and materials.
- G. Where mounting heights are not detailed or dimensioned, install plumbing services and overhead equipment to provide the maximum headroom possible.
- H. Install plumbing equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate the installation of plumbing materials and equipment above ceilings with suspension system, light fixtures, and other installations.
- J. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- K. Do not install plumbing work where it will interfere with work of other trades.
- L. Do not install plumbing work under HVAC terminal units above suspended ceilings, such as heat pump units, air handling units, variable volume units, coils, etc.
- M. Do not install plumbing work where it will interfere with access doors in ductwork.
- N. Do not install plumbing work where it will interfere with access to control panels on HVAC and/or electrical equipment.
- O. Do not install plumbing work where it will interfere with access space around mechanical and electrical equipment. Do not install piping where it will interfere with removal of HVAC coils, filters or fan shafts.
- P. Do not install piping so close to ceiling that ceiling tiles in accessible ceilings cannot be removed without damaging them.
- Q. Do not install plumbing work over the top of electrical equipment. Maintain minimum distances away from electrical equipment as required by the Electric Code.
- R. Photographs: When all inaccessible plumbing work is installed and before any wallboards or hard ceilings installation is to begin, the contractor is to photograph all



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plumbing work in all inaccessible ceilings and walls. Each photograph is to have a label as a part of the photograph that indicates the orientation (i.e., north wall, south wall and etc.) and the room location. One copy of the photographs with a written description of each filename including orientation and room location are to be presented to the owner in digital (jpg) format on 3-1/2" floppy disks. The resolution of the picture is to be of a level that is required to clearly show the location of all mechanical and electrical work.

#### **1.14 EXCAVATION, TRENCHING AND BACKFILLING**

- A. Photographs: The contractor shall photograph all underground utilities before backfilling. Photographs shall be oriented and labeled so that the locations, all crossings and depths of the utilities can be determined from the photographs.
- B. General: Excavate in accordance with requirements of Division Section "EARTHWORK" and requirements of this Section. Lay the pipe in open trench except when the Architect/Engineer gives written permission for tunneling. Open the trench sufficiently ahead of pipe laying to reveal obstructions. Maintain easy access to fire hydrants by fire fighting apparatus. Provide trench crossing as necessary to accommodate public travel.
- C. Provide trench crossing as necessary to accommodate public travel.
- D. Separate Trenches: Unless otherwise shown or requested, provide separate trenches for sewers, water lines and gas lines, respectively, with a minimum of 3' of undisturbed earth between trenches. In locations such as close to building, where separate trenches for sewers and water lines are impracticable, lay the water pipe on a solid shelf at least 18" above the top of the sewer. Always place gas lines in a separate trench from electrical lines.
- E. Width of Trench: Excavate trenches of sufficient width for proper installation of work. When the depth of backfill over sewer pipe exceeds 10', keep the trench at the level of the top of the pipe as narrow as possible.
- F. Sheeting and Bracing: Sheet and brace trenches as necessary to protect workmen and adjacent structures. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc. Do not remove sheeting until trench is backfilled sufficiently to protect pipe and prevent injurious caving. When ordered in writing by the Architect/ Engineer, leave sheeting in place and the Contract will be adjusted (See General Conditions): cut off such sheeting not to be removed at least 3' below finished grade.
- G. Water Removal: Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipes. Conduct the discharge from trench dewatering to drains or natural discharge channels.
- H. Disposition of Utilities: Observe rules and regulations governing the respective utilities in executing work under this heading. Protect active utilities from damage or remove in

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accordance with written instructions of the Architect/Engineer (See General Conditions). Plug, cap or remove inactive and abandoned utilities encountered in trenching operations. In absence of specific requirements, plug or cap such utility line at least 3' from utility line to be installed or as required by local regulations.

- I. Rock Excavation: Materials to be excavated shall include earth and any other material including rock encountered within the limits of trench excavation for the utilities to the depth and extent indicated on the drawings and herein specified. In case of any change ordered by the Owner or Architect/Engineer in the quantity of excavation, the contract price will be adjusted by unit price or as described under Excavation, Filling and Grading of Division Site Work of these specifications. The term "rock" as used is defined to be hard material in nature that cannot be dislodged from its bed and removed therefrom without blasting or drilling. Any other is "earth" insofar as removal of the material to be excavated is concerned.
  1. Allowance for Additional Rock Excavation: In addition to the rock removal specified in the preceding paragraph, include in the Contract Price an additional ten (10) cubic yards of trench rock removal by mechanical means. If more or less additional rock removal is required due to changes in routing or in elevations of underground utilities authorized in writing, the Contract Price will be adjusted via unit prices.
- J. Blasting: See Division Section "EARTHWORK" to see if blasting is allowed. If blasting is allowed, obtain written approval of method from Architect/Engineer before proceeding with rock excavation.
- K. Trench Bottoms: Lay all pipe, unless otherwise noted or detailed, in undisturbed earth on at least 4" of #9 crushed stone, or other approved grillage. Bedding shall be in place and graded before pipe is installed.
- L. Special Supports: Whenever, in the option of the Architect/Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting sewers or other utilities and appurtenances specified in this section, provide special support as the Architect/Engineer may direct and the Contract Price will be adjusted. (See General Conditions).
- M. Tree Protection: Exercise care to protect the roots of trees to remain. Within the branch spread of such trees, perform trenching by hand. Open the trench only when the utility can be installed immediately, prune injured roots cleanly and backfill as soon as possible. Perform this work under the direction of the Architect/Engineer.
- N. Backfilling: Inspect and test piping and record locations of pipe lines and appurtenances before backfilling.
- O. Trenches Under Floor Slabs: Backfill under floor slab on grade to a point 5'-0" outside of perimeter building wall with fill as specified in Division Section "EARTHWORK". Remove excess excavation materials from the site daily unless otherwise instructed.
- P. Trenches in Other Areas: Backfill with materials in accordance with Division Section "EARTHWORK". Compact backfill thoroughly with a heavy tamper.

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- Q. The Contractor, at his option, may backfill the remaining depth of the trench from 12" above top of piping to 12" below finished grade with sand, wash gravel, or fine rock chat. The remaining depth of the trench would then be backfilled as specified in the preceding specification.

#### **1.15 SOIL MATERIALS**

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- D. Backfill and Fill Materials: Satisfactory soil materials.

#### **1.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

#### **1.17 WORKING DRAWINGS**

- A. Scale of drawings is approximate. Do not scale the drawings to determine locations of plumbing work. Exact locations, dimensions and elevations shall be governed by field conditions. Make field measurements of building before fabricating or installing equipment or materials.
- B. Drawings are based on physical dimensions of one or more manufacturer's equipment. Other approved equipment shall be of such dimensions that it can be readily installed in available space, leaving ample clearance for proper maintenance.
- C. Intent of drawings is to show systems and sizes. Drawings do not necessarily show all required offsets. Work shall be installed to conform with space limitations. Offsets, transitions, fittings, etc., shall be provided as part of the Contract where required to attain this objective.

#### **1.18 EQUIPMENT MOUNTING**

- A. Mount equipment with moving parts, such as compressors, pumps, etc., on vibration supports suitable for the purpose of minimizing noise and vibration transmission unless otherwise specified. In addition, isolate equipment from external connections such as piping, with flexible connectors, vibration isolators, or other approved means.

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- B. Provide each piece of equipment or apparatus suspended from the ceiling or mounted above the floor level with suitable structural support, pipe stand, platform or carrier as approved by the Architect/Engineer.

### **1.19 PAINTING**

- A. Paint the following items.
  - 1. Exposed plumbing piping, valve bodies and fittings - bare and insulated, including hangers, platforms, etc.
  - 2. "Exposed" shall mean exposed to view, such as, in mechanical spaces, tunnels, on roofs and in rooms with no suspended ceilings.
- B. Colors of piping shall be as specified in the "Identification for Plumbing Piping and Equipment" section of the Specifications. See "color coding" in identification schedules.
- C. Painting shall be done in accordance with the "Painting" section of the specifications unless otherwise specified under other sections of the specifications,
- D. Do not paint aluminum and stainless steel equipment, motor and identification plates, tags, etc.
- E. Do not paint piping concealed in walls or above suspended ceilings.

### **1.20 DEBRIS**

- A. Remove from the site any debris and dirt caused by the work. Maintain the premises in a clean and orderly condition.

### **1.21 PROTECTION OF EQUIPMENT AND MATERIALS**

- A. Provide suitable protection from dampness damage, dirt, etc., for equipment and materials during construction and until final acceptance by the Owner. Keep ends of piping capped off when work on them is not in progress. Such protection shall be by a means acceptable to the Architect/Engineer.

### **1.22 CLEANING UP**

- A. After completion of the work and before final acceptance of the work, thoroughly clean equipment and materials and remove foreign matter such as grease, dirt, labels, stickers, etc., from the exterior of piping, equipment and associated fabrications.

### **1.23 EQUIPMENT CONNECTIONS**

- A. Make connections to equipment furnished by others whenever such equipment is shown on any part of the drawings or mentioned in any section of the specifications.

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- B. Verify equipment locations and the sizes, number, locations, and types of connections to be made before installation of any such equipment.

#### **1.24 EQUIPMENT INSTALLATION INSTRUCTIONS**

- A. Install plumbing piping and equipment in strict accordance with manufacturer's recommendations. Provide equipment accessories necessary for proper operation or recommended by the manufacturer, even if such accessories are not shown on the drawings or mentioned in the specifications.

#### **1.25 PERMITS, CODES AND APPROVALS**

- A. Permits. Obtain and pay for the permits and licenses necessary for the complete plumbing systems from the authorities governing such work.
- B. Codes. Installation shall be in accordance with applicable codes and regulations, including but not limited to the following:
  - 1. City or County Building Inspector
  - 2. National and Local Electric Codes
  - 3. Kentucky State Plumbing Code
  - 4. Kentucky Building Code and its referenced codes
  - 5. Kentucky State Fire Marshal
  - 6. Local Fire Codes
  - 7. Local Building Inspections
- C. Approvals. All work must be approved by the Architect/Engineer before final payment is made.
- D. Obtain a final certificate of approval for the entire plumbing installation from the Department of Housing, Building and Construction, Division of Plumbing. Submit to the Architect/Engineer after completion of the work and before final payment is made.

#### **1.26 SUBSTITUTION OF MATERIALS AND EQUIPMENT**

- A. When making a shop drawing submittal for materials and/or equipment of a different manufacturer than that specified, it shall be understood and agreed that such substitution if approved will be made without cost to the Owner, regardless of changes in connections, spacing, electrical service, etc.

#### **1.27 WORKMANSHIP**

- A. Work shall be performed by mechanics skilled in their respective trades and shall present appearance typical of best trade practice. Work not installed in this manner shall be repaired, removed or replaced, or otherwise remedied as directed by the Architect/Engineer.

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### **1.28 RECORD DRAWINGS**

- A. Keep accurate record of deviations from drawings, particularly where work is concealed. Submit one (1) set of drawings marked to show changes when work is completed.

### **1.29 SUPERVISION**

- A. The Contractor shall personally supervise the work or have a competent superintendent, satisfactory to the Architect/Engineer and Owner on the work at all times during progress with full authority to act.
- B. The Contractor shall lay out his work and be responsible for any necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so. Work at the site of the project shall be observed by the Architect/Engineer or his representative.
- C. Final Inspection: At the time of final inspection of the work performed under this Contract, systems shall be complete in every respect and in perfect operating condition. Surplus materials of every character resulting from work of this section shall have been removed. Sanitary sewers shall be free from sand, silt or other obstructions. Any defect discovered in the utilities subsequent to this inspection shall have been corrected.

### **1.30 STRUCTURAL RESPONSIBILITY**

- A. The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing, or weakening. No structural member shall be cut or otherwise weakened in any manner without the written consent of the Architect/Engineer.
- B. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Owner or Architect/Engineer, without cost to either the Owner or the Architect/ Engineer.

### **1.31 OPENINGS**

- A. This Contractor shall be responsible for the openings he may require in floors, walls, roof or ceilings of any type of new or existing construction whether or not shown on the Architectural, Structural or Plumbing Drawings.
- B. Openings that have been shown on the Architectural and/or Structural Drawings will be provided under other Divisions; however, the responsibility for the correct size and location of such openings shall be that of this Contractor.

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- C. Openings that have not been shown on the Architectural and/or Structural Drawings shall be provided by this Contractor.
- D. Review and conform to all structural requirements as detailed or specified in the Structural drawings and specifications.

### **1.32 CUTTING, FITTING AND PATCHING**

- A. Before doing any cutting or drilling, Contractor shall obtain permission from the Architect/Engineer and shall follow his instructions as to how proposed cutting or drilling is to be done.
- B. Do any cutting, patching, drilling of masonry, steel, wood or iron work and any fitting necessary for the proper installation of apparatus and materials included in these specifications or governed thereby.
- C. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- D. 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.
- E. Coordinate with the Structural Engineer BEFORE drilling, cutting, notching, etc., any new or existing structural members. Obtain written permission from Structural Engineer before doing such work. Locations and sizes of openings and methods of cutting or drilling such openings must be approved in advance by the Structural Engineer. Positively identify exact locations of reinforcing bars or tension cables in structural members by X-raying or other methods approved by the Structural Engineer if required by the Structural Engineer.
- F. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
- G. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- H. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
- I. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
- J. Comply with requirements of applicable Sections of Division 22 "Plumbing" where cutting and patching requires excavating and backfilling.

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- K. The patching and finishing shall be done in a workmanlike manner to the satisfaction of the Architect/Engineer.
- L. Patch any openings in existing floors, walls, ceilings or roof, left by removal of existing plumbing work.
- M. Review and conform to all structural requirements as detailed or specified in the Structural drawings and specifications.

### **1.33 CONNECTIONS TO EXISTING UTILITY MAINS**

- A. Make arrangements with the utility companies for connection to such services as water, sewer, gas, etc. The entire utilities installations are included under this contract, including payment of all utility company charges, and including the points of tie-ins to utility company mains. Where meters, regulators, vaults, etc., are noted on the drawings or specified as being furnished or furnished and installed by the utility companies, the Contractor shall pay any fees and charges connected with the particular installation such as tap-in charges, meter charges, installation charges, etc.
- B. Install meters, regulators, etc. furnished by the utilities companies.
- C. Pipe up meters in accordance with utility company's requirements. Provide meters, regulators, shutoff valves, bypass valves, test plugs, piping, fittings and any other devices required by the utility company. In addition, provide any devices required by the Drawings.

### **1.34 TEMPORARY UTILITIES**

- A. In any installation that requires deletion of existing services to install new services, a means of providing temporary service for the intermediate period shall be provided. The means of providing temporary service is to be reviewed and revised as required by the Engineer. This means of providing temporary service is to include but not limited to piping and its associated fittings, valves, insulation, restraints & thrust blocks and all other components required to make a temporary service operational to a level equal to the existing utility service.

### **1.35 RESTORATION OF SURFACES**

- A. Each Contractor shall restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, shrubs, and other items damaged or removed by his operations that are outside of the Limit of Site boundaries. Replacement and repairs shall be in accordance with good construction practice and shall match material employed in the original construction of the item to be replaced.



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### **1.36 SHOP DRAWINGS AND OTHER REQUIRED SUBMITTALS**

- A. Comply with requirements listed in Division 1 Section – SUBMITTAL PROCEDURES and the following paragraphs.
- B. Definitions
  - 1. Action Submittals: See Division 1 Section – "SUBMITTAL PROCEDURES".
  - 2. Informational Submittals: See Division 1 Section – "SUBMITTAL PROCEDURES".
- C. Submittals may be submitted in electronic format. Submit in accordance with requirements in Division 1 Section – "SUBMITTAL PROCEDURES" and requirements of this Section.
- D. Prepare and submit to the Architect/Engineer for review, shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc., and any other data required.
- E. Submittal data shall have the stamp of approval of the General Contractor to show that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will be returned for proper resubmission.
- F. No roughing-in, connections, etc., shall be done until acceptable shop drawings are in the hands of the Contractors. It shall be the responsibility of the Contractor to obtain acceptable shop drawings and to make connections, etc., in the neatest and most workmanlike manner possible.
- G. Submittal data must be complete for each piece of equipment. Partial or incomplete data will not be processed.
- H. Architect/Engineer's review of shop drawings the applies only to general design, arrangement, type, capacity and quality. Such approval does not apply to quantities, dimensions, connection locations, etc. In these cases, the Contractor alone shall be responsible for furnishing the proper quantity of the equipment and/or materials required for seeing that the equipment fits the available space in a satisfactory manner and that piping, electrical and other connections are suitably located.
- I. The Architect's/Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for deviations from drawings or specifications unless he has, in writing, called the Architect's/Engineer's attention to such deviation at the time of submission and secured his written acceptance nor shall it relieve him from responsibility for error in shop drawings or schedules.
- J. Submittal data must be complete and acceptable before project is accepted.

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### **1.37 OPERATING AND MAINTENANCE INSTRUCTIONS**

- A. This Contractor shall prepare three loose-leaf, bound brochures, entitled "Plumbing Equipment Operation and Maintenance Data." Mark identification on both front and spine of each binder. Each binder shall be a heavy duty 3-ring, vinyl-covered binder with pocket folders for folded sheet information. Each binder cover and spine shall have the project name (as listed on the drawings), and what is in the binder. If more than one binder is provide the cover and spine shall be marked with "Volume ? of ?". Binders shall be properly indexed (thumb- tabbed). Information shall be filed under applicable specification section number.
- B. Each brochure shall contain the following information:
  - 1. Name and address of Consulting Engineer, Contractor, and index of equipment, including vendor (name and address).
  - 2. Complete brochures, descriptive data and parts list, etc., on each piece of equipment, including all approved shop drawings.
  - 3. Complete maintenance and operating instructions, prepared by the manufacturer, on each major piece of equipment.
- C. All brochures shall be submitted to the Architect/Engineer or his representative prior to final inspection of the building.

### **1.38 OWNER INSTRUCTION**

- A. Conduct a minimum of a full-day walk-through instruction seminar for the Owner's personnel to be involved in the continued operation and maintenance of mechanical equipment and systems.
- B. Engage factory-authorized service representatives for the following equipment to train Owner's maintenance personnel:
  - 1. Air compressors
  - 2. Domestic water heaters
- C. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Review data in the operation and maintenance manuals.
- D. Explain the identification system, operational diagrams, emergency and alarm provisions, safety, efficiency and similar features of the systems.
- E. Video tape the instruction sessions and turn over video tapes to the Owner. Provide a disc to the owner in "DVD" format.

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**1.39 PERMANENT PLUMBING SYSTEM OPERATION DURING CONSTRUCTION (NEW AND EXISTING TO REMAIN)**

- A. Provide permanent plumbing system operation to all areas occupied during construction.
- B. Existing plumbing systems must remain in operation until occupied spaces served by each system have been vacated.
- C. Provide permanent plumbing only to occupied spaces. Do not provide permanent plumbing to any space under construction or being renovated except as described hereinafter. If permanent plumbing systems serve both occupied spaces and other spaces, then cap off piping to other spaces so that plumbing services are provided only to occupied spaces. When a space becomes ready for occupancy, then reconnect piping serving space to permanent plumbing system.

**1.40 SYSTEM DESIGN WORKING PRESSURES**

- A. Provide all piping system components suitable for 125 psig minimum steam working pressure.

**1.41 MAINTAINING EXISTING SERVICES**

- A. Properly make all temporary connections that may be necessary to continue these services in a safe and substantial manner until the permanent services are activated. Upon completion, remove all temporary work, and completely restore all areas that may be affected.

**1.42 INTERRUPTION OF EXISTING PLUMBING SERVICES**

- A. In general, do not interrupt plumbing services to occupied areas of the site. If services must be interrupted (for making temporary connections, for changing over from existing to new, or for making new connections to existing systems, for example) then do such work at the times designated by the Owner.
- B. Schedule this work in advance with the Owner. Perform work on premium time if required to do so by the Owner.
- C. At any time the existing building services are interrupted, the Contractor shall work continuously until the permanent services are restored.

**1.43 OWNER OCCUPANCY**

- A. Full Owner Occupancy: The Owner will occupy the site and buildings surrounding construction area during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage.

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Perform the Work to minimize interference with the Owner's operations. Perform portions of work on premium time if required to do so by the Owner.

#### **1.44 DEMOLITION**

- A. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
- B. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- C. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
- D. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- E. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- F. All other existing plumbing work (such as piping, valves, etc.) shall become the property of the Contractor and shall be removed from the job site.
- G. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- H. Remove or relocate existing plumbing work that interferes with new work of any kind.
- I. The Drawings show existing work to the extent possible. However, all existing work may not be shown. Remove or relocate any existing work that interferes with new work even if it is not shown on the Drawings.
- J. Remove existing work that does not have to remain in service. Relocate existing work that has to remain in service, as required to avoid interference with new work.
- K. Remove or relocate existing electrical work that interferes with new plumbing work, if such work is not indicated to be removed or relocated on the Electrical Drawings. Remove work that does not have to remain in service. Relocate work that has to remain in service, as required to avoid interference with new work.
- L. Existing work serving the floors above or below shall remain in service.

#### **1.45 PROVIDING AIRTIGHT SPACES**

- A. In rooms where room walls extend above ceiling to the floor or roof above, caulk around all new and existing penetrations through walls, ceilings, floors and/or roofs to make completely airtight rooms. Seal penetrations both above and below suspended

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ceilings. Seal any openings left by removal of any existing or new work. Caulking used shall be the same type as specified in the Architectural Specifications.

- B. Patch around rough openings of penetrations to form a tight fit before caulking.

#### **1.46 PROFESSIONAL ENGINEER QUALIFICATIONS**

- A. When the term “professional engineer”, or “qualified professional engineer” is used anywhere in these specifications it shall mean a person who is licensed to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

### **PART 2 - PRODUCTS**

#### **2.1 FIRESTOPPING**

- A. Provide seals for any opening through any walls, floors, or ceilings used as passage for plumbing components.
- B. General: Provide manufacturer's standard fire-stopping sealant, with accessory materials, having fire-resistance ratings as established by testing identical assemblies per ASTM E 814 by Underwriters' Laboratories, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction. Sealant shall provide protection equal or exceeding the fire resistance rating of fire rated walls, partitions, ceilings or floors. Use two-part or one part sealants as required to meet required fire resistance ratings.
- C. Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place, silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.
- D. One-Part Fire-Stopping Sealant: One part elastomeric sealant formulated for use in a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.
- E. Intumescent Fire-Stopping Sealant: A one-part, acrylic sealant that expands when exposed to heat.
- F. Firestop Compound: Trowelable compound for large openings
- G. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
  1. Foamed-in-Place Fire-Stopping Sealant:

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- a. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
  - b. "Pensil 85I"; General Electric Co.
2. One-Part Fire-Stopping Sealant:
- a. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
  - b. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
  - c. "RTV 7403"; General Electric Co.
  - d. "Fyre Putty"; Standard Oil Engineered Materials Co.
  - e. "FS 601"; Hilti Inc.
  - f. "FS 611A"; Intumescent Sealant; Hilti Inc.
  - g. "FS 635"; Hilti Inc.
- H. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials to fill openings around plumbing services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

## 2.2 ACCESS UNITS

- A. General. The work of this article is limited to the provisions for access through other work for access to plumbing work, and does not include internal access provisions (within the plumbing work). In general and where possible, furnish or furnish-and-mount required access units in other trades' work prior to their work, so that cutting and patching for the subsequent installation of such access units will not be required. In occupied spaces, provide finished access units of the maximum concealment type, including locks where appropriate, and matching access units provided in the same expanse of finish (for non-plumbing access, if any).
- B. The scope of access units to be furnished or provided as plumbing work includes those units indicated on the plumbing drawings or specified in Division 22 sections, and those additional units required for adequate access to Plumbing work and not shown or specified individually.
- C. Access Doors. Standard welded-steel construction, 16-gage frames and 14 gage door panels, 175 degree concealed spring hinges, rust-inhibitive prime coat, flush cam lock (for screw-driver operation where keyed lock is not required), recessed to receive applied finish where applicable (such as in concealed spline ceilings).
- D. Removable Access Plates. Where only hand access is sufficient, provide removable plate-type access unit, or minimum size which will facilitate the required access. Provide units of the type, style, design, material and finish appropriate for the location and exposure in each instance. In exposed surfaces of occupied spaces provide round plate units, flush floor units and frameless low-profile wall units, primed-for-paint in painted surfaces and polished chrome or stainless steel finish in other surfaces.
- E. Access Thru Fire Rated Walls or Ceilings. Where access doors or plates are required in fire rated partitions or ceilings, provide U.L. listed "B" Label doors or plates rated for

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1-1/2 hours. Furnish doors with automatic closers and key operated latches that latch automatically when door closes.

### **2.3 FLASHING:**

- A. General: Provide flashings from the following listing for each penetration of plumbing systems through roofs or waterproof membranes. Select appropriate flashing method for the type of roof used. Flashing shall be in accordance with roofing manufacturer's recommendations.
- B. Copper Flashing: Provide cold-rolled sheet copper, complying with ANSI/ASTM B 370, weighing 16 oz. per sq. ft. (0.0216" thick), except as otherwise indicated.
- C. Lead Flashing: Provide sheet lead complying with FS QQ-L-2201, Grade B; formed from common desilverized pig lead, complying with ANSI/ASTM B 29; weighing 4.0 lbs. per sq. ft., except as otherwise indicated.
- D. Bituminous Coating: FS TT-C-494, or MIL-C-18480, or SSPC-paint 12, cold-applied solvent-type bituminous mastic coating for application in dry film thickness of 15 mils per coat.
- E. Laminated Sheet Flashing: Bottom laminate of heavy-duty nonplasticized chlorinated polyethylene (CPE) synthetic elastomer, with top laminate of built-up roofing (BUR) sheet material; weighing 8 oz. per sq. ft.
- F. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of sheet metal being installed.
- G. Coat back side of lead flashings where in contact with concrete and other cementitious substrates, by painting surface in area of contact with heavy application of bituminous coating, or by other permanent separation as recommended by manufacturer of metal.
- H. On vertical surfaces, lap flashings minimum of 3".
- I. On vertical surfaces, for slopes of not less than 6" in 12", lap unsealed flashings minimum of 6".
- J. For embedment of metal flashing flanges in roofing or composition flashing or stripping, extend flanges minimum of 6" for embedment.

## **PART 3 - EXECUTION**

### **3.1 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.

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1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
2. 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 the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified.

### **3.2 ERECTION OF METAL SUPPORTS AND ANCHORAGES**

- A. Refer to other divisions for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### **3.3 GROUTING**

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**END OF SECTION 22 00 00**



## **SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

### **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 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.

#### **1.3 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 NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

#### **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.
- A. Motors Used with Variable Frequency Drives: Ratings, characteristics, and features coordinated with and approved by variable frequency drive 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.

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Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

4. Motors used with VFD's shall be provided with AEGIS™ SGR shaft grounding rings or equal. On motors greater than 100HP also provide an insulated, insulated ceramic or hybrid bearing on the non-drive end of the motor.
5. Motors shall be totally enclosed, fan cooled, inverter-duty motors. Inverter-ready and inverter-rated motors are not acceptable.
6. Motors shall be the standard efficiency design of the motor manufacturer.
7. Motors shall not be limited to use with the same manufacturer's variable frequency drives.
8. Motors shall be designed with critical vibration frequencies outside operating range of controller output. Motors shall comply with all of NEMA MG1, Part 31 "Definite Purpose Inverter-fed Motors." Motor Frames shall be cast iron construction.

- B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 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)

**END OF SECTION 22 05 13**

## **SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

### **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. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

#### **1.3 ACTION 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. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

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## 2.2 SLEEVE-SEAL SYSTEMS

- 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. 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: Stainless steel.
  3. Connecting Bolts and Nuts: Stainless steel 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.
- 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.

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- 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.
- 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.

### **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): Cast-iron wall sleeves.
    - b. Piping NPS 6 (DN 150) and Larger: Cast-iron 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.

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- b. Piping NPS 6 (DN 150) and Larger: 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.
  - b. Piping NPS 6 (DN 150) and Larger: 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.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION 22 05 17**

## **SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING**

### **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. Escutcheons.
  - 2. Floor plates.

#### **1.3 ACTION SUBMITTALS**

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

### **PART 2 - PRODUCTS**

#### **2.1 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.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

#### **2.2 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange.



- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

## **PART 3 - EXECUTION**

### **3.1 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 insulated 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, cast-brass type with polished, chrome-plated finish.
    - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
  2. Escutcheons for Existing Piping:
    - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated 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.
  2. Existing Piping: Split-casting, floor-plate type.

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**3.2 FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

**END OF SECTION 22 05 18**

## **SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING**

### **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. Filled-system thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
  - 6. Test-plug kits.
- B. Related Sections:
  - 1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
  - 2. Section 211313 "Wet-Pipe Sprinkler Systems"
  - 3. Section 221113 "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
  - 4. Section 221116 "Domestic Water Piping" for water meters inside the building.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of meter and gage, from manufacturer.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

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## PART 2 - PRODUCTS

### 2.1 FILLED-SYSTEM THERMOMETERS

#### A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

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. Ashcroft Inc.
  - b. Marsh Bellofram.
  - c. Miljoco Corporation.
  - d. Palmer Wahl Instrumentation Group.
  - e. REOTEMP Instrument Corporation.
  - f. Trelice, H. O. Co.
  - g. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
12. Accuracy: Plus or minus 1 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: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.

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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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, 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 or NPS 1/2 (DN 8 or DN 15), 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 in psi (kPa).
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.

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11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

## 2.5 TEST PLUGS

- 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. Flow Design, Inc.
  2. Miljoco Corporation.
  3. National Meter, Inc.
  4. Peterson Equipment Co., Inc.
  5. Sisco Manufacturing Company, Inc.
  6. Trerice, H. O. Co.
  7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  8. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

## 2.6 TEST-PLUG KITS

- 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. Flow Design, Inc.
  2. Miljoco Corporation.
  3. National Meter, Inc.

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4. Peterson Equipment Co., Inc.
  5. Sisco Manufacturing Company, Inc.
  6. Trerice, H. O. Co.
  7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  8. Weiss Instruments, Inc.
- B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).
- D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).
- E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).
- F. Carrying Case: Metal or plastic, with formed instrument padding.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid 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 test plugs in piping tees.
- I. Install thermometers in the following locations:

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1. Inlet and outlet of each water heater.

J. 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.

### **3.2 CONNECTIONS**

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### **3.3 ADJUSTING**

A. Adjust faces of meters and gages to proper angle for best visibility.

### **3.4 THERMOMETER SCHEDULE**

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:

1. Direct-mounted, metal-case, vapor-actuated type.

B. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:

1. Direct-mounted, metal-case, vapor-actuated type.

C. Thermometer stems shall be of length to match thermowell insertion length.

### **3.5 THERMOMETER SCALE-RANGE SCHEDULE**

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F (0 to plus 115 deg C).

### **3.6 PRESSURE-GAGE SCHEDULE**

A. Pressure gages at discharge of each water service into building shall be the following:

1. Liquid-filled, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:

1. Liquid-filled, direct-mounted, metal case.



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- C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
  - 1. Liquid-filled, direct-mounted, metal case.

### **3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

- A. Scale Range for Water Service Piping: 0 to 160 psi (0 to 1100 kPa).
- B. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

**END OF SECTION 22 05 19**

## **SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING**

### **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. Brass ball valves.
  - 2. Bronze ball valves.
  - 3. Steel ball valves.
  - 4. Iron ball valves.

#### **1.3 DEFINITIONS**

- A. CWP: Cold working pressure.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 and NSF 372.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and soldered ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

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- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.5 for flanges on steel valves.
  - 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 5. ASME B16.18 for solder-joint connections.
  - 6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 4 (DN 100) and larger.
  - 2. Handlever: For quarter-turn valves smaller than NPS 4 (DN 100).
- H. Valves in Insulated Piping:
  - 1. Include 2-inch (50-mm) stem extensions.
  - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
  - 3. Memory stops that are fully adjustable after insulation is applied.

### **2.2 BRASS BALL VALVES**

- A. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:

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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. American Valve, Inc.
- b. Conbraco Industries, Inc.; Apollo Valves.
- c. Crane Co.; Crane Valve Group; Crane Valves.
- d. Crane Co.; Crane Valve Group; Stockham Valves.
- e. DynaQuip Controls.
- f. Hammond Valve.
- g. Jomar International, LTD.
- h. Kitz Corporation.
- i. Legend Valve.
- j. Marwin Valve; a division of Richards Industries.
- k. Milwaukee Valve Company.
- l. NIBCO INC.
- m. Red-White Valve Corporation.
- n. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig (4140 kPa).
- c. Body Design: Two piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.

B. Two-Piece, Brass Ball Valves with Full Port and Stainless-Steel Trim:

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. Kitz Corporation.
- b. Marwin Valve; a division of Richards Industries.
- c. Milwaukee Valve Company.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig (4140 kPa).
- c. Body Design: Two piece.
- d. Body Material: Forged brass.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.

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- h. Ball: Stainless steel, vented.
- i. Port: Full.

C. Three-Piece, Brass Ball Valves with Full Port and Brass Trim:

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. Jomar International, LTD.
  - b. Kitz Corporation.
  - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig (4140 kPa).
  - c. Body Design: Three piece.
  - d. Body Material: Forged brass.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.

D. Three-Piece, Brass Ball Valves with Full Port and Stainless-Steel Trim:

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. Marwin Valve; a division of Richards Industries.
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig (4140 kPa).
  - c. Body Design: Three piece.
  - d. Body Material: Forged brass.
  - e. Ends: Threaded and soldered.
  - f. Seats: PTFE.
  - g. Stem: Stainless steel.
  - h. Ball: Stainless steel, vented.
  - i. Port: Full.

## 2.3 BRONZE BALL VALVES

A. Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:

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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. Conbraco Industries, Inc.; Apollo Valves.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Hammond Valve.
- d. Lance Valves; a division of Advanced Thermal Systems, Inc.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig (4140 kPa).
- c. Body Design: Two piece.
- d. Body Material: Bronze.
- e. Ends: Threaded and soldered.
- f. Seats: PTFE.
- g. Stem: Bronze or brass.
- h. Ball: Chrome-plated brass.
- i. Port: Full.

B. Two-Piece, Bronze Ball Valves with Full Port and Stainless-Steel Trim:

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. Conbraco Industries, Inc.; Apollo Valves.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Hammond Valve.
- d. Lance Valves; a division of Advanced Thermal Systems, Inc.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-110.
- b. CWP Rating: 600 psig (4140 kPa).
- c. Body Design: Two piece.
- d. Body Material: Bronze.
- e. Ends: Threaded or soldered.
- f. Seats: PTFE.
- g. Stem: Stainless steel.
- h. Ball: Stainless steel, vented.
- i. Port: Full.

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C. Three-Piece, Bronze Ball Valves with Full Port and Bronze or Brass Trim:

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. Conbraco Industries, Inc.; Apollo Valves.
  - b. DynaQuip Controls.
  - c. Hammond Valve.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Red-White Valve Corporation.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig (4140 kPa).
  - c. Body Design: Three piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded.
  - f. Seats: PTFE.
  - g. Stem: Bronze or brass.
  - h. Ball: Chrome-plated brass.
  - i. Port: Full.

D. Three-Piece, Bronze Ball Valves with Full Port and Stainless-Steel Trim:

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. Conbraco Industries, Inc.; Apollo Valves.
  - b. Hammond Valve.
  - c. Milwaukee Valve Company.
  - d. NIBCO INC.
  - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig (4140 kPa).
  - c. Body Design: Three piece.
  - d. Body Material: Bronze.
  - e. Ends: Threaded.
  - f. Seats: PTFE.
  - g. Stem: Stainless steel.
  - h. Ball: Stainless steel, vented.
  - i. Port: Full.

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E. Two-Piece, Safety-Exhaust, Bronze Ball 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. Conbraco Industries, Inc.; Apollo Valves.
  - b. Jamesbury, Inc.; a subsidiary of Metso Automation.
  - c. NIBCO INC.
2. Description:
  - a. Standard: MSS SP-110.
  - b. CWP Rating: 600 psig (4140 kPa).
  - c. Body Design: Two piece.
  - d. Body Material: Bronze, ASTM B 584, Alloy C844.
  - e. Ends: Threaded.
  - f. Seats: PTFE.
  - g. Stem: Stainless steel.
  - h. Ball: Chrome-plated brass, with exhaust vent opening for pneumatic applications.
  - i. Port: Full.

## 2.4 STEEL BALL VALVES

A. Class 150, Steel Ball Valves with Full Port:

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. Conbraco Industries, Inc.; Apollo Valves.
  - b. Jamesbury, Inc.; a subsidiary of Metso Automation.
  - c. NIBCO INC.
2. Description:
  - a. Standard: MSS SP-72.
  - b. CWP Rating: 285 psig (1964 kPa).
  - c. Body Design: Split body.
  - d. Body Material: Carbon steel, ASTM A 216, Type WCB.
  - e. Ends: Flanged or threaded.
  - f. Seats: PTFE.
  - g. Stem: Stainless steel.
  - h. Ball: Stainless steel, vented.
  - i. Port: Full.



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## 2.5 IRON BALL VALVES

### A. Class 125, Iron Ball 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. American Valve, Inc.
  - b. Conbraco Industries, Inc.; Apollo Valves.
  - c. Kitz Corporation.
  - d. Sure Flow Equipment Inc.
  - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-72.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Split body.
  - d. Body Material: ASTM A 126, gray iron.
  - e. Ends: Flanged or threaded.
  - f. Seats: PTFE.
  - g. Stem: Stainless steel.
  - h. Ball: Stainless steel.
  - i. Port: Full.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### **3.2 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.
- E. Install valve tags. Comply with requirements in specifications for valve tags and schedules.

### **3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves 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. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
  - 5. For Steel Piping, 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.
  - 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

### **3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)**

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Two-piece, brass ball valves with full port and brass or stainless-steel trim.
  - 3. Two-piece, bronze ball valves with full port and bronze, brass or stainless-steel trim.
  - 4. Three-piece, brass ball valves with full port and brass or stainless-steel trim.
  - 5. Three-piece, bronze ball valves with full port and bronze, brass or stainless-steel trim.
- B. Pipe NPS 2-1/2 (DN 65) and Larger:

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1. Steel and Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Class 150, steel ball valves with full port.

### **3.5 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO 1380 kPa))**

#### **A. Pipe NPS 2 (DN 50) and Smaller:**

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Two-piece, brass ball valves with full port and brass or stainless-steel trim.
3. Two-piece, bronze ball valves with full port and bronze, brass or stainless-steel trim.
4. Three-piece, brass ball valves with full port and brass or stainless-steel trim.
5. Three-piece, bronze ball valves with full port and bronze, brass or stainless-steel trim.

#### **B. Pipe NPS 2-1/2 (DN 65) and Larger:**

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Class 150, steel ball valves with full port.
3. Class 150, iron ball valves.

### **3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

#### **A. Pipe NPS 2 (DN 50) and Smaller:**

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Two-piece, brass ball valves with full port and brass or stainless-steel trim.
3. Two-piece, bronze ball valves with full port and bronze, brass or stainless-steel trim.
4. Three-piece, brass ball valves with full port and brass or stainless-steel trim.
5. Three-piece, bronze ball valves with full port and bronze, brass or stainless-steel trim.

#### **B. Pipe NPS 2-1/2 (DN 65) and Larger:**

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Class 150, steel ball valves with full port.
3. Class 125, iron ball valves.

**END OF SECTION 22 05 23.12**

## **SECTION 22 05 23.13 - BUTTERFLY VALVES FOR PLUMBING PIPING**

### **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. Iron, single-flange butterfly valves.
  - 2. Chainwheels.

#### **1.3 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-dieneterpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 and NSF 372.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set butterfly valves closed or slightly open.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.

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2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
1. ASME B16.1 for flanges on iron valves.
  2. ASME B16.5 for flanges on steel valves.
  3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  4. ASME B31.9 for building service piping valves.
- C. NSF Compliance: NSF 61[ **and NSF 372**] for valve materials for potable-water service.
- D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream piping unless otherwise indicated.
- F. Valve Actuator Types:
1. Gear Actuator: For valves NPS 8 (DN 200) and larger.
  2. Handlever: For valves NPS 6 (DN 150) and smaller.
  3. Chainwheel: Device for attachment to gear, handlever, or stem; of size and with chain for mounting height, according to "Valve Installation" Article.
- G. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions.

### **2.2 IRON, SINGLE-FLANGE BUTTERFLY VALVES**

- A. Iron, Single-Flange Butterfly Valves with Aluminum-Bronze Disc:
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. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.

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- c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
- d. Crane Co.; Crane Valve Group; Jenkins Valves.
- e. Crane Co.; Crane Valve Group; Stockham Valves.
- f. DeZurik Water Controls.
- g. Flo Fab Inc.
- h. Hammond Valve.
- i. Kitz Corporation.
- j. Legend Valve.
- k. Milwaukee Valve Company.
- l. NIBCO INC.
- m. Norriseal; a Dover Corporation company.
- n. Red-White Valve Corporation.
- o. Spence Strainers International; a division of CIRCOR International, Inc..
- p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Aluminum bronze.

### 2.3 CHAINWHEELS

- 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. Babbitt Steam Specialty Co.
  - 2. Roto Hammer Industries.
  - 3. Trumbull Industries.
- B. Description: Valve actuation assembly with sprocket rim, chain guides, chain, and attachment brackets for mounting chainwheels directly to handwheels.
  - 1. Sprocket Rim with Chain Guides: Bronze, of type and size required for valve.
  - 2. Chain: Stainless steel, of size required to fit sprocket rim.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine mating flange faces for damage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective valves; replace with new valves.

#### **3.2 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.
- E. Install chainwheels on operators for butterfly valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.
- F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

#### **3.3 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.

#### **3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

**END OF SECTION 22 05 23.13**

## **SECTION 22 05 23.14 - CHECK VALVES FOR PLUMBING PIPING**

### **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. Bronze lift check valves.
  - 2. Bronze swing check valves.
  - 3. Iron swing check valves.
  - 4. Iron swing check valves with closure control.
  - 5. Iron, center-guided check valves.
  - 6. Iron, plate-type check valves.

#### **1.3 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene-diene terpolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 and NSF 372.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set check valves in either closed or open position.
- B. Use the following precautions during storage:



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1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
  2. ASME B16.1 for flanges on iron valves.
  3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  4. ASME B16.18 for solder joint.
  5. ASME B31.9 for building services piping valves.
- C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- D. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Bypass and Drain Connections: MSS SP-45.

### **2.2 BRONZE LIFT CHECK VALVES**

### **2.3 BRONZE SWING CHECK VALVES**

- A. Class 150, Bronze Swing Check Valves with Bronze Disc:
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:

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- 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 Valves.
- e. Kitz Corporation.
- f. The Macomb Groups.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Red-White Valve Corporation.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 300 psig (2070 kPa).
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded or soldered. See valve schedule articles.
- f. Disc: Bronze.

## 2.4 IRON SWING CHECK VALVES

A. Class 250, Iron Swing Check Valves with Metal Seats:

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. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Valves.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-71, Type I.
- b. CWP Rating: 500 psig (3450 kPa).
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged or threaded. See valve schedule articles.
- f. Trim: Bronze.
- g. Gasket: Asbestos free.

## 2.5 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

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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. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Valves.
  - d. Hammond Valve.
  - e. Milwaukee Valve Company.
  - f. NIBCO INC.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  
2. Description:
  - a. Standard: MSS SP-71, Type I.
  - b. CWP Rating: 200 psig (1380 kPa).
  - c. Body Design: Clear or full waterway.
  - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - e. Ends: Flanged or threaded. See valve schedule articles.
  - f. Trim: Bronze.
  - g. Gasket: Asbestos free.
  - h. Closure Control: Factory-installed exterior lever and weight.

## 2.6 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES

### A. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

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. APCO Willamette Valve and Primer Corporation.
  - b. Crispin Valve.
  - c. DFT Inc.
  - d. Flo Fab Inc.
  - e. Hammond Valve.
  - f. Metraflex, Inc.
  - g. Milwaukee Valve Company.
  - h. NIBCO INC.
  - i. Sure Flow Equipment Inc.
  - j. Val-Matic Valve & Manufacturing Corp.
  
2. Description:
  - a. Standard: MSS SP-125.
  - b. CWP Rating: 400 psig (2760 kPa).
  - c. Body Material: ASTM A 126, gray iron.
  - d. Style: Compact wafer, spring loaded.
  - e. Seat: Bronze.

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- B. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:
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. APCO Willamette Valve and Primer Corporation.
    - b. Crispin Valve.
    - c. DFT Inc.
    - d. Flomatic Corporation.
    - e. Hammond Valve.
    - f. Metraflex, Inc.
    - g. Milwaukee Valve Company.
    - h. Mueller Steam Specialty; a division of SPX Corporation.
    - i. NIBCO INC.
    - j. Val-Matic Valve & Manufacturing Corp.
  2. Description:
    - a. Standard: MSS SP-125.
    - b. CWP Rating: 400 psig (2760 kPa).
    - c. Body Material: ASTM A 126, gray iron.
    - d. Style: Globe, spring loaded.
    - e. Ends: Flanged.
    - f. Seat: Bronze.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 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.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.
- F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

### 3.3 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.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Pump-Discharge Check Valves:
    - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat check valves.
    - c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. End Connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded or soldered.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.

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3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged.

**3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)**

- A. Pipe NPS 2 (DN 50) and Smaller:
1. Horizontal and Vertical Applications: Bronze swing check valves, Class 150, bronze disc with soldered or threaded end connections.
- B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron swing check valves, Class 250, metal seats with end connections.
  2. Iron, dual-plate check valves, Class 150, metal seat with threaded or flanged end connections.
  3. Iron, single-plate check valves, Class 250, resilient seat with threaded or flanged end connections.

**3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO 1380 kPa))**

- A. Pipe NPS 2 (DN 50) and Smaller:
1. Horizontal and Vertical Applications: Bronze swing check valves, Class 150, bronze disc with soldered or threaded end connections.
- B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron swing check valves, Class 250, metal seats with threaded or flanged end connections.
  2. Iron, grooved-end swing check valves, 300 CWP with threaded or flanged end connections.
  3. Iron, dual-plate check valves, Class 250, metal seat with threaded or flanged end connections.
  4. Iron, single-plate check valves, Class 250, resilient seat with threaded or flanged end connections.

**3.7 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 (DN 50) and Smaller: Bronze swing check valves, Class 150, bronze disc with soldered or threaded end connections.
- B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron swing check valves, Class 250, metal seats with threaded or flanged end connections.

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2. Iron swing check valves with closure control, Class 125, lever and spring with threaded or flanged end connections.
3. Iron, center-guided check valves, Class 250, compact wafer.
4. Iron, center-guided check valves, Class 250, globe, metal seat with threaded or flanged end connections.
5. Iron, dual-plate check valves, Class 250, metal seat with threaded or flanged end connections.
6. Iron, single-plate check valves, Class 250, resilient seat with threaded or flanged end connections.

**END OF SECTION 22 05 23.14**

## **SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment supports.

- B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220548 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

#### **1.3 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### **1.4 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.



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1. Design supports for multiple pipes, including pipe stands, 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.

## **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  1. Trapeze pipe hangers.
  2. Metal framing systems.
  3. Fiberglass strut systems.
  4. Pipe stands.
  5. 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.
  1. Detail fabrication and assembly of trapeze hangers.
  2. Design Calculations: Calculate requirements for designing trapeze hangers.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

## **1.7 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.

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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 stainless 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.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless 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 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

## 2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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:

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- a. Allied Tube & Conduit.
  - b. Cooper B-Line, Inc.
  - c. Flex-Strut Inc.
  - d. GS Metals Corp.
  - e. Thomas & Betts Corporation.
  - f. Unistrut Corporation; Tyco International, Ltd.
  - g. Wesanco, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
  3. Standard: MFMA-4.
  4. Channels: Continuous slotted steel channel with inturned lips.
  5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
  7. Metallic Coating: Electroplated zinc.
- B. Non-MFMA Manufacturer Metal Framing Systems:
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. Anvil International; a subsidiary of Mueller Water Products Inc.
    - b. Empire Industries, Inc.
    - c. ERICO International Corporation.
    - d. Haydon Corporation; H-Strut Division.
    - e. NIBCO INC.
    - f. PHD Manufacturing, Inc.
    - g. PHS Industries, Inc.
  2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
  3. Standard: Comply with MFMA-4.
  4. Channels: Continuous slotted steel channel with inturned lips.
  5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
  7. Coating: Zinc.

## 2.5 FIBERGLASS STRUT SYSTEMS

- 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. Allied Tube & Conduit.
  2. Champion Fiberglass, Inc.

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3. Cooper B-Line, Inc.
4. SEASAFE, INC.; a Gibraltar Industries Company.

B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

1. Channels: Continuous slotted fiberglass channel with inturred lips.
2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

## 2.6 THERMAL-HANGER SHIELD INSERTS

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. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.7 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.

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- 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.

## **2.8 PIPE STANDS**

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## **2.9 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## **2.10 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. Powder Actuated Concrete Fasteners
  - 1. Obtain written approval from the structural engineer before using powder-actuated concrete fasteners.
  - 2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- C. Suspension From Metal Decking

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1. Do not use metal decking for suspension of piping, ductwork or equipment. Hang items from top member of joist or provide additional structure to span between top members if needed.
- D. 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.
- E. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- F. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- G. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- H. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- I. 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.
- J. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See specifications for curbs.
- K. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- L. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

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- M. Install hangers and supports to allow controlled thermal 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.
- N. Install lateral bracing with pipe hangers and supports to prevent swaying.
- O. 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.
- P. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- Q. 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.
- R. 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.
- 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, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers, fiberglass pipe hangers and fiberglass strut systems and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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).

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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. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. 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.
15. 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.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. 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.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
19. 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.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

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21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. 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.
- L. 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.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- M. 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-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

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12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. 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.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. 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.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.

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- c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
  
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
  
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
  
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

**END OF SECTION 22 05 29**

## **SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

### **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. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Underground-Type Plastic Line Marker.
  - 6. Utility Service Markers
  - 7. Ceiling Identification Discs
  - 8. Valve tags.
  - 9. Warning tags.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

### **PART 2 - PRODUCTS**

#### **2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brimar Industries, Inc.
  - b. Carlton Industries, LP.
  - c. Champion America.
  - d. Seton Identification Products.
2. Material and Thickness: Brass, 0.032-inch (0.8-mm) or stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. 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).
6. 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-quarters the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brimar Industries, Inc.
  - b. Carlton Industries, LP.
  - c. Champion America.
  - d. Seton Identification Products.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
6. 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).
7. 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-quarters the size of principal lettering.
8. Fasteners: Stainless-steel self-tapping screws.

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9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. 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) and 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Brimar Industries, Inc.
  2. Carlton Industries, LP.
  3. Champion America.
  4. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Yellow.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- F. 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).
- G. 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-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.



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### 2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brimar Industries, Inc.
  2. Carlton Industries, LP.
  3. Champion America.
  4. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- 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; also include 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: Size letters according to ASME A13.1 for piping.

### 2.4 STENCILS

- A. Stencils for Piping:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brimar Industries, Inc.
    - b. Carlton Industries, LP.
    - c. Champion America.
  2. Lettering Size: Size letters according to ASME A13.1 for piping.
  3. Stencil Material: Fiberboard or metal.
  4. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
  5. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

### 2.5 UNDERGROUND-TYPE PLASTIC LINE MARKERS:

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick.

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Provide tape with printing which most accurately indicates type of service of buried pipe.

- B. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

## 2.6 UTILITY SERVICE MARKERS:

- A. Markers shall consist of bronze plates, ground and polished, and marked to identify the service. Markers shall also be stamped with arrows indicating the direction the service extends. A typical marker detail is shown on the Drawings.
- B. Markers locating services at the building shall be installed in masonry or concrete walls 2' above grade. Markers locating services elsewhere on the site shall be installed in concrete walks or curbs, or in 6" x 6" steel reinforced concrete posts as detailed.

## 2.7 MARKERS FOR IDENTIFYING EQUIPMENT ABOVE CEILINGS:

- A. Provide manufacturer's standard laminated plastic, color-coded equipment markers for identifying type and location of mechanical equipment above suspended ceilings. Provide markers with pressure adhesive and engraved as scheduled in this section. Markers shall be narrow enough to fit on exposed ceiling grid and long enough to accommodate specified engraving. Install on ceiling grid closest to equipment above ceiling.

## 2.8 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Brimar Industries, Inc.
  2. Carlton Industries, LP.
  3. Champion America.
  4. Seton Identification Products.
- B. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
  1. Tag Material: Brass, 0.032-inch (0.8-mm) or stainless steel, 0.025-inch (0.64-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Fasteners: Brass S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or

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modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.9 WARNING TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brimar Industries, Inc.
2. Carlton Industries, LP.
3. Champion America.
4. Seton Identification Products.

- B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

## 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 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### 3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

**3.4 PIPE LABEL INSTALLATION**

- A. Piping Color Coding: Painting of piping is specified.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
  - 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: 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.
  - 8. Space every 10' in mechanical rooms.
- D. Provide piping identification markers in accordance with the following schedule. Provide black lettering on yellow and white backgrounds and white lettering on backgrounds with other colors.
  - 1. COMMONWEALTH OF KENTUCKY (STATE). STANDARD COLOR CODING FOR PLUMBING PIPING
  - 2. Piping Identification Schedule

<u>Piping</u>	<u>Background Color</u>	<u>Letter Color</u>	<u>Legend - Band</u>
3. Domestic Cold Water	Light Blue	Black	D.C.W.
4. Domestic Hot Water	Light Blue	Black	D.H.W.
5. Domestic Recirc. Hot Water	Light Blue	White	R.H.W.
6. Fire Protection Water	Red	White	F.P.
7. Natural Gas	Yellow	Black	NAT. GAS
8. Compressed Air	Yellow	Black	AIR
9. Soil & Waste Piping	Gray	White	SAN
10. Sanitary Vent Piping	Gray	White	VENT
11. Storm Water Piping	Gray	White	STORMRoof Leader
Piping	Gray	White	R.L.20.Overflow Roof Leader Piping
Gray	White	O.R.L.	

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- E. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

### 3.5 MECHANICAL EQUIPMENT IDENTIFICATION ABOVE CEILING:

- A. Attach Seton-Ply Discs to ceiling grid under equipment or to access doors in non-accessible ceilings as follows:

	<u>Equipment</u>	<u>Engraved</u>	<u>Background</u> <u>Color</u>	<u>Lettering</u> <u>Color</u>
1.	Valve	V	Yellow	Black

### 3.6 UNDERGROUND PIPING IDENTIFICATION:

- A. General: During back-filling/top-soiling of each exterior underground piping systems, install continuous underground-type plastic line marker, located directly over buried line at 12" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.

### 3.7 UTILITY SERVICE MARKERS

- A. Install utility service markers where shown on plans.

### 3.8 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
    - a. Cold Water: 1-1/2 inches (38 mm), round.
    - b. Hot Water: 1-1/2 inches (38 mm), round.
    - c. Low-Pressure Compressed Air: 1-1/2 inches (38 mm), round.
    - d. High-Pressure Compressed Air: 1-1/2 inches (38 mm), round.
  2. Valve-Tag Colors:
    - a. Cold Water: Natural.
    - b. Hot Water: Natural.
    - c. Low-Pressure Compressed Air: Natural.

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- d. High-Pressure Compressed Air: Natural.
3. Letter Colors:
- a. Cold Water: Black.
  - b. Hot Water: Black.
  - c. Low-Pressure Compressed Air: Black.
  - d. High-Pressure Compressed Air: Black.
- C. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Owner.
- D. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

### **3.9 WARNING-TAG INSTALLATION**

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION 22 05 53**

## **SECTION 22 07 16 - PLUMBING EQUIPMENT INSULATION**

### **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 insulating the following plumbing equipment:
  - 1. Domestic water boiler breechings.
  - 2. Domestic water, hot-water pumps.
- B. Related Sections:
  - 1. Section 220719 "Plumbing Piping Insulation."

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory and field applied, if any).
- 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 removable insulation at equipment connections and access panels.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.
  - 5. Detail field application for each equipment type.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

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- C. Field quality-control reports.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## **1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

## **1.8 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.



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## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Domestic Water Boiler Breeching Insulation Schedule" and "Equipment 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 I. 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. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.
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. Industrial Insulation Group (IIG); MinWool-1200 Flexible Batt.
    - b. Johns Manville; HTB 26 Spin-Glas.
    - c. Roxul Inc.; Roxul RW.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- a. CertainTeed Corp.; CertaPro Commercial Board.

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- 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.
- I. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.
- 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.; FBX.
    - b. Industrial Insulation Group (IIG); MinWool-1200 Industrial Board.
    - c. Rock Wool; Delta Board.
    - d. Roxul Inc.; RHT and RockBoard.
    - e. Thermafiber, Inc.; Thermafiber Industrial Felt.
- J. 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-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. 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.; CrimpWrap.
    - b. Johns Manville; MicroFlex.
    - c. Knauf Insulation; Pipe and Tank Insulation.
    - d. Manson Insulation Inc.; AK Flex.

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- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 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. Mineral-Fiber 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. Childers Brand, a business of H. B. Fuller Company; CP-127.
- b. Eagle Bridges - Marathon Industries; 225.
- c. Foster Brand, a business of H. B. Fuller Company; 85-60.
- d. Mon-Eco Industries, Inc.; 22-25.
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: 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, a business of H. B. Fuller Company; CP-82.
- b. Eagle Bridges - Marathon Industries; 225.
- c. Foster Brand, a business of H. B. Fuller Company; 85-0.
- d. Mon-Eco Industries, Inc.; 22-25.

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
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.

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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, a business of H. B. Fuller Company; 30-65.
    - b. Childers Brand, CP-34
    - c. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.03 perm at 45-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  4. Color: White.
- C. Vapor-Barrier Mastic: Solvent 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. Childers Brand, a business of H. B. Fuller Company; CP-30LO.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor 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. Childers Brand, a business of H. B. Fuller Company; Encacel CP-45.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, a business of H. B. Fuller Company; 60-95/60-90.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
  4. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Shall be compatible with insulation materials, jackets, and substrates.

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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, a business of H. B. Fuller Company; CP-50 AMV1.
  - b. Foster Brand, a business of H. B. Fuller Company; 30-36.
  - c. Vimasco Corporation; 713 and 714.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

## 2.6 SEALANTS

### A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, sealant.
3. Service Temperature Range: Minus 75 to plus 200 deg F (Minus 59 to plus 93 deg C).
4. Color: White or gray.

### B. 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, a business of H. B. Fuller Company; CP-76.
  - b. Foster Brand, a business of H. B. Fuller Company; 95-44.
  - c. Pittsburgh Corning PC 727
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.

### C. ASJ Flashing Sealants, and Vinyl, PVDC, 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, 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.

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## 2.7 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.

## 2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
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. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

## 2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

## 2.10 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.

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- 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.

## 2.11 SECUREMENTS

- A. Bands:
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.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal.
- B. Insulation Pins and Hangers:

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1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
  - 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.; CHP-1.
    - 2) GEMCO; Cupped Head Weld Pin.
    - 3) Midwest Fasteners, Inc.; Cupped Head.
    - 4) Nelson Stud Welding; CHP.
2. 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.
  - a. Products: Subject to compliance with requirements, provide the following provide one of 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: Stainless 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.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, stainless-steel 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.



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- 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, stainless 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.

## 2.12 CORNER ANGLES

- A. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating

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manufacturer for appropriate coating materials and application methods for operating temperature range.

- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item 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.
  - 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.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

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- 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). 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)] [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.
- 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.
- O. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### **3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION**

- A. Mineral-Fiber, Pipe, and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
  2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  3. Protect exposed corners with secured corner angles.

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4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
  - a. Do not weld anchor pins to ASME-labeled pressure vessels.
  - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
  - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches (75 mm) from insulation end joints, and 16 inches (400 mm) o.c. in both directions.
  - d. Do not overcompress insulation during installation.
  - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
  - f. Impale insulation over anchor pins and attach speed washers.
  - g. 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.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches (150 mm) from each end. Install wire or cable between two circumferential girdles 12 inches (300 mm) o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches (1200 mm) o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches (75 mm).
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch (150-mm) centers, starting at corners. Install 3/8-inch- (10-mm-) diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from stainless steel, at least 0.040 inch (1.0 mm) thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

### 3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### 3.6 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified.
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 DOMESTIC WATER BOILER BREECHING INSULATION SCHEDULE

- A. Round, exposed breeching and connector insulation shall be the following:
1. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- B. Round, concealed breeching and connector insulation shall be one of the following:

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1. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
  2. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- C. Rectangular, exposed breeching and connector insulation shall be the following:
1. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- D. Rectangular, concealed breeching and connector insulation shall be one of the following:
1. High-Temperature Mineral-Fiber Blanket: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
  2. High-Temperature Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

### **3.8 EQUIPMENT INSULATION SCHEDULE**

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Domestic hot-water pump insulation shall be the following:
1. Mineral-Fiber Board: 1 inch (25 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- D. Domestic hot-water hydropneumatic tank insulation shall be one of the following:
1. Mineral-Fiber Board: 1 inch (25 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
  2. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.

**END OF SECTION 22 07 16**

## **SECTION 22 07 19 - PLUMBING PIPING INSULATION**

### **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 insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Roof drains and rainwater leaders.
- B. Related Sections:
  - 1. Section 220716 "Plumbing Equipment Insulation."

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- 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 elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 3. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 4. Detail application of field-applied jackets.
  - 5. Detail application at linkages of control devices.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.

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- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## **1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.



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## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come 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. 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.
- G. 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 I. 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.

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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-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 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. Flexible Elastomeric and Polyolefin 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. Aeroflex USA, Inc.; Aero seal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, a business of H. B. Fuller Company; 85-75.
    - d. Childers CP-82
    - e. K-Flex USA; R-373 Contact Adhesive.
- C. Mineral-Fiber 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. Childers Brand, a business of H. B. Fuller Company; CP-127.

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- b. Eagle Bridges - Marathon Industries; 225.
  - c. Foster Brand, a business of H. B. Fuller Company; 85-60.
  - d. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive, and FSK Jacket Adhesive: 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, a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, a business of H. B. Fuller Company; 85-20/85-60.
    - d. Mon-Eco Industries, Inc.; 22-25.

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates.
- 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, a business of H. B. Fuller Company; 30-65.
    - b. Childers Brand, CP-34
    - c. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.03 perm at 45-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent 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. Childers Brand, a business of H. B. Fuller Company; CP-30LO.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.

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2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  4. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor 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. Childers Brand, a business of H. B. Fuller Company; Encacel X/V.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, a business of H. B. Fuller Company; 60-95/60-90.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
  4. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. 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, a business of H. B. Fuller Company; CP-50 AMV1.
    - b. Foster Brand, a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  5. Color: White.

## 2.6 SEALANTS

- A. Joint Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Permanently flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 100 to plus 200 deg F (Minus 73 to plus 93 deg C).
  4. Color: White or gray.

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5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants 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."

B. 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, a business of H. B. Fuller Company; CP-76.
  - b.
  - c. Foster Brand, a business of H. B. Fuller Company; 95-44.
  - d. Pittsburgh Corning PC 727
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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants 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."

C. ASJ Flashing Sealants, and Vinyl, PVDC, 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, 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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants 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."

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## 2.7 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.

## 2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
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. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

## 2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
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: Aluminum and Stainless Steel Jacketing.
    - b. RPR Products, Inc.; Insul-Mate.
  2. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
    - a. Factory cut and rolled to size.
    - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
    - d. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

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- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.10 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.

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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.

## 2.11 SECUREMENTS

### A. Bands:

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.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal.

### 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, stainless 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.

## 2.12 Protective Shielding Piping Enclosures:

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. Truebro; a brand of IPS Corporation.
  - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.



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2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### **3.3 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.

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- 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)] [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 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.

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- 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.

### 3.4 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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements.

### 3.5 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. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. 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.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### **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 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.

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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 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### 3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified.

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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 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.

### **3.11 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Cold Water:
  1. Pipe Sizes 1" and under: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
  2. Pipe Sizes 1¼" and over: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (26 mm) thick.
- B. Domestic Hot and Recirculated Hot Water:
  1. Pipe Sizes 2" and under: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
  2. Pipe Sizes 2½" to 4": Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1½" inch thick.
  3. Pipe Sizes 5" and over: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2" inch thick.
- C. Stormwater and Overflow:



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1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Flexible Elastomeric: 1 inch (25 mm) thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- D. Roof Drain and Overflow Drain Bodies:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch (25 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- E. Floor Drains, Traps, and Sanitary Drain Piping Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch (25 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
  2. Insulate sanitary drain piping all the way to where it exits the building.

### **3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Exposed piping in any room and all piping in boiler, mechanical rooms, and tunnels shall have an 8 ounce canvas jacket applied over the fiberglass factory ASJ/SSL jacketing to further protect the insulation from abuse. This jacketing must be properly applied with lagging adhesive, such that the outer surface is smooth and free of wrinkles. The canvas jacketing in all mechanical areas is to be prepared for painting, and then painted according to the schedule included in specifications.
- B. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- C. If more than one material is listed, selection from materials listed is Contractor's option.
- D. Piping, Exposed:
  1. Stainless Steel, Type 316, Stucco Embossed: 0.010 inch (0.25 mm) thick.

**END OF SECTION 22 07 19**

## **SECTION 22 11 13 - FACILITY WATER DISTRIBUTION PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes water-distribution piping and related components outside the building for water service.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene propylene diene terpolymer rubber.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PA: Polyamide (nylon) plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
- H. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
  - 1. Wiring Diagrams: Power, signal, and control wiring for alarms.

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### **1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control test reports.

### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

### **1.7 QUALITY ASSURANCE**

- A. Regulatory Requirements:
  - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
  - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
  - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- G. NSF Compliance:
  - 1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  - 1. Ensure that valves are dry and internally protected against rust and corrosion.
  - 2. Protect valves against damage to threaded ends and flange faces.
  - 3. Set valves in best position for handling. Set valves closed to prevent rattling.

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- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
  - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.

## **1.9 PROJECT CONDITIONS**

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

## **1.10 COORDINATION**

- A. Coordinate connection to water main with utility company.

## **PART 2 - PRODUCTS**

### **2.1 COPPER TUBE AND FITTINGS**

- A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, annealed temper.

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1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- B. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.
1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

## 2.2 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
  2. Gaskets: AWWA C111, rubber.
- C. Flanges: ASME 16.1, Class 125, cast iron.

## 2.3 SPECIAL PIPE FITTINGS

- A. Ductile-Iron Rigid Expansion Joints:
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. EBA Iron, Inc.
    - b. U.S. Pipe and Foundry Company.

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2. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - a. Pressure Rating: 250 psig (1725 kPa) minimum.

**B. Ductile-Iron Flexible Expansion Joints:**

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. EBA Iron, Inc.
  - b. Hays Fluid Controls; a division of ROMAC Industries Inc.
  - c. Star Pipe Products.
2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - a. Pressure Rating: 250 psig (1725 kPa) minimum.

**C. Ductile-Iron Deflection Fittings:**

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. EBA Iron, Inc.
2. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - a. Pressure Rating: 250 psig (1725 kPa) minimum.

## **2.4 JOINING MATERIALS**

- A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.

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## 2.5 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
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. Cascade Waterworks Manufacturing.
    - b. Dresser, Inc.; Dresser Piping Specialties.
    - c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    - d. Hays Fluid Controls; a division of ROMAC Industries Inc.
    - e. JCM Industries.
    - f. Smith-Blair, Inc.
    - g. Viking Johnson.
  2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
    - a. Standard: AWWA C219.
    - b. Center-Sleeve Material: Manufacturer's standard.
    - c. Gasket Material: Natural or synthetic rubber.
    - d. Pressure Rating: 150 psig (1035 kPa) minimum.
    - e. Metal Component Finish: Corrosion-resistant coating or material.
- C. Split-Sleeve Pipe Couplings:
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. Victaulic Depend-O-Lok.
  2. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
    - a. Standard: AWWA C219.
    - b. Sleeve Material: Manufacturer's standard.
    - c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
    - d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
    - e. Pressure Rating: 150 psig (1035 kPa) minimum.
    - f. Metal Component Finish: Corrosion-resistant coating or material.
- D. Flexible Connectors:

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1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

E. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
  - a. Description:
    - 1) Standard: ASSE 1079.
    - 2) Pressure Rating: 150 psig (1035 kPa).
    - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges:
  - a. Description:
    - 1) Standard: ASSE 1079.
    - 2) Factory-fabricated, bolted, companion-flange assembly.
    - 3) Pressure Rating: 150 psig (1035 kPa) [**300 psig (2070 kPa)**].
    - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
  - a. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig (1035 kPa).
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
  - a. Description:
    - 1) Standard: IAPMO PS 66
    - 2) Electroplated steel nipple. complying with ASTM F 1545.
    - 3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.



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## 2.6 GATE VALVES

### A. AWWA, Cast-Iron Gate Valves:

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. American AVK Co.; Valves & Fittings Div.
  - b. American Cast Iron Pipe Co.; American Flow Control Div.
  - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
  - d. Crane Co.; Crane Valve Group; Stockham Div.
  - e. East Jordan Iron Works, Inc.
  - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
  - g. McWane, Inc.; Kennedy Valve Div.
  - h. McWane, Inc.; M & H Valve Company Div.
  - i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.
  - j. Mueller Co.; Water Products Div.
  - k. NIBCO INC.
  - l. U.S. Pipe and Foundry Company.
  
2. Nonrising-Stem, Metal-Seated Gate Valves:
  - a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
    - 1) Standard: AWWA C500.
    - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
    - 3) End Connections: Mechanical joint.
    - 4) Interior Coating: Complying with AWWA C550.
  
3. Nonrising-Stem, Resilient-Seated Gate Valves:
  - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
    - 1) Standard: AWWA C509.
    - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
    - 3) End Connections: Mechanical joint.
    - 4) Interior Coating: Complying with AWWA C550.
  
4. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
  - a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
    - 1) Standard: AWWA C500.
    - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
    - 3) End Connections: Flanged.

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5. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

- a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
- 1) Standard: AWWA C509.
  - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
  - 3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:

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. American Cast Iron Pipe Co.; American Flow Control Div.
- b. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
- c. Crane Co.; Crane Valve Group; Stockham Div.
- d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
- e. McWane, Inc.; Kennedy Valve Div.
- f. McWane, Inc.; M & H Valve Company Div.
- g. Mueller Co.; Water Products Div.
- h. NIBCO INC.
- i. U.S. Pipe and Foundry Company.

2. UL/FMG, Nonrising-Stem Gate Valves:

- a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
- 1) Standards: UL 262 and FMG approved.
  - 2) Minimum Pressure Rating: 175 psig (1207 kPa).
  - 3) End Connections: Flanged.

3. OS&Y, Rising-Stem Gate Valves:

- a. Description: Iron body and bonnet and bronze seating material.
- 1) Standards: UL 262 and FMG approved.
  - 2) Minimum Pressure Rating: 175 psig (1207 kPa).
  - 3) End Connections: Flanged.

C. Bronze Gate Valves:

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. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.

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- c. Crane Co.; Crane Valve Group; Stockham Div.
  - d. Hammond Valve.
  - e. Milwaukee Valve Company.
  - f. NIBCO INC.
  - g. Red-White Valve Corporation.
2. OS&Y, Rising-Stem Gate Valves:
- a. Description: Bronze body and bonnet and bronze stem.
    - 1) Standards: UL 262 and FMG approved.
    - 2) Minimum Pressure Rating: 175 psig (1207 kPa).
    - 3) End Connections: Threaded.
3. Nonrising-Stem Gate Valves:
- a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
    - 1) Standard: MSS SP-80.

## 2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

### A. Tapping-Sleeve Assemblies:

- 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. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
  - b. East Jordan Iron Works, Inc.
  - c. Flowserve.
  - d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
  - e. McWane, Inc.; Kennedy Valve Div.
  - f. McWane, Inc.; M & H Valve Company Div.
  - g. Mueller Co.; Water Products Div.
  - h. U.S. Pipe and Foundry Company.
- 2. Description: Sleeve and valve compatible with drilling machine.
  - a. Standard: MSS SP-60.
  - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
  - c. Valve: AWWA, cast-iron, nonrising-stem, [metal] [resilient]-seated gate valve with one raised face flange mating tapping-sleeve flange.

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- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.
  - 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

## 2.8 CHECK VALVES

### A. AWWA Check Valves:

- 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. American AVK Co.; Valves & Fittings Div.
  - b. American Cast Iron Pipe Co.; American Flow Control Div.
  - c. APCO Williamette; Valve and Primer Corporation.
  - d. Crane Co.; Crane Valve Group; Crane Valves.
  - e. Crane Co.; Crane Valve Group; Stockham Div.
  - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
  - g. McWane, Inc.; Kennedy Valve Div.
  - h. McWane, Inc.; M & H Valve Company Div.
  - i. Mueller Co.; Water Products Div.
  - j. NIBCO INC.
  - k. Watts Water Technologies, Inc.
- 2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
  - a. Standard: AWWA C508.
  - b. Pressure Rating: 175 psig (1207 kPa).

### B. UL/FMG, Check Valves:

- 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. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
  - b. Crane Co.; Crane Valve Group; Stockham Div.
  - c. Globe Fire Sprinkler Corporation.
  - d. Kidde Fire Fighting.
  - e. MATCO-NORCA, Inc.

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- f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
  - g. McWane, Inc.; Kennedy Valve Div.
  - h. Mueller Co.; Water Products Div.
  - i. NIBCO INC.
  - j. Reliable Automatic Sprinkler Co., Inc.
  - k. Tyco Fire & Building Products.
  - l. United Brass Works, Inc.
  - m. Victaulic Company of America.
  - n. Viking Corporation.
  - o. Watts Water Technologies, Inc.
2. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
- a. Standards: UL 312 and FMG approved.
  - b. Pressure Rating: [175 psig (1207 kPa)] [250 psig (1725 kPa)].

## 2.9 DETECTOR CHECK VALVES

### A. Detector Check Valves:

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. Ames Fire & Waterworks; a division of Watts Regulator Co.
  - b. Badger Meter, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Globe Fire Sprinkler Corporation.
  - e. McWane, Inc.; Kennedy Valve Div.
  - f. Mueller Co.; Hersey Meters.
  - g. Victaulic Company of America.
  - h. Viking Corporation.
  - i. Watts Water Technologies, Inc.
2. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
- a. Standards: UL 312 and FMG approved.
  - b. Pressure Rating: 175 psig (1207 kPa).
  - c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
3. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.

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- a. Standards: UL 312 and FMG approved.
- b. Pressure Rating: 175 psig (1207 kPa).

## 2.10 BUTTERFLY VALVES

### A. AWWA Butterfly Valves:

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. DeZURIK/Copes-Vulcan; a unit of SPX Corporation.
  - b. Milliken Valve Company.
  - c. Mosser Valve; a division of Olson Technologies, Inc.
  - d. Mueller Co.; Water Products Div.
  - e. Pratt, Henry Company.
  - f. Val-Matic Valve & Manufacturing Corp.
2. Description: Rubber seated.
  - a. Standard: AWWA C504.
  - b. Body: Cast or ductile iron.
  - c. Body Type: Flanged.
  - d. Pressure Rating: 150 psig (1035 kPa).

### B. UL Butterfly Valves:

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. McWane, Inc.; Kennedy Valve Div.
  - b. Milwaukee Valve Company.
  - c. Mueller Co.; Water Products Div.
  - d. NIBCO INC.
  - e. Pratt, Henry Company.
2. Description: Metal on resilient material seating.
  - a. Standards: UL 1091 and FMG approved.
  - b. Body: Cast or ductile iron.
  - c. Body Type: Flanged.
  - d. Pressure Rating: 175 psig (1207 kPa).

## 2.11 WATER METERS

- A. Water meters will be furnished by utility company.

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## 2.12 DETECTOR-TYPE WATER METERS

### A. Detector-Type Water Meters:

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. Badger Meter, Inc.
  - b. Mueller Co.; Hersey Meters.
  - c. Neptune Technology Group Inc.
  - d. Sensus Metering Systems.

### B. Description: Main line, proportional meter with second meter on bypass. Register flow in gallons (liters).

1. Standards: AWWA C703, UL listed, and FMG approved.
2. Pressure Rating: 150 psig (1035 kPa).
3. Bypass Meter: AWWA C701, turbine-type, bronze case.
  - a. Size: At least one-half nominal size of main-line meter.

## 2.13 VACUUM BREAKERS

### A. Pressure Vacuum Breaker 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. Ames Fire & Waterworks; a division of Watts Regulator Co.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Flomatic Corporation.
  - e. Toro Co. (The); Irrigation Division.
  - f. Watts Water Technologies, Inc.
  - g. Wilkins; a Zurn company.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Accessories: Ball valves on inlet and outlet.

## 2.14 BACKFLOW PREVENTERS

### A. Reduced-Pressure-Principle Backflow Preventers:

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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. Ames Fire & Waterworks; a division of Watts Regulator Co.
    - b. Conbraco Industries, Inc.
    - c. FEBCO; SPX Valves & Controls.
    - d. Flomatic Corporation.
    - e. Watts Water Technologies, Inc.
    - f. Wilkins; a Zurn company.
  2. Standard: ASSE 1013 or AWWA C511.
  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 for NPS 2-1/2 (DN 65) and larger.
  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 vertical inlet, horizontal center section, and vertical outlet flow.
  8. Accessories:
    - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y 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. Double-Check, Backflow-Prevention Assemblies:
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. Ames Fire & Waterworks; a division of Watts Regulator Co.
    - b. Conbraco Industries, Inc.
    - c. FEBCO; SPX Valves & Controls.
    - d. Flomatic Corporation.
    - e. Watts Water Technologies, Inc.
    - f. Wilkins; a Zurn company.
  2. Standard: ASSE 1015 or AWWA C510.
  3. Operation: Continuous-pressure applications, unless otherwise indicated.
  4. Pressure Loss: 5 psig (35 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 for NPS 2-1/2 (DN 65) and larger.
  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.



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8. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

C. Double-Check, Detector-Assembly Backflow Preventers:

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. Ames Fire & Waterworks; a division of Watts Regulator Co.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Watts Water Technologies, Inc.
  - e. Wilkins; a Zurn company.
2. Standards: ASSE 1048 and UL listed or FMG approved.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
5. Size: <Insert NPS (DN).>
6. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
7. End Connections: Flanged.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
  - a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
  - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

D. Backflow Preventer Test Kits:

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. Conbraco Industries, Inc.
  - b. FEBCO; SPX Valves & Controls.
  - c. Flomatic Corporation.
  - d. Watts Water Technologies, Inc.
  - e. Wilkins; a Zurn company.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

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## 2.15 CONCRETE VAULTS

- A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.
1. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.
  2. Manhole: ASTM A 48/A 48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
    - a. Dimension: 24-inch (610-mm) minimum diameter, unless otherwise indicated.
  3. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

## 2.16 FIRE HYDRANTS

- A. Dry-Barrel Fire Hydrants:
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. American AVK Co.; Valves & Fittings Div.
    - b. American Cast Iron Pipe Co.; American Flow Control Div.
    - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
    - d. American Foundry Group, Inc.
    - e. East Jordan Iron Works, Inc.
    - f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
    - g. McWane, Inc.; Kennedy Valve Div.
    - h. McWane, Inc.; M & H Valve Company Div.
    - i. Mueller Co.; Water Products Div.
    - j. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
    - k. U.S. Pipe and Foundry Company.
  2. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
    - a. Standard: AWWA C502.
    - b. Pressure Rating: 150 psig (1035 kPa) minimum.
    - c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
    - d. Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
    - e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.

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- f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

## 2.17 FIRE DEPARTMENT CONNECTIONS

### A. Fire Department Connections:

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. Elkhart Brass Mfg. Co., Inc.
  - b. Fire End & Croker Corporation.
  - c. Guardian Fire Equipment, Inc.
  - d. Kidde Fire Fighting.
  - e. Potter Roemer.
  - f. Reliable Automatic Sprinkler Co., Inc.
  
2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.
  - a. Standard: UL 405.
  - b. Connections: Two NPS 2-1/2 (DN 65) inlets and one NPS 4 (DN 100) outlet.
  - c. Inlet Alignment: Inline, horizontal.
  - d. Finish Including Sleeve: Polished chrome-plated.
  - e. Escutcheon Plate Marking: "AUTO SPKR."

## 2.18 ALARM DEVICES

- A. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.
  
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide 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 when cover is removed.
  
- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
  
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

## **PART 3 - EXECUTION**

### **3.1 EARTHWORK**

- A. Refer to other specifications for excavating, trenching, and backfilling.

### **3.2 PIPING APPLICATIONS**

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground water-service piping NPS 4 to NPS 8 (DN 100 to DN 200) shall be the following:
  - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
- G. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-joint fittings; and brazed joints.
- H. Aboveground and vault water-service piping NPS 4 to NPS 8 (DN 100 to DN 200) shall be the following:
  - 1. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
- I. Underground Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be the following:
  - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.

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- J. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- K. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be the following:
  - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
- L. Aboveground and Vault Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

### 3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, metal-seated gate valves with valve box.
  - 2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
  - 3. Use the following for valves in vaults and aboveground:
    - a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, rising stem.
    - b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.
    - c. Check Valves: AWWA C508, swing type.
  - 4. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

### 3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See specifications for piping-system common requirements.

### 3.5 PIPING INSTALLATION

- A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

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- B. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:
  - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
  - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
  - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- C. Comply with NFPA 24 for fire-service-main piping materials and installation.
  - 1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- E. Bury piping with depth of cover over top at least 30 inches (750 mm), with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:
  - 1. Under Driveways: With at least 36 inches (910 mm) cover over top.
  - 2. Under Railroad Tracks: With at least 48 inches (1220 mm) cover over top.
  - 3. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm) additional cover.
- F. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- G. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
  - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- H. Sleeves are specified in in other sections.
- I. Mechanical sleeve seals are specified in other sections.
- J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- K. See other sections for fire-suppression-water piping inside the building.
- L. See other sections for potable-water piping inside the building.

### 3.6 JOINT CONSTRUCTION

- A. See other sections for basic piping joint construction.
- B. Make pipe joints according to the following:
  - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
  - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
  - 3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
  - 4. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
    - a. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric nipples.
    - b. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
    - c. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### 3.7 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
  - 4. Bolted flanged joints.
  - 5. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
  - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
  - 2. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

### 3.8 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

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- C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

### **3.9 DETECTOR-CHECK VALVE INSTALLATION**

- A. Install in vault or aboveground.
- B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

### **3.10 WATER METER INSTALLATION**

- A. Install water meters, piping, and specialties according to utility company's written instructions.

### **3.11 ROUGHING-IN FOR WATER METERS**

- A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

### **3.12 BACKFLOW PREVENTER INSTALLATION**

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.



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### **3.13 CONCRETE VAULT INSTALLATION**

- A. Install precast concrete vaults according to ASTM C 891.

### **3.14 FIRE HYDRANT INSTALLATION**

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
- C. AWWA Fire Hydrants: Comply with AWWA M17.
- D. UL/FMG Fire Hydrants: Comply with NFPA 24.

### **3.15 FIRE DEPARTMENT CONNECTION INSTALLATION**

- A. Install ball drip valves at each check valve for fire department connection to mains.
- B. Install protective pipe bollards on two sides of each fire department connection.

### **3.16 ALARM DEVICE INSTALLATION**

- A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
- B. Supervisory Switches: Supervise valves in open position.
  - 1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
  - 2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
- C. Locking and Sealing: Secure unsupervised valves as follows:
  - 1. Valves: Install chain and padlock on open OS&Y gate valve.
  - 2. Post Indicators: Install padlock on wrench on indicator post.
- D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.
- E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.
- F. Connect alarm devices to building fire alarm system per specifications.

### **3.17 CONNECTIONS**

- A. See other sections for piping connections to valves and equipment.
- B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- C. Connect water-distribution piping to interior domestic water and fire-suppression piping.
- D. Connect waste piping from concrete vault drains to storm-drainage system. piping.
- E. Ground equipment and connect wiring according to electrical specifications.

### **3.18 FIELD QUALITY CONTROL**

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
  - 1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

### **3.19 IDENTIFICATION**

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping.

### **3.20 CLEANING**

- A. Clean and disinfect water-distribution piping as follows:
  - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

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- a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
- b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
- c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

**END OF SECTION 22 11 13**

## **SECTION 22 11 16 - DOMESTIC WATER PIPING**

### **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. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
- B. Related Requirements:
  - 1. Section 221113 "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.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For transition fittings and dielectric fittings.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

#### **1.5 FIELD CONDITIONS**

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not interrupt water service without Owner's written permission.

## **PART 2 - PRODUCTS**

### **2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

### **2.2 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.

### **2.3 DUCTILE-IRON PIPE AND FITTINGS**

- A. Mechanical-Joint, Ductile-Iron Pipe:
  - 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Standard-Pattern, Mechanical-Joint Fittings:
  - 1. AWWA C110/A21.10, ductile or gray iron.
  - 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- C. Compact-Pattern, Mechanical-Joint Fittings:

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1. AWWA C153/A21.53, ductile iron.
  2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

## 2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

## 2.5 TRANSITION FITTINGS

- A. General Requirements:
1. Same size as pipes to be joined.
  2. Pressure rating at least equal to pipes to be joined.
  3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
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. Cascade Waterworks Manufacturing.
    - b. Dresser, Inc.; Piping Specialties Products.
    - c. Ford Meter Box Company, Inc. (The).
    - d. JCM Industries.
    - e. Romac Industries, Inc.
    - f. Smith-Blair, Inc.; a Sensus company.
    - g. Viking Johnson.

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## 2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. 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; member of the Phoenix Forge Group.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Jomar International.
    - e. Matco-Norca.
    - f. McDonald, A. Y. Mfg. Co.
    - g. Watts; a division of Watts Water Technologies, Inc.
    - h. Wilkins; a Zurn company.
  2. Standard: ASSE 1079.
  3. Pressure Rating: 150 psig (1035 kPa).
  4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
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; member of the Phoenix Forge Group.
    - b. Central Plastics Company.
    - c. Matco-Norca.
    - d. Watts; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.
  2. Standard: ASSE 1079.
  3. Factory-fabricated, bolted, companion-flange assembly.
  4. Pressure Rating: 150 psig (1035 kPa).
  5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
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.

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- b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
2. Nonconducting materials for field assembly of companion flanges.
  3. Pressure Rating: 150 psig (1035 kPa).
  4. Gasket: Neoprene or phenolic.
  5. Bolt Sleeves: Phenolic or polyethylene.
  6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
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. Elster Perfection Corporation.
    - b. Grinnell Mechanical Products; Tyco Fire Products LP.
    - c. Matco-Norca.
    - d. Precision Plumbing Products, Inc.
    - e. Victaulic Company.
  2. Standard: IAPMO PS 66.
  3. Electroplated steel nipple complying with ASTM F 1545.
  4. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C).
  5. End Connections: Male threaded or grooved.
  6. Lining: Inert and noncorrosive, propylene.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Comply with requirements in other sections 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.



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- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in other sections and with requirements for drain valves and strainers in other sections.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in other sections.
- G. Install domestic water piping level without pitch and plumb.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in other sections.
- Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in other sections.
- R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in other sections.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in other sections.
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in other sections.

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- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in other sections.

### **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 for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. 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.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### **3.4 TRANSITION FITTING INSTALLATION**

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

### **3.5 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 flange kits.

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- D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in other sections.
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.
    - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
  3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).
- D. 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.
  5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
  6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
  7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- E. Install supports for vertical copper tubing every 10 feet (3 m).
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

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- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 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.

### **3.8 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification materials and installation in other sections.
- B. Label pressure piping with system operating pressure.

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - 2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

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- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
  - C. Prepare test and inspection reports.

### 3.10 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

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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. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller, shall be the following:
  1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger, shall be the following:
  1. Push-on-joint, ductile-iron pipe; standard- or compact-pattern, push-on-joint fittings; and gasketed joints.
- E. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12 (DN 150 to DN 300), shall be the following:
  1. Push-on-joint, ductile-iron pipe; standard- or compact-pattern, push-on-joint fittings; and gasketed joints.

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- F. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
  - 1. Hard or soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- G. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper, solder-joint fittings; and soldered joints.
- H. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper, solder-joint fittings; and soldered joints.
- I. Aboveground domestic water piping, NPS 5 to NPS 8 (DN 125 to DN 200), shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast- or wrought-copper, solder-joint fittings; and soldered joints.

### 3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves 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: Calibrated 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.

**END OF SECTION 22 11 16**

## **SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES**

### **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. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Drain valves.
11. Trap-seal primer valves.
12. Specialty valves.
13. Flexible connectors.

- B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
4. Section 224713 "Drinking Fountains" for water filters for water coolers.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.



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## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

### 2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
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. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    - b. Cash Acme; a division of Reliance Worldwide Corporation.
    - c. Conbraco Industries, Inc.
    - d. FEBCO; a division of Watts Water Technologies, Inc.
    - e. Rain Bird Corporation.
    - f. Toro Company (The); Irrigation Div.
    - g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    - h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
  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: Chrome plated.
- B. Hose-Connection Vacuum Breakers:
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:

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- a. Arrowhead Brass Products.
- b. Cash Acme; a division of Reliance Worldwide Corporation.
- c. Conbraco Industries, Inc.
- d. Legend Valve.
- e. MIFAB, Inc.
- f. Prier Products, Inc.
- g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
- h. Woodford Manufacturing Company; a division of WCM Industries, Inc.
- i. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
- j. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

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. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; a division of Watts Water Technologies, Inc.
  - d. Flomatic Corporation.
  - e. Toro Company (The); Irrigation Div.
  - f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - g. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig (35 kPa) maximum, through middle third of flow range.
5. Accessories:
  - a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers:

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. Conbraco Industries, Inc.

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- b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
- 2. Standard: ASSE 1056.
- 3. Operation: Continuous-pressure applications.
- 4. Accessories:
  - a. Valves: Ball type, on inlet and outlet.

## 2.4 BACKFLOW PREVENTERS

### A. Reduced-Pressure-Principle Backflow Preventers:

- 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. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; a division of Watts Water Technologies, Inc.
  - d. Flomatic Corporation.
  - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
- 2. Standard: ASSE 1013.
- 3. Operation: Continuous-pressure applications.
- 4. Pressure Loss: 12 psig (83 kPa) maximum, through middle third of flow range.
- 5. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
- 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 NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
  - b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
  - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

### B. Hose-Connection Backflow Preventers:

- 1. 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:

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- a. Conbraco Industries, Inc.
  - b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - c. Woodford Manufacturing Company; a division of WCM Industries, Inc.
2. Standard: ASSE 1052.
  3. Operation: Up to 10-foot head of water (30-kPa) back pressure.
  4. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
  5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
  6. Capacity: At least 3-gpm (0.19-L/s) flow.

C. Backflow-Preventer Test Kits:

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. Conbraco Industries, Inc.
  - b. FEBCO; a division of Watts Water Technologies, Inc.
  - c. Flomatic Corporation.
  - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

## 2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

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. Cash Acme; a division of Reliance Worldwide Corporation.
  - b. Conbraco Industries, Inc.
  - c. Honeywell International Inc.
  - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
4. Body: Bronze with chrome-plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

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5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Water-Control 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. CLA-VAL.
  - b. Flomatic Corporation.
  - c. OCV Control Valves.
  - d. Watts; a division of Watts Water Technologies, Inc.; Control Valves (Watts ACV).
  - e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig (1035 kPa) minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
  - a. Pattern: Globe-valve design.
  - b. Trim: Stainless steel.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

## 2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing 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. Armstrong International, Inc.
  - b. Flo Fab Inc.
  - c. ITT Corporation; Bell & Gossett Div.
  - d. NIBCO Inc.
  - e. TAC.
  - f. TACO Incorporated.
  - g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Type: Y-pattern globe valve with two readout ports and memory-setting indicator.

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3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing 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. Armstrong International, Inc.
  - b. Flo Fab Inc.
  - c. ITT Corporation; Bell & Gossett Div.
  - d. NIBCO Inc.
  - e. TAC.
  - f. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

## 2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

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. Armstrong International, Inc.
  - b. Cash Acme; a division of Reliance Worldwide Corporation.
  - c. Conbraco Industries, Inc.
  - d. Honeywell International Inc.
  - e. Legend Valve.
  - f. Leonard Valve Company.
  - g. Powers; a division of Watts Water Technologies, Inc.
  - h. Symmons Industries, Inc.
  - i. TACO Incorporated.
  - j. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - k. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1017.

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3. Pressure Rating: 125 psig (860 kPa).
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Chrome plated.

B. Primary, Thermostatic, Water Mixing 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. Armstrong International, Inc.
  - b. Lawler Manufacturing Company, Inc.
  - c. Leonard Valve Company.
  - d. Powers; a division of Watts Water Technologies, Inc.
  - e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Type: Cabinet-type, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Chrome plated.
9. Piping Finish: Chrome plated.
10. Cabinet: Factory fabricated, stainless steel, for recessed mounting and with hinged, stainless-steel door.

C. Manifold, Thermostatic, Water Mixing-Valve Assemblies:

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. Leonard Valve Company.
  - b. Powers; a division of Watts Water Technologies, Inc.
  - c. Symmons Industries, Inc.
2. Description: Factory-fabricated, **[cabinet-type]** **[exposed-mounted]**, thermostatically controlled, water mixing-valve assembly in **[two]** **[three]**-valve parallel arrangement.
3. Large-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
4. Small-Flow Parallel: Thermostatic, water mixing valve.
5. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.

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6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
7. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
8. Cabinet: Factory fabricated, stainless steel, for recessed mounting and with hinged, stainless-steel door.
9. Thermostatic Mixing Valve and Water Regulator Finish: Chrome plated.
10. Piping Finish: Chrome plated.

D. Individual-Fixture, Water Tempering 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. Cash Acme; a division of Reliance Worldwide Corporation.
  - b. Conbraco Industries, Inc.
  - c. Honeywell International Inc.
  - d. Lawler Manufacturing Company, Inc.
  - e. Leonard Valve Company.
  - f. Powers; a division of Watts Water Technologies, Inc.
  - g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  - h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

E. Primary Water Tempering 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. Heat-Timer Corporation.
  - b. Holby Valve Co., Inc.
2. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
4. Body: Bronze.
5. Temperature Control: Manual.
6. Inlets and Outlet: Threaded.
7. Valve Finish: Rough bronze.



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## 2.8 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 that complies with AWWA C550 or that is FDA approved, epoxy coated 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).
  - b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm).
  - c. Strainers NPS 5 (DN 125) and Larger: 0.10 inch (2.54 mm).
6. Drain: Factory-installed, hose-end drain valve.

## 2.9 OUTLET BOXES

### A. Icemaker Outlet Boxes:

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. Acorn Engineering Company.
  - b. IPS Corporation.
  - c. LSP Products Group, Inc.
  - d. Oatey.
  - e. Plastic Oddities.
2. Mounting: Recessed.
3. Material and Finish: Stainless-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 (DN 15) or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

## 2.10 HOSE BIBBS

### A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.

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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: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.11 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants:

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. 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.
  - g. Woodford Manufacturing Company; a division of WCM Industries, Inc.
  - h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
  - i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
2. Standard: ASME A112.21.3M for concealed-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: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle and Wall-Plate Finish: Polished nickel bronze.
9. Operating Keys(s): One with each wall hydrant.

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## 2.12 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.

## 2.13 TRAP-SEAL PRIMER DEVICE

- A. Supply-Type, Trap-Seal Primer Device:
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. MIFAB, Inc.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
  2. Standard: ASSE 1018.
  3. Pressure Rating: 125 psig (860 kPa) minimum.
  4. Body: Bronze.
  5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
  6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
  7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

## 2.14 SPECIALTY VALVES

- A. Comply with requirements for general-duty metal valves in other sections.

## 2.15 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:

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1. Flex-Hose Co., Inc.
  2. Flexicraft Industries.
  3. Flex Pression, Ltd.
  4. Flex-Weld Incorporated.
  5. Hyspan Precision Products, Inc.
  6. Mercer Gasket & Shim, Inc.
  7. Metraflex, Inc.
  8. Proco Products, Inc.
  9. TOZEN Corporation.
  10. Unaflex.Universal Metal Hose; a Hyspan company.
- B. 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.
- C. 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).
  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 INSTALLATION**

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

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- 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 cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.
- G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in other sections."
- 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.

### **3.2 CONNECTIONS**

- A. Comply with requirements for ground equipment in other sections.
- B. Fire-retardant-treated-wood blocking is specified in other sections for electrical connections.

### **3.3 LABELING AND IDENTIFYING**

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Pressure vacuum breakers.
  - 2. Reduced-pressure-principle backflow preventers.
  - 3. Water pressure-reducing valves.
  - 4. Calibrated balancing valves.
  - 5. Primary, thermostatic, water mixing valves.
  - 6. Manifold, thermostatic, water mixing-valve assemblies.
  - 7. Primary water tempering valves.
  - 8. Outlet boxes.
  - 9. Supply-type, trap-seal primer valves.
- 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 other sections.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:

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1. Test each pressure vacuum breaker and reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.5 ADJUSTING**

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

**END OF SECTION 22 11 19**

## **SECTION 22 13 13 - FACILITY SANITARY SEWERS**

### **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. Pipe and fittings.
  - 2. Nonpressure and pressure couplings.
  - 3. Expansion joints and deflection fittings.
  - 4. Cleanouts.
  - 5. Manholes.

#### **1.3 DEFINITIONS**

- A. FRP: Fiberglass-reinforced plastic.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Expansion joints and deflection fittings.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- B. Field quality-control reports.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect pipe, pipe fittings, and seals from dirt and damage.

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- B. Handle manholes according to manufacturer's written rigging instructions.

## 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  2. Do not proceed with interruption of service without Owner's written permission.

## PART 2 - PRODUCTS

### 2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Gaskets: ASTM C 564, rubber. Pipe and Fittings: ASTM A 74, Service class. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

### 2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Heavy-Duty, Shielded Couplings:
  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. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Dallas Specialty & Mfg. Co.
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. Stant; a Tompkins company.
    - f. Tyler Pipe.
  2. Description: ASTM C 1277 and ASTM C 1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

### 2.3 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

- A. Pipe: ASTM A 746, for push-on joints.



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- B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
- C. Compact Fittings: AWWA C153, ductile iron, for push-on joints.
- D. Gaskets: AWWA C111, rubber.

## 2.4 NONPRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - 2. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
- C. Shielded, Flexible Couplings:
  - 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. Cascade Waterworks Mfg.
    - b. Dallas Specialty & Mfg. Co.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
  - 2. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Ring-Type, Flexible Couplings:
  - 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. Fernco Inc.
    - b. Logan Clay Pipe.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
  - 2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
- E. Nonpressure-Type, Rigid Couplings:

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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. ANACO-Husky.
2. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

## 2.5 CLEANOUTS

### A. Cast-Iron Cleanouts:

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. Josam Company.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe.
  - e. Watts Water Technologies, Inc.
  - f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

## 2.6 MANHOLES

### A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (100-mm) minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.

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7. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
9. Apply Xypex sealer on manholes in accordance with Frankfort Plant Board standards.
10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: 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. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

C. Manhole-Cover Inserts:

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. FRW Industries; a Syneco Systems, Inc. company.
  - b. Knutson Enterprises.
  - c. L. F. Manufacturing, Inc.
  - d. Parson Environmental Products, Inc.
2. Description; Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.
3. Type: Solid.

## 2.7 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:
  1. Cement: ASTM C 150, Type II.
  2. Fine Aggregate: ASTM C 33, sand.
  3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

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1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: 1 percent through manhole.
  2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

## **PART 3 - EXECUTION**

### **3.1 EARTHWORK**

- A. Excavating, trenching, and backfilling are specified in other sections.

### **3.2 PIPING INSTALLATION**

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

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- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
  - 2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
  - 3. Install piping with 36-inch (915-mm) minimum cover.
  - 4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
  - 6. Install ductile-iron, gravity sewer piping according to ASTM A 746.
- G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
  - 1. 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.
  - 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
  - 3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
  - 4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
  - 5. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.
- B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
  - 1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    - a. Shielded flexible or rigid couplings for pipes of same or slightly different OD.

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- b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
- c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

### **3.4 MANHOLE INSTALLATION**

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.
- E. Install manhole-cover inserts in frame and immediately below cover.

### **3.5 CONCRETE PLACEMENT**

- A. Place cast-in-place concrete according to ACI 318.

### **3.6 CLEANOUT INSTALLATION**

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
  - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
  - 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
  - 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
  - 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

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### 3.7 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
  - 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
    - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
    - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  - 4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Connect to oil interceptors specified in Section 221323 "Sanitary Waste Interceptors."

### 3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
  - 1. Close open ends of piping with at least [8-inch- (203-mm-)] <Insert dimension> thick, brick masonry bulkheads.
  - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

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- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
  - 1. Remove manhole and close open ends of remaining piping.
  - 2. Remove top of manhole down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade other sections.

### 3.9 IDENTIFICATION

- A. Comply with requirements in specifications for underground utility identification devices. Arrange for installation of warning tapes directly over piping and at outside edges of underground manholes.
  - 1. Use detectable warning tape over ferrous piping.
  - 2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

### 3.10 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
  - 1. Submit separate report for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to requirements of authorities having jurisdiction.



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3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate report for each test.
  5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    - a. Close openings in system and fill with water.
    - b. Purge air and refill with water.
    - c. Disconnect water supply.
    - d. Test and inspect joints for leaks.
  6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6.
  7. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### **3.11 CLEANING**

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

**END OF SECTION 22 13 13**

## **SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING**

### **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. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
- B. Related Sections:
  - 1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

#### **1.4 ACTION SUBMITTALS**

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

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

#### **1.6 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Hubless Couplings shall be certified by NSF to the CISPI-310 Standard, and bear the NSF mark.

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## 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
  2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

## 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 and Extra Heavy class(es). ). Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

### 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. ). Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Heavy-Duty, Hubless-Piping Couplings:
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. 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.

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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. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
- E. Copper Pressure Fittings:
  1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- F. 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.
- G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## 2.5 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. Shielded, Nonpressure Transition Couplings:
    - 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:

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- 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.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

- 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) Capitol Manufacturing Company.
- 2) Central Plastics Company.
- 3) Hart Industries International, Inc.
- 4) Jomar International Ltd.
- 5) Matco-Norca, Inc.
- 6) McDonald, A. Y. Mfg. Co.
- 7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 8) Wilkins; a Zurn company.

- b. Description:

- 1) Standard: ASSE 1079.
- 2) Pressure Rating: 150 psig (1035 kPa).
- 3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

- 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) Capitol Manufacturing Company.
- 2) Central Plastics Company.
- 3) Matco-Norca, Inc.
- 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 5) Wilkins; a Zurn company.

- b. Description:

- 1) Standard: ASSE 1079.
- 2) Factory-fabricated, bolted, companion-flange assembly.

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- 3) Pressure Rating: 150 psig (1035 kPa).
  - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
- 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) Advance Products & Systems, Inc.
    - 2) Calpico, Inc.
    - 3) Central Plastics Company.
    - 4) Pipeline Seal and Insulator, Inc.
  - b. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig (1035 kPa).
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
- 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) Elster Perfection.
    - 2) Grinnell Mechanical Products.
    - 3) Matco-Norca, Inc.
    - 4) Precision Plumbing Products, Inc.
    - 5) Victaulic Company.
  - b. Description:
    - 1) Standard: IAPMO PS 66
    - 2) Electroplated steel nipple.
    - 3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.

## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in other sections .

### **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 to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written

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instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- 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. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified.
  - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified.
- 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 other sections.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified other sections.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in other sections.

### **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 hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.
- C. 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.



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- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. 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.
- F. 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.

### 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: Shielded, nonpressure transition couplings.
- B. Dielectric Fittings:
  - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  - 2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
  - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric **[flanges]**.
  - 4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### 3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.14 "Check Valves for Plumbing Piping."
- B. Shutoff Valves:
  - 1. Install full-port ball valve for piping NPS 2 (DN 50) and smaller.
  - 2. Install butterfly valve for piping NPS 2-1/2 (DN 65) and larger.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

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- B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
1. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  2. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  4. 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.
  5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  6. 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. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
  5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
  6. 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.

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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.
  5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
  6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- I. Install supports for vertical copper tubing every 10 feet (3 m).
  - J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### **3.7 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 Section 221319 "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.

### **3.8 IDENTIFICATION**

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in other sections.

### **3.9 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.

### **3.10 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.

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- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.11 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. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Copper DWV tube, copper drainage fittings, and soldered joints.
  3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
  3. Copper DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type L; copper pressure fittings; and soldered joints.
  4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

**END OF SECTION 22 13 16**

## **SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES**

### **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. Cleanouts.
  - 2. Floor drains.
  - 3. Trench drains.
  - 4. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
  - 1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.

#### **1.3 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

#### **1.4 ACTION SUBMITTALS**

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

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

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## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified.
- B. Coordinate size and location of roof penetrations.

## PART 2 - PRODUCTS

### 2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
  - 1. ASME A112.36.2M, Cast-Iron Cleanouts:
    - 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) Josam Company.
      - 2) MIFAB, Inc.
      - 3) Smith, Jay R. Mfg. Co.
      - 4) Tyler Pipe.
      - 5) Watts Drainage Products.
      - 6) Zurn Plumbing Products Group.
    - 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.

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6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

- 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) Josam Company.
- 2) Oatey.
- 3) Sioux Chief Manufacturing Co., Inc.
- 4) Smith, Jay R. Mfg. Co.
- 5) Tyler Pipe.
- 6) Watts Drainage Products.
- 7) Zurn Plumbing Products Group.

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. Outlet Connection: Inside calk.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round <Insert shape>.
11. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

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. Josam Company; Josam Div.
- b. MIFAB, Inc.
- c. Smith, Jay R. Mfg. Co.
- d. Tyler Pipe; Wade Div.
- e. Watts Drainage Products.
- 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: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, brass plug.



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6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Square, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

## 2.2 FLOOR DRAINS

### A. Cast-Iron Floor Drains:

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. Commercial Enameling Co.
  - b. Josam Company; Josam Div.
  - c. MIFAB, Inc.
  - d. Prier Products, Inc.
  - e. Smith, Jay R. Mfg. Co.
  - f. Tyler Pipe; Wade Div.
  - g. Watts Drainage Products.
  - h. Zurn Plumbing Products Group.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Outlet: Bottom.
6. Trap Material: Cast iron.

## 2.3 TRENCH DRAINS

### A. Trench Drains:

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. 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 A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Trap Material: Cast iron.
5. Trap Pattern: Standard P-trap.

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## 2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Open Drains:
1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
  2. Size: Same as connected waste piping with increaser fitting of size indicated.
- B. 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.
- C. Floor-Drain, Trap-Seal Primer Fittings:
1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
  2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4 (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.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install 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.

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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.
- E. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.
- F. Assemble open drain fittings and install with top of hub 1 inch (25 mm) above floor.
- G. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- H. 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.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install wood-blocking reinforcement for wall-mounting-type specialties.
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### **3.2 CONNECTIONS**

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to electrical specifications.
- D. Connect wiring according to electrical specifications."

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**3.3 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION 22 13 19**

## **SECTION 22 13 23 - SANITARY WASTE INTERCEPTORS**

### **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. Oil interceptors.

#### **1.3 DEFINITIONS**

- A. FRP: Fiberglass-reinforced plastic.
- B. PP: Polypropylene plastic.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.
- B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
  - 1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

#### **1.5 PROJECT CONDITIONS**

- A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
  - 1. Notify Owner no fewer than seven days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of sewer services without Owner's written permission.

## **PART 2 - PRODUCTS**

### **2.1 OIL INTERCEPTORS**

- A. Oil Interceptors: Precast concrete comply with ASTM C 913.
1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
  2. Structural Design Loads:
    - a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
  3. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.
  4. 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. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches (1500 mm).
  5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
  6. 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.
    - a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
    - b. Include indented top design with lettering cast into cover, using wording equivalent to " OIL INTERCEPTOR."

### **2.2 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.

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- 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. Include indented top design with lettering cast into cover, using wording equivalent to the following:
    - a. Oil Interceptors in Sanitary Sewerage System: " OIL INTERCEPTOR."

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Excavating, trenching, and backfilling are specified in other sections.

#### **3.2 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. Set tops 3 inches (75 mm) above finish surface elsewhere, unless otherwise indicated.
- D. Set tops of grating frames and grates flush with finished surface.
- E. Set interceptors level and plumb.

#### **3.3 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.

#### **3.4 IDENTIFICATION**

- A. Identification materials and installation are specified in other sections. Arrange for installation of warning tapes directly over piping and at outside edges of underground interceptors.

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1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

**END OF SECTION 22 13 23**



## **SECTION 22 15 13 - GENERAL-SERVICE COMPRESSED-AIR PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 200 psig (1380 kPa) or less.

#### **1.3 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. HDPE: High-density polyethylene plastic.
- E. NBR: Acrylonitrile-butadiene rubber.
- F. PE: Polyethylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. High-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig (1035 and 1380 kPa).
- I. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig (1035 kPa) or less.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Dielectric fittings.
  - 2. Flexible pipe connectors.
  - 3. Safety valves.
  - 4. Pressure regulators. Include rated capacities and operating characteristics.
  - 5. Automatic drain valves.

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6. Filters. Include rated capacities and operating characteristics.
7. Lubricators. Include rated capacities and operating characteristics.
8. Quick couplings.
9. Hose assemblies.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Brazing and welding certificates.
- B. Qualification Data: For Installers.
- C. Field quality-control test reports.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- C. ASME Compliance:
  1. Comply with ASME B31.1, "Power Piping," for high-pressure compressed-air piping.
  2. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

## **PART 2 - PRODUCTS**

### **2.1 PIPES, TUBES, AND FITTINGS**

- A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.
  1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
  2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
  3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.

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4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
  5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
  6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.
- B. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B) seamless, drawn-temper, water tube.
1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
  2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
  3. Copper Unions: ASME B16.22 or MSS SP-123.
- C. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

## 2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. 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. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.3 VALVES

- A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

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## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. 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: 150 psig (1035 kPa).
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
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. Matco-Norca, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.
  2. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 150 psig (1035 kPa).
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:

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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. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
  
2. 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.

## 2.5 FLEXIBLE PIPE CONNECTORS

- 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. Flex-Hose Co., Inc.
  2. Flexicraft Industries.
  3. Hyspan Precision Products, Inc.
  4. Mercer Rubber Co.
  5. Metraflex, Inc.
  6. Proco Products, Inc.
  7. Unaflex, Inc.
  8. Universal Metal Hose; a Hyspan Company
  
- B. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
  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.
  
- C. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  1. Working-Pressure Rating: 200 psig (1380 kPa) minimum.
  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.

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## 2.6 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
  - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig (1725-kPa) inlet pressure, unless otherwise indicated.
  - 1. Type: Pilot operated.
- C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig (1380-kPa) minimum inlet pressure, unless otherwise indicated.
- D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig (1380-kPa) minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.
- E. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.
- F. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated.
  - 1. Provide with automatic feed device for supplying oil to lubricator.

## 2.7 QUICK COUPLINGS

- 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. Aeroquip Corporation; Eaton Corp.
  - 2. Bowes Manufacturing Inc.
  - 3. Foster Manufacturing, Inc.
  - 4. Milton Industries, Inc.
  - 5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
  - 6. Rectus Corp.
  - 7. Schrader-Bridgeport; Amflo Div. Schrader-Bridgeport/Standard Thomson.
  - 8. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
  - 9. TOMCO Products Inc.
  - 10. Tuthill Corporation; Hansen Coupling Div.

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- B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
  - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
  - 2. Plug End: Straight-through type with barbed outlet for attaching hose.

## 2.8 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig (2070-kPa) minimum working pressure, unless otherwise indicated.
  - 1. Hose: Reinforced single- or double-wire-braid, CR-covered hose for compressed-air service.
  - 2. Hose Clamps: Stainless-steel clamps or bands.
  - 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
  - 4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Compressed-Air Piping between Air Compressors and Receivers: Use one of the following piping materials for each size range:
  - 1. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
  - 2. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
  - 3. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
  - 4. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
  - 5. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
  - 6. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
  - 7. NPS 5 (DN 125) and Larger: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.

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8. NPS 5 (DN 125) and Larger: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
- B. Low-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
1. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
  2. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
  3. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
  4. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
  5. NPS 5 and NPS 6 (DN 125 and DN 150): Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
- C. High-Pressure Compressed-Air Distribution Piping: Use one of the following piping materials for each size range:
1. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
  2. NPS 2 (DN 50) and Smaller: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
  3. NPS 2 (DN 50) and Smaller: Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
  4. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
  5. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
  6. NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Type K or L (Type A or B), copper tube; wrought-copper fittings; and brazed joints.
  7. NPS 8 (DN 200) and Larger: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
- D. Drain Piping: Use the following piping materials:
1. NPS 2 (DN 50) and Smaller: Type L copper tube; wrought-copper fittings; and brazed or soldered joints.

### 3.2 VALVE APPLICATIONS

- A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Articles in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," according to the following:



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1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
2. High-Pressure Compressed Air: Valve types specified for medium-pressure compressed air.
3. Equipment Isolation NPS 2 (DN 50) and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

### **3.3 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, 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 otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
  1. Use steel companion flange with gasket for connection to steel pipe.
  2. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Flanged joints may be used instead of specified joint for any piping or tubing system.
- J. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- K. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

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- L. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 "Meters and Gages for Plumbing Piping."
- M. Install piping to permit valve servicing.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified.
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified.

### **3.4 JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints for Steel Piping: Join according to AWS D10.12/D10.12M.
- E. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."
- G. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- H. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

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### **3.5 VALVE INSTALLATION**

- A. General-Duty Valves: Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
- D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

### **3.6 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. NPS 2 (DN 50) and Smaller: Use dielectric unions.
- C. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
- D. NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### **3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION**

- A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

### **3.8 SPECIALTY INSTALLATION**

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment and tools.
- D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

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- E. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.
- F. Install air-line lubricators in branch piping to machine tools. Mount on wall at locations indicated.
- G. Install quick couplings at piping terminals for hose connections.
- H. Install hose assemblies at hose connections.

### **3.9 CONNECTIONS**

- A. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.
- B. 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 and machine.

### **3.10 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Vertical Piping: MSS Type 8 or 42, clamps.
- C. Individual, Straight, Horizontal Piping Runs:
  - 1. 100 Feet (30 m) or Less: MSS Type 1, adjustable, steel clevis hangers.
  - 2. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
- D. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- E. Base of Vertical Piping: MSS Type 52, spring hangers.
- F. Support horizontal piping within 12 inches (300 mm) of each fitting and coupling.
- G. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- H. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1/4 to NPS 1/2 (DN 8 to DN 15): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 3/4 to NPS 1-1/4 (DN 20 to DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
  - 3. NPS 1-1/2 (DN 40): 12 feet (3.7 m) with 3/8-inch (10-mm) rod.
  - 4. NPS 2 (DN 50): 13 feet (4 m) with 3/8-inch (10-mm) rod.

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5. NPS 2-1/2 (DN 65): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
  6. NPS 3 (DN 80): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
  7. NPS 3-1/2 (DN 90): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
  8. NPS 4 (DN 100): 17 feet (5.2 m) with 5/8-inch (16-mm) rod.
  9. NPS 5 (DN 125): 19 feet (5.8 m) with 5/8-inch (16-mm) rod.
  10. NPS 6 (DN 150): 21 feet (6.4 m) with 3/4-inch (19-mm) rod.
  11. NPS 8 (DN 200): 24 feet (7.3 m) with 3/4-inch (19-mm) rod.
  12. NPS 10 (DN 250): 26 feet (7.9 m) with 7/8-inch (22-mm) rod.
  13. NPS 12 (DN 300): 30 feet (9.1 m) with 7/8-inch (22-mm) rod.
- I. Install supports for vertical, Schedule 40, steel piping every 15 feet (4.6 m).
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1/4 (DN 8): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
  2. NPS 3/8 and NPS 1/2 (DN 10 and DN 15): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
  3. NPS 3/4 (DN 20): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
  4. NPS 1 (DN 25): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
  5. NPS 1-1/4 (DN 32): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
  6. NPS 1-1/2 (DN 40): 10 feet (3 m) with 3/8-inch (10-mm) rod.
  7. NPS 2 (DN 50): 11 feet (3.4 m) with 3/8-inch (10-mm) rod.
  8. NPS 2-1/2 (DN 65): 13 feet (4 m) with 1/2-inch (13-mm) rod.
  9. NPS 3 (DN 80): 14 feet (4.3 m) with 1/2-inch (13-mm) rod.
  10. NPS 3-1/2 (DN 90): 15 feet (4.6 m) with 1/2-inch (13-mm) rod.
  11. NPS 4 (DN 100): 16 feet (4.9 m) with 1/2-inch (13-mm) rod.
  12. NPS 5 (DN 125): 18 feet (5.5 m) with 1/2-inch (13-mm) rod.
  13. NPS 6 (DN 150): 20 feet (6 m) with 5/8-inch (16-mm) rod.
  14. NPS 8 (DN 200): 23 feet (7 m) with 3/4-inch (19-mm) rod.
- K. Install supports for vertical copper tubing every 10 feet (3 m).

### 3.11 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.12 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig (345 kPa) above system

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operating pressure, but not less than 150 psig (1035 kPa). Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

2. Repair leaks and retest until no leaks exist.
3. Inspect filters, lubricators, and pressure regulators for proper operation.

C. Prepare test reports.

**END OF SECTION 22 15 13**

## **SECTION 22 16 23 - FACILITY NATURAL-GAS PIPING**

### **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. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.
  - 6. Service meters.
  - 7. Concrete bases.

#### **1.3 GAS MAIN CONNECTION**

- A. Arrange and pay for tap in gas main, of size and in location indicated, by Local Gas Utility Company. Pay all costs pertaining to this work, including materials, labor, piping, excavation, backfill, tap-on fees, meter charges, etc.

#### **1.4 COORDINATION WITH LOCAL GAS UTILITY CO.**

- A. Coordinate with the Local Gas Utility Co. and determine the extent of the work required to be done by them. Provide the work required by the Contract Documents that the Gas Co. does not provide. If the Gas Co. does not install the gas service piping then furnish the labor and materials necessary to install the gas service pipe. If the Gas Co. does not furnish the gas meter then provide the gas meter in accordance with the Gas Co.'s requirements and the requirements of this section. If the Gas Co. furnishes the gas meter then provide the materials, accessories and labor necessary to install it.

#### **1.5 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

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- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

## 1.6 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.
  - 3. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa).
- B. Natural-Gas System Pressure within Buildings: 0.5 psig (3.45 kPa) 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.

## 1.7 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Piping specialties.
  - 2. Corrugated, stainless-steel tubing with associated components.
  - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 4. Pressure regulators. Indicate pressure ratings and capacities.
  - 5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars.
  - 6. Dielectric fittings.
- 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.
  - 1. Shop Drawing Scale: 1/4 inch per foot (1:50).
  - 2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

## 1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.



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- B. Welding certificates.
- C. Field quality-control reports.

#### 1.9 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For motorized gas valves, pressure regulators, and service meters to include in emergency, operation, and maintenance manuals.

#### 1.10 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

#### 1.12 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.

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2. Do not proceed with interruption of natural-gas service without Owner's written permission.

### 1.13 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in other sections.

## 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. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
  5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A).
  1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
  2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
    - a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

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- C. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K (ASTM B 88M, Type A).
1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
  2. Flare Fittings: Comply with ASME B16.26 and SAE J513.
    - a. Copper fittings with long nuts.
    - b. Metal-to-metal compression seal without gasket.
    - c. Dryseal threads complying with ASME B1.20.3.
- D. 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 flanged or suitable for welded connection.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  4. Transition Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: 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 flanged or suitable for welded connection.
    - c. Bridging sleeve over mechanical coupling.
    - d. Factory-connected anode.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

## 2.2 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.

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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; flanged ends for NPS 2-1/2 (DN 65) and larger.
  3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  4. CWP Rating: 125 psig (862 kPa).
- D. Basket Strainers:
1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
  2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
  3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  4. CWP Rating: 125 psig (862 kPa).
- E. T-Pattern Strainers:
1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
  2. End Connections: Grooved ends.
  3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
  4. CWP Rating: 750 psig (5170 kPa).
- F. 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.

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### 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. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 125 psig (862 kPa).
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. 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.

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- 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.

E. Bronze Plug Valves: MSS SP-78.

- 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. Lee Brass Company.
  - b. McDonald, A. Y. Mfg. Co.
- 2. Body: Bronze, complying with ASTM B 584.
- 3. Plug: Bronze.
- 4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
- 5. Operator: Square head or lug type with tamperproof feature where indicated.
- 6. Pressure Class: 125 psig (862 kPa).
- 7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
- 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

- 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. McDonald, A. Y. Mfg. Co.
  - b. Mueller Co.; Gas Products Div.
  - c. Xomox Corporation; a Crane company.
- 2. Body: Cast iron, complying with ASTM A 126, Class B.
- 3. Plug: Bronze or nickel-plated cast iron.
- 4. Seat: Coated with thermoplastic.

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5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig (862 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.

G. 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 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

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. ASCO Power Technologies, LP; Division of Emerson.
  - b. Dungs, Karl, Inc.
  - c. Eaton Corporation; Controls Div.
  - d. Eclipse Combustion, Inc.
  - e. Honeywell International Inc.
  - f. Johnson Controls.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

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. ASCO Power Technologies, LP; Division of Emerson.

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- b. Dungs, Karl, Inc.
  - c. Eclipse Combustion, Inc.
  - d. Goyen Valve Corp.; Tyco Environmental Systems.
  - e. Magnatrol Valve Corporation.
  - f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
  - g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
  3. Body: Brass or aluminum.
  4. Seats and Disc: Nitrile rubber.
  5. Springs and Valve Trim: Stainless steel.
  6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
  7. NEMA ICS 6, Type 4, coil enclosure.
  8. Normally closed.
  9. Visual position indicator.

## 2.6 PRESSURE REGULATORS

### A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

### B. Service Pressure Regulators: Comply with ANSI Z21.80.

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. Actaris.
  - b. American Meter Company.
  - c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - d. Invensys.
  - e. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.



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8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Line Pressure Regulators: Comply with ANSI Z21.80.

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. Actaris.
  - b. American Meter Company.
  - c. Eclipse Combustion, Inc.
  - d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - e. Invensys.
  - f. Maxitrol Company.
  - g. Richards Industries; Jordan Valve Div.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig (13.8 kPa).

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

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. Canadian Meter Company Inc.
  - b. Eaton Corporation; Controls Div.

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- c. Harper Wyman Co.
  - d. Maxitrol Company.
  - e. SCP, Inc.
2. Body and Diaphragm Case: Die-cast aluminum.
  3. Springs: Zinc-plated steel; interchangeable.
  4. Diaphragm Plate: Zinc-plated steel.
  5. Seat Disc: Nitrile rubber.
  6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
  8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
  9. Maximum Inlet Pressure: 1 psig (6.9 kPa).

## 2.7 SERVICE METERS

### A. Diaphragm-Type Service Meters: Comply with ANSI B109.1.

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. Actaris.
  - b. American Meter Company.
  - c. Invensys.
2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Meter Index: Cubic feet and liters.
7. Meter Case and Index: Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig (690 kPa).
10. Pressure Loss: Maximum 0.5-inch wg (124 Pa).
11. Accuracy: Maximum plus or minus 1.0 percent.

### B. Rotary-Type Service Meters: Comply with ANSI B109.3.

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. American Meter Company.
  - b. Invensys.
2. Case: Extruded aluminum.
3. Connection: Flange.

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4. Impellers: Polished aluminum.
5. Rotor Bearings: Self-lubricating.
6. Meter Index: Cubic feet and liters.
7. Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig (690 kPa).
10. Accuracy: Maximum plus or minus 2.0 percent.

C. Turbine Meters: Comply with ASME MFC-4M.

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. American Meter Company.
  - b. Invensys.
2. Housing: Cast iron or welded steel.
3. Connection Threads or Flanges: Steel.
4. Turbine: Aluminum or plastic.
5. Turbine Bearings: Self-lubricating.
6. Meter Index: Cubic feet and liters.
7. Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig (690 kPa).
10. Accuracy: Maximum plus or minus 2.0 percent.

D. Service-Meter Bars:

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. Actaris.
  - b. American Meter Company.
  - c. Lyall, R. W. & Company, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Mueller Co.; Gas Products Div.
  - f. Perfection Corporation; a subsidiary of American Meter Company.
2. Malleable- or cast-iron frame for supporting service meter.
3. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
4. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.

E. Service-Meter Bypass Fittings:

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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. Lyall, R. W. & Company, Inc.
  - b. Williamson, T. D., Inc.
2. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
3. Integral ball-check bypass valve.

## 2.8 DIELECTRIC FITTINGS

- A. **General Requirements:** Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. **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: 150 psig (1035 kPa).
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. **Dielectric Flanges:**
  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. Matco-Norca, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.

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2. Description:

- a. Standard: ASSE 1079.
- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 150 psig (1035 kPa).
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

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. Calpico, Inc.
- c. Central Plastics Company.
- d. Pipeline Seal and Insulator, Inc.

2. 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.

## 2.9 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 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

### **3.3 OUTDOOR PIPING INSTALLATION**

- A. Comply with NFPA 54 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 Section 312000 "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. 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 upstream and downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

### **3.4 INDOOR PIPING INSTALLATION**

- A. Comply with NFPA 54 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.

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- 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. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
  - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

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2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
  3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
  4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
  5. Prohibited Locations:
    - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gage upstream and downstream from each line regulator.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors..
- X. Install sleeve seals for piping penetrations of concrete walls and slabs.
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors..

### **3.5 SERVICE-METER ASSEMBLY INSTALLATION**

- A. Install service-meter assemblies aboveground, on concrete bases.
- B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.



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- C. Install strainer on inlet of service-pressure regulator and meter set.
- D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.
- E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.
- F. Install service meters downstream from pressure regulators.
- G. Install metal bollards to protect meter assemblies.

### **3.6 VALVE INSTALLATION**

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install anode for metallic valves in underground PE piping.

### **3.7 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.

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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. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. 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.
- H. 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.

### **3.8 HANGER AND SUPPORT INSTALLATION**

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Comply with requirements for pipe hangers and supports specified in Section 230529 "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).
  4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
  5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).
- D. Install hangers for horizontal drawn-temper copper 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 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).

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3. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
4. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).

### **3.9 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.

### **3.10 LABELING AND IDENTIFYING**

- A. 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.

### **3.11 PAINTING**

- A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel (flat).
- B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
  1. Alkyd System: MPI INT 5.1E.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Topcoat: Interior alkyd (flat).

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- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### **3.12 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. 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 the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement.

### **3.13 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### **3.14 OUTDOOR PIPING SCHEDULE**

- A. Underground natural-gas piping shall be the following:
  - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.

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- C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

### 3.15 **INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)**

- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Underground, below building, piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- 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.

### 3.16 **UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
  - 1. PE valves.
  - 2. NPS 2 (DN 50) and Smaller: Bronze plug valves.
  - 3. NPS 2-1/2 (DN 65) and Larger: Cast-iron, nonlubricated plug valves.

### 3.17 **ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.

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- B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
  - 3. Cast-iron, nonlubricated plug valve.
  
- C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
  
- D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.
  - 3. Cast-iron, nonlubricated plug valve.
  
- E. Valves in branch piping for single appliance shall be one of the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
  - 2. Bronze plug valve.

**END OF SECTION 22 16 23**

## **SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS**

### **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. Residential, electric, storage, domestic-water heaters.
  - 2. Domestic-water heater accessories.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of residential, electric, domestic-water heater, from manufacturer.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

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## 1.6 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. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

## 1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

## 1.8 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. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Periods: From date of Substantial Completion.
    - a. Residential, Electric, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: 10 years.
      - 2) Controls and Other Components: Two years.
    - b. Compression Tanks: Five years.

## PART 2 - PRODUCTS

### 2.1 RESIDENTIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Residential, Electric, Storage, Domestic-Water Heaters:
  - 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. A. O. Smith Corporation.
    - b. Lochinvar, LLC.



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- c. Rheem Manufacturing Company.
2. Standard: UL 174.
3. Storage-Tank Construction: Steel.
  - a. Tappings: ASME B1.20.1 pipe thread.
  - b. Pressure Rating: 150 psig (1035 kPa).
  - c. Interior Finish: Comply with NSF 61 Annex G 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. Dip Tube: Required unless cold-water inlet is near bottom of tank.
  - c. Drain Valve: ASSE 1005.
  - d. Insulation: Comply with ASHRAE 90.2.
  - e. Jacket: Steel, cylindrical, with enameled finish.
  - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
  - g. Heating Elements: Two; electric, screw-in immersion type; wired for nonsimultaneous operation unless otherwise indicated. Limited to 12 kW total.
  - h. Temperature Control: Adjustable thermostat.
  - i. Safety Control: High-temperature-limit cutoff device or system.
  - j. Relief Valve: ASME rated and stamped for 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 valve with sensing element that extends into storage tank.

## 2.2 DOMESTIC-WATER HEATER ACCESSORIES

### A. Domestic-Water Compression Tanks:

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. A. O. Smith Corporation.
  - b. AMTROL, Inc.
  - c. State Industries.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:
  - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

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- b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
  - c. Air-Charging Valve: Factory installed.
- 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. 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.
- D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- E. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches (457 mm) above the floor.

## 2.3 SOURCE QUALITY CONTROL

- A. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- B. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Residential, Electric, Domestic-Water Heater Mounting: Install residential, electric, domestic-water heaters on floor.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.

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- 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 Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.13 "Butterfly Valves for Plumbing Piping,."
- C. 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.
- D. 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.
- E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified.
- F. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- G. Fill electric, domestic-water heaters with water.
- H. Charge domestic-water compression tanks with air.

### **3.2 CONNECTIONS**

- A. Comply with requirements for piping specified in Section 221116 "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 Section 220553 "Identification for Plumbing Piping and Equipment."

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.

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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 Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

### **3.5 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain, electric, domestic-water heaters.

**END OF SECTION 22 33 00**

## **SECTION 22 40 00 - PLUMBING FIXTURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following conventional plumbing fixtures and related components:
  - 1. Faucets for lavatories, showers, and sinks.
  - 2. Laminar-flow faucet-spout outlets.
  - 3. Flushometers.
  - 4. Toilet seats.
  - 5. Protective shielding guards.
  - 6. Fixture supports.
  - 7. Dishwasher air-gap fittings.
  - 8. Disposers.
  - 9. Water closets.
  - 10. Urinals.
  - 11. Lavatories.
  - 12. Commercial sinks.
  - 13. Individual showers.
  - 14. Kitchen sinks.
  - 15. Service sinks.
  - 16. Service basins.

#### **1.3 DEFINITIONS**

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

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- D. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.
- B. Sample Warranty: For special warranty.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

#### **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
  - 3. Flushometer-Tank Repair Kits: Equal to 5 percent of amount of each type installed, but no fewer than two of each type.
  - 4. Toilet Seats: Equal to 5 percent of amount of each type installed.

#### **1.8 WARRANTY**

- A. Warranty: Special warranty specified in this Section.

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## 1.9 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Plastic Shower Enclosures: ANSI Z124.2.
  - 3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - 4. Slip-Resistant Bathing Surfaces: ASTM F 462.
  - 5. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
  - 6. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
  - 7. Stainless-Steel Residential Sinks: ASME A112.19.3.
  - 8. Vitreous-China Fixtures: ASME A112.19.2M.
  - 9. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
  - 10. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  - 4. Faucets: ASME A112.18.1.
  - 5. Hose-Connection Vacuum Breakers: ASSE 1011.

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6. Hose-Coupling Threads: ASME B1.20.7.
  7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  8. NSF Potable-Water Materials: NSF 61.
  9. Pipe Threads: ASME B1.20.1.
  10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  11. Supply Fittings: ASME A112.18.1.
  12. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for shower faucets:
1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
  2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
  3. Faucets: ASME A112.18.1.
  4. Hand-Held Showers: ASSE 1014.
  5. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
  6. Hose-Coupling Threads: ASME B1.20.7.
  7. Manual-Control Antiscald Faucets: ASTM F 444.
  8. Pipe Threads: ASME B1.20.1.
  9. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
  10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- J. 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. Dishwasher Air-Gap Fittings: ASSE 1021.
  4. Manual-Operation Flushometers: ASSE 1037.
  5. Plastic Tubular Fittings: ASTM F 409.
  6. Brass Waste Fittings: ASME A112.18.2.
  7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
  2. Dishwasher Air-Gap Fittings: ASSE 1021.
  3. Flexible Water Connectors: ASME A112.18.6.
  4. Floor Drains: ASME A112.6.3.
  5. Grab Bars: ASTM F 446.
  6. Hose-Coupling Threads: ASME B1.20.7.
  7. Off-Floor Fixture Supports: ASME A112.6.1M.
  8. Pipe Threads: ASME B1.20.1.
  9. Plastic Shower Receptors: ANSI Z124.2.
  10. Plastic Toilet Seats: ANSI Z124.5.
  11. Supply and Drain Protective Shielding Guards: ICC A117.1.



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### **1.10 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
  3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than 2 of each type.
  4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
  5. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
  6. Toilet Seats: Equal to 5 percent of amount of each type installed.

## **PART 2 - PRODUCTS**

### **2.1 LAVATORY FAUCETS**

- A. See schedule on drawings for additional information.
- B. Lavatory Faucets,:
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. American Standard Companies, Inc.
    - b. Chicago Faucets.
    - c. Zurn Plumbing Products Group; Commercial Brass Operation.

### **2.2 SHOWER FAUCETS**

- A. Shower Faucets,:
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. American Standard Companies, Inc.
    - b. Chicago Faucets.
    - c. Leonard Valve Company.
    - d. Powers; a Watts Industries Co.

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### 2.3 SINK FAUCETS

#### A. Sink Faucets:

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. American Standard Companies, Inc.
  - b. Chicago Faucets.
  - c. T & S Brass and Bronze Works, Inc.
  - d. Zurn Plumbing Products Group; Commercial Brass Operation.

### 2.4 FLUSHOMETERS

#### A. Flushometers:

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. Delta Faucet Company.
  - b. Sloan Valve Company.
  - c. Zurn Plumbing Products Group; Commercial Brass Operation.
  - d. <Insert manufacturer's name.>

### 2.5 TOILET SEATS

#### A. Toilet Seats:

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. Bemis Manufacturing Company.
  - b. Church Seats.
  - c. Zurn.

### 2.6 PROTECTIVE SHIELDING GUARDS

#### A. Protective Shielding Pipe Covers:

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. McGuire Manufacturing Co., Inc.
  - b. TRUEBRO, Inc.
  - c. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.

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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.

## 2.7 FIXTURE SUPPORTS

- 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. Smith, Jay R. Mfg. Co.
  2. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  3. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports:
  1. Description: Combination carrier designed for accessible or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
- C. Urinal Supports:
  1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
  2. Accessible-Fixture Support: Include rectangular steel uprights.
- D. Lavatory Supports:
  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.
- E. Sink Supports:
  1. Description: Type I, sink carrier with exposed arms and tie rods for sink-type fixture. Include steel uprights with feet.

## 2.8 DISHWASHER AIR-GAP FITTINGS

- A. Dishwasher Air-Gap Fittings:
  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. Brass Craft Mfg. Co.; a Subsidiary of Masco Corporation.

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- b. Dearborn Brass; a div. of Moen, Inc.
- c. Sioux Chief Manufacturing Company, Inc.
- d. Watts Brass & Tubular; a division of Watts Regulator Co.

## **2.9 DISPOSERS**

### **A. Disposers:**

- 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. American Standard Companies, Inc.
  - b. In-Sink-Erator; a div. of Emerson Electric Co.
  - c. Maytag Co.

## **2.10 WATER CLOSETS**

### **A. Water Closets:**

- 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. American Standard Companies, Inc.
  - b. Crane Plumbing, L.L.C./Fiat Products.
  - c. Eljer.
  - d. Zurn

## **2.11 URINALS**

### **A. Urinals:**

- 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. American Standard Companies, Inc.
  - b. Eljer.
  - c. Zurn
  - d.

## **2.12 LAVATORIES**

### **A. Lavatories:**

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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. American Standard Companies, Inc.
  - b. Crane Plumbing, L.L.C./Fiat Products.
  - c. Zurn.

## 2.13 COMMERCIAL SINKS

### A. Commercial Sinks:

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. Elkay Manufacturing Co.
  - b. Just Manufacturing Company.

## 2.14 INDIVIDUAL SHOWERS

### A. Individual Showers:

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. Aqua Glass Corporation.
  - b. Clarion Bathware.
  - c. Praxis Industries, Inc.; Aquarius Products.

## 2.15 KITCHEN SINKS

### A. Kitchen Sinks:

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. Dayton Products, Inc.
  - b. Elkay Manufacturing Co.
  - c. Just Manufacturing Company.
  - d. Kohler Co.
  - e. Moen, Inc.

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## **2.16 SERVICE SINKS**

## **2.17 SERVICE BASINS**

### **A. Service Basins:**

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. Acorn Engineering Company.
  - b. Crane Plumbing, L.L.C./Fiat Products.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 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 with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

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- G. Install counter-mounting fixtures in and attached to casework.
- H. Install fixtures level and plumb according to roughing-in drawings.
- I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Use ball or globe valves if supply stops are not specified with fixture. Valves are specified.
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- N. Install toilet seats on water closets.
- O. 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.
- P. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- Q. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- R. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- S. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- T. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- U. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck. Connect inlet hose to dishwasher and outlet hose to disposer.

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- V. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified.
- W. Set service basins in leveling bed of cement grout. Grout is specified.
- X. 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.

### **3.3 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."

### **3.4 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.

### **3.5 ADJUSTING**

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- C. Replace washers and seals of leaking and dripping faucets and stops.



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### **3.6 CLEANING**

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

### **3.7 PROTECTION**

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION 22 40 00**

## **DIVISION 23 – HVAC**

### **SECTION 23 00 00 – GENERAL PROVISIONS FOR HVAC SYSTEMS**

#### **PART 1 - GENERAL**

##### **1.1 GENERAL**

- A. The General Conditions, Special Conditions, Supplemental Conditions, Instructions to Bidders, and other Contract Documents apply to this branch of the work as well as to the other branches.
- B. Provide the materials (piping, ductwork, wiring, conduit, software, equipment, equipment accessories, etc.) and labor necessary for complete and functioning HVAC systems. The Drawings and Specifications are intended to indicate complete working systems. Provide complete and properly working systems, even if all materials and labor necessary to achieve this are not specifically shown on the Drawings or specified.
- C. The Contractor shall familiarize himself with the work of all other trades, general type construction, and the relationship of his work to other sections. He shall examine all working drawings, specifications and conditions affecting his work. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, verify all dimensions in the field and advise the Engineer of any discrepancy before fabricating or performing any work.
- D. The work shall include complete testing of all equipment, piping and ductwork at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment.
- E. Perform any necessary temporary work during construction.
- F. Work under this section shall conform to governing codes, ordinances and regulations of the City, County and State.
- G. The Contractor shall be responsible for any errors in fabrication, for the correct fitting, installation and erection of the various HVAC systems.

##### **1.2 COMMISSIONING**

- A. The Owner has directly contracted with a Commissioning Agency.
- B. Provide the services required by the Commissioning Agency in Division 1 Specification Sections.

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### **1.3 POWDER ACTUATED CONCRETE FASTENERS**

- A. Obtain written approval from the structural engineer before using powder-actuated concrete fasteners.
- B. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

### **1.4 SUSPENSION FROM METAL DECKING**

- A. Do not use metal decking for suspension of piping, ductwork or equipment. Hang items from top member of joist or provide additional structure to span between top members if needed.

### **1.5 COORDINATION BETWEEN TRADES**

- A. Demand and examine all Drawings and Specifications pertaining to the construction before installing the work described and shown under these Drawings and Specifications. Cooperate with all other Contractors in locating piping, ductwork, conduit, openings, chases and equipment in order to avoid conflict with any other Contractor's work. Give special attention to points where ducts or piping must cross other ducts or piping and where ducts, piping and conduit must fur into the walls and columns. All work installed above a lay-in ceiling must be coordinated and installed so there is a minimum of 4 inches between the top of the ceiling grid and the bottom of the installation.
- B. Make known to other trades intended positioning of materials and intended order of work. Determine intended position of work of other trades and intended order of installation.

### **1.6 DISCREPANCIES**

- A. If any discrepancies occur between the accompanying Drawings and these Specifications and Drawings and Specifications covering other Contracts, report such discrepancies to the Architect/Engineer far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of piping, ductwork, conduit and equipment not installed in accordance with the above instructions, and which interferes with work and equipment of other Contractors.

### **1.7 EXISTING PIPE AND SERVICES**

- A. Existing piping and services are located as accurately as possible from available information, but it shall be the Contractor's responsibility to locate, determine exact elevations and make required connections to such lines and services in manner approved by the Architect/Engineer.

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- B. Maintain in operating condition active utilities encountered in the utility installation. Repair to the satisfaction of the Architect/ Engineer and the Owner any surface or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

## **1.8 CONTINUOUS OPERATION AND CUTOVER**

- A. To facilitate the continuous operation of the existing utilities, no utility service shall be tapped into without prior notification of 48 hours to and approval received from the designated authority of the utility company.

## **1.9 ASBESTOS**

- A. If during the course of his work the Contractor observes the existence of asbestos, or asbestos-bearing materials, the Contractor shall immediately terminate further work on the project and notify the Owner of the condition. The Owner will, after consultation with the Engineer, determine a further course of action.

## **1.10 ACCESSIBILITY**

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- B. Extend all grease fittings to an accessible location.

## **1.11 ROUGH-IN**

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

## **1.12 HVAC INSTALLATIONS**

- A. Coordinate HVAC equipment and materials installation with other building components.
- B. Verify all dimensions by field measurements. Field verify existing conditions and all required measurements before fabricating any piping, ductwork or equipment.
- C. Arrange for chases, slots, and openings in other building components to allow for HVAC installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

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- E. Sequence, coordinate, and integrate installations of HVAC materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- F. Coordinate the cutting and patching of building components to accommodate the installation of HVAC equipment and materials.
- G. Where mounting heights are not detailed or dimensioned, install HVAC services and overhead equipment to provide the maximum headroom possible.
- H. Install HVAC equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate the installation of HVAC materials and equipment above ceilings with suspension system, light fixtures, and other installations.
- J. Coordinate connection of HVAC systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- K. Do not install HVAC work where it will interfere with work of other trades.
- L. Do not install HVAC work where it will interfere with access to control panels on HVAC and/or electrical equipment.
- M. Do not install HVAC work where it will interfere with access space around HVAC and electrical equipment. Do not install piping where it will interfere with removal of HVAC coils, filters or fan shafts.
- N. Do not install piping so close to ceiling that ceiling tiles in accessible ceilings cannot be removed without damaging them.
- O. Do not install HVAC work over the top of electrical equipment. Maintain minimum distances away from electrical equipment as required by the Electric Code.

### **1.13 EXCAVATION, TRENCHING AND BACKFILLING**

- A. Photographs: The contractor shall photograph all underground utilities before backfilling. Photographs shall be oriented and labeled so that the locations, all crossings and depths of the utilities can be determined from the photographs.
- B. General: Excavate in accordance with requirements of Division Section "EARTHWORK" and requirements of this Section. Lay the pipe in open trench except when the Architect/Engineer gives written permission for tunneling. Open the trench sufficiently ahead of pipe laying to reveal obstructions. Maintain easy access to fire hydrants by fire fighting apparatus. Provide trench crossing as necessary to accommodate public travel.

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- C. Provide trench crossing as necessary to accommodate public travel.
- D. **Separate Trenches:** Unless otherwise shown or requested, provide separate trenches for sewers, water lines and gas lines, respectively, with a minimum of 3' of undisturbed earth between trenches. In locations such as close to building, where separate trenches for sewers and water lines are impracticable, lay the water pipe on a solid shelf at least 18" above the top of the sewer. Always place gas lines in a separate trench from electrical lines.
- E. **Width of Trench:** Excavate trenches of sufficient width for proper installation of work. When the depth of backfill over sewer pipe exceeds 10', keep the trench at the level of the top of the pipe as narrow as possible.
- F. **Sheeting and Bracing:** Sheet and brace trenches as necessary to protect workmen and adjacent structures. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc. Do not remove sheeting until trench is backfilled sufficiently to protect pipe and prevent injurious caving. When ordered in writing by the Architect/ Engineer, leave sheeting in place and the Contract will be adjusted (See General Conditions): cut off such sheeting not to be removed at least 3' below finished grade.
- G. **Water Removal:** Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipes. Conduct the discharge from trench dewatering to drains or natural discharge channels.
- H. **Disposition of Utilities:** Observe rules and regulations governing the respective utilities in executing work under this heading. Protect active utilities from damage or remove in accordance with written instructions of the Architect/Engineer (See General Conditions). Plug, cap or remove inactive and abandoned utilities encountered in trenching operations. In absence of specific requirements, plug or cap such utility line at least 3' from utility line to be installed or as required by local regulations.
- I. **Rock Excavation:** Materials to be excavated shall include earth and any other material including rock encountered within the limits of trench excavation for the utilities to the depth and extent indicated on the drawings and herein specified. In case of any change ordered by the Owner or Architect/Engineer in the quantity of excavation, the contract price will be adjusted by unit price or as described under Excavation, Filling and Grading of Division Site Work of these specifications. The term "rock" as used is defined to be hard material in nature that cannot be dislodged from its bed and removed therefrom without blasting or drilling. Any other is "earth" insofar as removal of the material to be excavated is concerned.
  - 1. **Allowance for Additional Rock Excavation:** In addition to the rock removal specified in the preceding paragraph, include in the Contract Price an additional ten (10) cubic yards of trench rock removal by mechanical means. If more or less additional rock removal is required due to changes in routing or in elevations of underground utilities authorized in writing, the Contract Price will be adjusted via unit prices.

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- J. Blasting: See Division Section “EARTHWORK” to see if blasting is allowed. If blasting is allowed, obtain written approval of method from Architect/Engineer before proceeding with rock excavation.
- K. Trench Bottoms: Lay all pipe, unless otherwise noted or detailed, in undisturbed earth on at least 4" of #9 crushed stone, or other approved grillage. Bedding shall be in place and graded before pipe is installed.
- L. Special Supports: Whenever, in the option of the Architect/Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting sewers or other utilities and appurtenances specified in this section, provide special support as the Architect/Engineer may direct and the Contract Price will be adjusted. (See General Conditions).
- M. Tree Protection: Exercise care to protect the roots of trees to remain. Within the branch spread of such trees, perform trenching by hand. Open the trench only when the utility can be installed immediately; prune injured roots cleanly and backfill as soon as possible. Perform this work under the direction of the Architect/Engineer.
- N. Backfilling: Inspect and test piping and record locations of pipe lines and appurtenances before backfilling.
- O. Trenches Under Floor Slabs: Backfill under floor slab on grade to a point 5'-0" outside of perimeter building wall with fill as specified in Division Section “EARTHWORK”. Remove excess excavation materials from the site daily unless otherwise instructed.
- P. Trenches in Other Areas: Backfill with materials in accordance with Division Section “EARTHWORK”. Compact backfill thoroughly with a heavy tamper.
- Q. The Contractor, at his option, may backfill the remaining depth of the trench from 12" above top of piping to 12" below finished grade with sand, wash gravel, or fine rock chat. The remaining depth of the trench would then be backfilled as specified in the preceding specification.

#### **1.14 SOIL MATERIALS**

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- D. Backfill and Fill Materials: Satisfactory soil materials.

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### **1.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

### **1.16 WORKING DRAWINGS**

- A. Scale of drawings is approximate. Do not scale the drawings to determine locations of mechanical work. Exact locations, dimensions and elevations shall be governed by field conditions. Make field measurements of building before fabricating or installing equipment or materials.
- B. Drawings are based on physical dimensions of one or more manufacturer's equipment. Other approved equipment shall be of such dimensions that it can be readily installed in available space, leaving ample clearance for proper maintenance.
- C. Intent of drawings is to show systems and sizes. Drawings do not necessarily show all required offsets. Work shall be installed to conform with space limitations. Offsets, transitions, fittings, etc., shall be provided as part of the Contract where required to attain this objective.

### **1.17 EQUIPMENT MOUNTING**

- A. Mount equipment with moving parts, such as compressors, fans, air handling units, etc., on vibration supports suitable for the purpose of minimizing noise and vibration transmission unless otherwise specified. In addition, isolate equipment from external connections such as piping, ducts, etc., with flexible connectors, vibration isolators, or other approved means.
- B. Provide each piece of equipment or apparatus suspended from the ceiling or mounted above the floor level with suitable structural support, pipe stand, platform or carrier as approved by the Architect/Engineer.
- C. Gasket and seal to mounting surface flush and surface mounted equipment such as diffusers, grilles, etc.

### **1.18 PAINTING**

- A. Paint the following items.
  - 1. Exposed mechanical piping, valve bodies and fittings - bare and insulated, including hangers, platforms, etc.
  - 2. Exposed ductwork, whether or not insulated, and any grilles, diffusers, etc., not factory finished.
  - 3. "Exposed" shall mean exposed to view, such as, in mechanical spaces, tunnels, on roofs and in rooms with no suspended ceilings.



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- B. Colors of piping and ductwork shall be as specified in the "Identification for HVAC Piping and Equipment" section of the Specifications. See "color coding" in identification schedules.
- C. Painting shall be done in accordance with the "Painting" section of the specifications unless otherwise specified under other sections of the specifications,
- D. Do not paint aluminum and stainless steel equipment, motor and identification plates, tags, etc.
- E. Do not paint piping and ductwork concealed in walls or above suspended ceilings.

#### **1.19 DEBRIS**

- A. Remove from the site any debris and dirt caused by the work. Maintain the premises in a clean and orderly condition.

#### **1.20 PROTECTION OF EQUIPMENT AND MATERIALS**

- A. Provide suitable protection from dampness damage, dirt, etc., for equipment and materials during construction and until final acceptance by the Owner. Keep ends of piping and ductwork capped off when work on them is not in progress. Such protection shall be by a means acceptable to the Architect/Engineer.

#### **1.21 CLEANING UP**

- A. After completion of the work and before final acceptance of the work, thoroughly clean equipment and materials and remove foreign matter such as grease, dirt, labels, stickers, etc., from the exterior of piping, equipment and associated fabrications.

#### **1.22 EQUIPMENT CONNECTIONS**

- A. Make connections to equipment furnished by others whenever such equipment is shown on any part of the drawings or mentioned in any section of the specifications.
- B. Verify equipment locations and the sizes, number, locations, and types of connections to be made before installation of any such equipment.

#### **1.23 EQUIPMENT INSTALLATION INSTRUCTIONS**

- A. Install HVAC piping, ductwork and equipment in strict accordance with manufacturer's recommendations. Provide equipment accessories necessary for proper operation or recommended by the manufacturer, even if such accessories are not shown on the drawings or mentioned in the specifications.

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#### **1.24 PERMITS, CODES AND APPROVALS**

- A. Permits. Obtain and pay for the permits and licenses necessary for the complete HVAC systems from the authorities governing such work.
- B. Codes. Installation shall be in accordance with applicable codes and regulations, including but not limited to the following:
  - 1. City or County Building Inspector
  - 2. National and Local Electric Codes
  - 3. Kentucky Building Code and its referenced codes
  - 4. Kentucky Boiler Code
  - 5. Kentucky Energy Code
  - 6. Kentucky State Fire Marshal
  - 7. Local Fire Codes
  - 8. Local Building Inspections
- C. Approvals. All work must be approved by the Architect/Engineer before final payment is made.

#### **1.25 SUBSTITUTION OF MATERIALS AND EQUIPMENT**

- A. When making a shop drawing submittal for materials and/or equipment of a different manufacturer than that specified, it shall be understood and agreed that such substitution if approved will be made without cost to the Owner, regardless of changes in connections, spacing, electrical service, etc.

#### **1.26 WORKMANSHIP**

- A. Work shall be performed by mechanics skilled in their respective trades and shall present appearance typical of best trade practice. Work not installed in this manner shall be repaired, removed or replaced, or otherwise remedied as directed by the Architect/Engineer.

#### **1.27 RECORD DRAWINGS**

- A. Keep accurate record of deviations from drawings, particularly where work is concealed. Submit one (1) set of drawings marked to show changes when work is completed.

#### **1.28 SUPERVISION**

- A. The Contractor shall personally supervise the work or have a competent superintendent, satisfactory to the Architect/Engineer and Owner on the work at all times during progress with full authority to act.

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- B. The Contractor shall lay out his work and be responsible for any necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so. Work at the site of the project shall be observed by the Architect/Engineer or his representative.
- C. Final Inspection: At the time of final inspection of the work performed under this Contract, systems shall be complete in every respect and in perfect operating condition. Surplus materials of every character resulting from work of this section shall have been removed. Sanitary sewers shall be free from sand, silt or other obstructions. Any defect discovered in the utilities subsequent to this inspection shall have been corrected.

### **1.29 STRUCTURAL RESPONSIBILITY**

- A. The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing, or weakening. No structural member shall be cut or otherwise weakened in any manner without the written consent of the Architect/Engineer.
- B. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Owner or Architect/Engineer, without cost to either the Owner or the Architect/ Engineer.

### **1.30 OPENINGS**

- A. This Contractor shall be responsible for the openings he may require in floors, walls, roof or ceilings of any type of new or existing construction whether or not shown on the Architectural, Structural or Mechanical Drawings.
- B. Openings that have been shown on the Architectural and/or Structural Drawings will be provided under other Divisions; however, the responsibility for the correct size and location of such openings shall be that of this Contractor.
- C. Openings that have not been shown on the Architectural and/or Structural Drawings shall be provided by this Contractor.
- D. Review and conform to all structural requirements as detailed or specified in the Structural drawings and specifications.

### **1.31 CUTTING, FITTING AND PATCHING**

- A. Before doing any cutting or drilling, Contractor shall obtain permission from the Architect/Engineer and shall follow his instructions as to how proposed cutting or drilling is to be done.

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- B. Each respective Contractor shall do any cutting, patching, drilling of masonry, steel, wood or iron work and any fitting necessary for the proper installation of apparatus and materials included in these specifications or governed thereby.
- C. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- D. 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.
- E. Coordinate with the Structural Engineer BEFORE drilling, cutting, notching, etc., any new or existing structural members. Obtain written permission from Structural Engineer before doing such work. Locations and sizes of openings and methods of cutting or drilling such openings must be approved in advance by the Structural Engineer. Positively identify exact locations of reinforcing bars or tension cables in structural members by X-raying or other methods approved by the Structural Engineer if required by the Structural Engineer.
- F. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
- G. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- H. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
- I. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
- J. Comply with requirements of applicable Sections of Division 23 where cutting and patching requires excavating and backfilling.
- K. The patching and finishing shall be done in a workmanlike manner to the satisfaction of the Architect/Engineer.
- L. Patch any openings in existing floors, walls, ceilings or roof, left by removal of existing HVAC work.
- M. Review and conform to all structural requirements as detailed or specified in the Structural drawings and specifications.

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### **1.32 TEMPORARY UTILITIES**

- A. In any installation that requires deletion of existing services to install new services, a means of providing temporary service for the intermediate period is to be provided. The means of providing temporary service is to be reviewed and revised as required by the Engineer. This means of providing temporary service is to include but not limited to piping and its associated fittings, ductwork and its associated fittings, valves and dampers, insulation, restraints & thrust blocks and all other components required to make a temporary service operational to a level equal to the existing utility service.

### **1.33 RESTORATION OF SURFACES**

- A. Each Contractor shall restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, shrubs, and other items damaged or removed by his operations that are outside of the Limit of Site boundaries. Replacement and repairs shall be in accordance with good construction practice and shall match material employed in the original construction of the item to be replaced.

### **1.34 SHOP DRAWINGS AND OTHER REQUIRED SUBMITTALS**

- A. Comply with requirements listed in Division 1 Section – SUBMITTAL PROCEDURES and the following paragraphs.
- B. Definitions
  - 1. Action Submittals: See Division 1 Section – "SUBMITTAL PROCEDURES".
  - 2. Informational Submittals: See Division 1 Section – "SUBMITTAL PROCEDURES".
- C. Prepare and submit to the Architect/Engineer for review, shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc., and any other data required.
- D. Submittal data shall have the stamp of approval of the General Contractor to show that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will be returned for proper resubmission.
- E. No roughing-in, connections, etc., shall be done until acceptable shop drawings are in the hands of the Contractors. It shall be the responsibility of the Contractor to obtain acceptable shop drawings and to make connections, etc., in the neatest and most workmanlike manner possible.
- F. Submittal data must be complete for each piece of equipment. Partial or incomplete data will not be processed.
- G. Architect/Engineer's review of shop drawings the applies only to general design, arrangement, type, capacity and quality. Such approval does not apply to quantities, dimensions, connection locations, etc. In these cases, the Contractor alone shall be

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responsible for furnishing the proper quantity of the equipment and/or materials required for seeing that the equipment fits the available space in a satisfactory manner and that piping, electrical and other connections are suitably located.

- H. The Architect's/Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for deviations from drawings or specifications unless he has, in writing, called the Architect's/Engineer's attention to such deviation at the time of submission and secured his written acceptance nor shall it relieve him from responsibility for error in shop drawings or schedules.
- I. Submittal data must be complete and acceptable before project is accepted.

### **1.35 OPERATING AND MAINTENANCE INSTRUCTIONS**

- A. Comply with requirements listed in Division 1 Section – OPERATION AND MAINTENANCE DATA and the following paragraphs.
- B. This Contractor shall prepare three loose-leaf, bound brochures, entitled "Mechanical Equipment Operation and Maintenance Data." Mark identification on both front and spine of each binder. Each binder shall be a heavy duty 3-ring, vinyl-covered binder with pocket folders for folded sheet information. Each binder cover and spine shall have the project name (as listed on the drawings), what is in the binder (i.e. HVAC ...). If more than one binder is provide the cover and spine shall be marked with "Volume ? of ?". Binders shall be properly indexed (thumb- tabbed). Information shall be filed under applicable specification section number.
- C. Each brochure shall contain the following information:
  1. Name and address of Consulting Engineer, Contractor, and index of equipment, including vendor (name and address).
  2. Complete brochures, descriptive data and parts list, etc., on each piece of equipment, including all approved shop drawings.
  3. Complete maintenance and operating instructions, prepared by the manufacturer, on each major piece of equipment.
  4. Complete shop drawing submittal on temperature controls including control diagrams updated to reflect "as-built" conditions.
  5. Final testing and balancing report.
- D. All brochures shall be submitted to the Architect/Engineer or his representative prior to final inspection of the building.

### **1.36 OWNER INSTRUCTION**

- A. Conduct a minimum of a full-day walk-through instruction seminar for the Owner's personnel to be involved in the continued operation and maintenance of mechanical equipment and systems.

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- B. Engage factory-authorized service representatives for the following equipment to train Owner's maintenance personnel:
  - 1. Packaged terminal air conditioning units
  - 2. Split system air conditioning units
  - 3. Energy recovery units
  - 4. Fans
- C. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Review data in the operation and maintenance manuals.
- D. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems.
- E. Video record the instruction sessions and turn over CD to the Owner. The CD shall be provided to the Owner in "DVD" format.

#### **1.37 LINTELS:**

- A. General: Provide lintels for penetration of HVAC systems through masonry walls if not provided elsewhere in these specifications. Lintels shall be type and size required to span the required openings.
- B. Lintels will not be required for openings 16 inches length or less.

#### **1.38 SYSTEM DESIGN WORKING PRESSURES**

- A. Provide all piping system components (piping, fittings, valves, traps, strainers, etc.) suitable for 125 psig minimum steam working pressure.

#### **1.39 TEMPORARY COOLING**

- A. Do not provide temporary cooling for areas under construction.

#### **1.40 TEMPORARY DEHUMIDIFICATION**

- A. Provide temporary dehumidification for the new construction areas. Maintain a maximum relative humidity of 50%. Provide temporary dehumidification in each area at the time required by construction. Operate temporary dehumidification until all dirt and dust producing activities in the affected area have been completed and area is ready for operation from the permanent HVAC system.
- B. Pay all utilities costs related to operation of temporary dehumidification.
- C. Do not use the permanent building HVAC systems for temporary dehumidification.

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#### **1.41 TEMPORARY HEAT**

- A. Provide temporary heat for new construction areas. Maintain a minimum temperature of 55 deg.F. Provide temporary heat in each area at the time required by construction. Operate temporary heat until all dirt and dust producing activities in the affected area have been completed and area is ready for operation from the permanent HVAC system.
- B. Pay all utilities costs related to operation of temporary heating.
- C. Do not use the permanent building HVAC systems (either new or existing to remain) for temporary heating.

#### **1.42 MAINTAINING EXISTING SERVICES**

- A. Properly make all temporary connections that may be necessary to continue these services in a safe and substantial manner until the permanent services are activated. Upon completion, remove all temporary work, and completely restore all areas that may be affected.

#### **1.43 INTERRUPTION OF EXISTING HVAC SERVICES**

- A. In general, do not interrupt HVAC services to occupied areas of the building (both inside and outside construction area). If services must be interrupted (for making temporary connections, for changing over from existing to new, or for making new connections to existing systems, for example) then do such work at the times designated by the Owner.
- B. Schedule this work in advance with the Owner. Perform work on premium time if required to do so by the Owner.
- C. At any time the existing building services are interrupted, the Contractor shall work continuously until the permanent services are restored.

#### **1.44 OWNER OCCUPANCY**

- A. Full Owner Occupancy: The Owner will occupy the site and buildings surrounding construction area during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work to minimize interference with the Owner's operations. Perform portions of work on premium time if required to do so by the Owner.

#### **1.45 DEMOLITION**

- A. Disconnect, demolish, and remove existing HVAC systems, equipment, and components indicated to be removed.



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- B. Refrigerant:
1. Remove refrigerant from HVAC equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
  2. Provide Statement of Refrigerant Recovery signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- C. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
- D. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
- E. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
- F. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- G. Equipment to Be Removed: Disconnect and cap services and remove equipment.
- H. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- I. Equipment to Be Removed and Salvaged: Disconnect and cap services and comply with the following:
1. Clean salvaged items of dirt and demolition debris.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to storage area designated by Owner.
  5. Protect items from damage during transport and storage.
  6. Salvage the following items:
    - a. Unit heaters
    - b. Other
- J. All other existing HVAC work (such as piping, ductwork, valves, etc.) shall become the property of the Contractor and shall be removed from the job site.
- K. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- L. Remove or relocate existing HVAC work that interferes with new work of any kind.

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- M. The Drawings show existing work to the extent possible. However, all existing work may not be shown. Remove or relocate any existing work that interferes with new work even if it is not shown on the Drawings.
- N. Remove existing work that does not have to remain in service. Relocate existing work that has to remain in service, as required to avoid interference with new work.
- O. Remove or relocate existing electrical work that interferes with new HVAC work, if such work is not indicated to be removed or relocated on the Electrical Drawings. Remove work that does not have to remain in service. Relocate work that has to remain in service, as required to avoid interference with new work.

#### **1.46 PROVIDING AIRTIGHT SPACES**

- A. In rooms where room walls extend above ceiling to the floor or roof above, caulk around all new and existing penetrations through walls, ceilings, floors and/or roofs to make completely airtight rooms. Seal penetrations both above and below suspended ceilings. Seal any openings left by removal of any existing or new work. Caulking used shall be the same type as specified in the Architectural Specifications.
- B. Patch around rough openings of penetrations to form a tight fit before caulking.

#### **1.47 LICENSE REQUIRED**

- A. Contractors installing HVAC work must be licensed by the Kentucky Board of Heating, Cooling and Ventilation Contractors. Submit proof of licensing.

#### **1.48 PROFESSIONAL ENGINEER QUALIFICATIONS**

- A. When the term “professional engineer”, or “qualified professional engineer” is used anywhere in these specifications it shall mean a person who is licensed to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

### **PART 2 - PRODUCTS**

#### **2.1 FIRESTOPPING**

- A. Provide seals for any opening through any walls, floors, or ceilings used as passage for mechanical components such as piping or ductwork.
- B. General: Provide manufacturer's standard fire-stopping sealant, with accessory materials, having fire-resistance ratings as established by testing identical assemblies

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per ASTM E 814 by Underwriters' Laboratories, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction. Sealant shall provide protection equal or exceeding the fire resistance rating of fire rated walls, partitions, ceilings or floors. Use two-part or one part sealants as required to meet required fire resistance ratings.

- C. Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place, silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.
- D. One-Part Fire-Stopping Sealant: One part elastomeric sealant formulated for use in a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.
- E. Intumescent Fire-Stopping Sealant: A one-part, acrylic sealant that expands when exposed to heat.
- F. Firestop Compound: Trowelable compound for large openings
- G. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
  - 1. Foamed-in-Place Fire-Stopping Sealant:
    - a. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
    - b. "Pensil 85I"; General Electric Co.
  - 2. One-Part Fire-Stopping Sealant:
    - a. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
    - b. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
    - c. "RTV 7403"; General Electric Co.
    - d. "Fyre Putty"; Standard Oil Engineered Materials Co.
    - e. "FS 601"; Hilti Inc.
    - f. "FS 611A"; Intumescent Sealant; Hilti Inc.
    - g. "FS 635"; Hilti Inc.
- H. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

## 2.2 ACCESS UNITS

- A. General. The work of this article is limited to the provisions for access through other work for access to HVAC work, and does not include internal access provisions (within the HVAC work). In general and where possible, furnish or furnish-and-mount required access units in other trades' work prior to their work, so that cutting and patching for the

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subsequent installation of such access units will not be required. In occupied spaces, provide finished access units of the maximum concealment type, including locks where appropriate, and matching access units provided in the same expanse of finish (for non-HVAC access, if any).

- B. The scope of access units to be furnished or provided as HVAC work includes those units indicated on the mechanical drawings or specified in Division 23 sections, and those additional units required for adequate access to HVAC work and not shown or specified individually.
- C. Access Doors. Standard welded-steel construction, 16-gage frames and 14 gage door panels, 175 degree concealed spring hinges, rust-inhibitive prime coat, flush cam lock (for screw-driver operation where keyed lock is not required), recessed to receive applied finish where applicable (such as in concealed spline ceilings).
- D. Removable Access Plates. Where only hand access is sufficient, provide removable plate-type access unit, or minimum size which will facilitate the required access. Provide units of the type, style, design, material and finish appropriate for the location and exposure in each instance. In exposed surfaces of occupied spaces provide round plate units, flush floor units and frameless low-profile wall units, primed-for-paint in painted surfaces and polished chrome or stainless steel finish in other surfaces.
- E. Access Thru Fire Rated Walls or Ceilings. Where access doors or plates are required in fire rated partitions or ceilings, provide U.L. listed "B" Label doors or plates rated for 1-1/2 hours. Furnish doors with automatic closers and key operated latches that latch automatically when door closes.

### **2.3 FLASHING:**

- A. General: Provide flashings from the following listing for each penetration of HVAC systems through roofs or waterproof membranes. Select appropriate flashing method for the type of roof used. Flashing shall be in accordance with roofing manufacturer's recommendations.
- B. Copper Flashing: Provide cold-rolled sheet copper, complying with ANSI/ASTM B 370, weighing 16 oz. per sq. ft. (0.0216" thick), except as otherwise indicated.
- C. Lead Flashing: Provide sheet lead complying with FS QQ-L-2201, Grade B; formed from common desilverized pig lead, complying with ANSI/ASTM B 29; weighing 4.0 lbs. per sq. ft., except as otherwise indicated.
- D. Bituminous Coating: FS TT-C-494, or MIL-C-18480, or SSPC-paint 12, cold-applied solvent-type bituminous mastic coating for application in dry film thickness of 15 mils per coat.
- E. Laminated Sheet Flashing: Bottom laminate of heavy-duty nonplasticized chlorinated polyethylene (CPE) synthetic elastomer, with top laminate of built-up roofing (BUR) sheet material; weighing 8 oz. per sq. ft.

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- F. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of sheet metal being installed.
- G. Coat back side of lead flashings where in contact with concrete and other cementitious substrates, by painting surface in area of contact with heavy application of bituminous coating, or by other permanent separation as recommended by manufacturer of metal.
- H. On vertical surfaces, lap flashings minimum of 3".
- I. On vertical surfaces, for slopes of not less than 6" in 12", lap unsealed flashings minimum of 6".
- J. For embedment of metal flashing flanges in roofing or composition flashing or stripping, extend flanges minimum of 6" for embedment.

### **PART 3 - EXECUTION**

#### **3.1 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. 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 the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified.

#### **3.2 ERECTION OF METAL SUPPORTS AND ANCHORAGES**

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

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### 3.3 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**END OF SECTION 23 00 00**

## **SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

### **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 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.

#### **1.3 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 NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

#### **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.



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4. Motors used with VFD's shall be provided with AEGIS™ SGR shaft grounding rings or equal. On motors greater than 100HP also provide an insulated, insulated ceramic or hybrid bearing on the non-drive end of the motor.
  5. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
  6. Motors shall be totally enclosed, inverter-duty motors. Inverter-ready and inverter-rated motors are not acceptable.
  7. Motors shall be the premium efficiency design of the motor manufacturer.
  8. Motors shall not be limited to use with the same manufacturer's variable frequency drives.
  9. Motors shall be designed with critical vibration frequencies outside operating range of controller output.
  10. Motors shall comply with all of NEMA MG1, Part 31 "Definite Purpose Inverter-fed Motors." Motor Frames shall be cast iron construction.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

## 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)

**END OF SECTION 23 05 13**

## **SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**

### **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. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

#### **1.3 ACTION 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. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

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## 2.2 SLEEVE-SEAL SYSTEMS

- 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. 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: Stainless steel.
  3. Connecting Bolts and Nuts: Stainless steel 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.
- 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.

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- 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..
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

### **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): Cast-iron wall sleeves.
    - b. Piping NPS 6 (DN 150) and Larger: Cast-iron 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.
    - b. Piping NPS 6 (DN 150) and Larger: Cast-iron wall sleeves with sleeve-seal system.

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- 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.
    - b. Piping NPS 6 (DN 150) and Larger: 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.
    - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
5. Interior Partitions:
    - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION 23 05 17**

## **SECTION 23 05 18 - ESCUTCHEONS FOR HVAC PIPING**

### **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. Escutcheons.
  - 2. Floor plates.

#### **1.3 ACTION SUBMITTALS**

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

### **PART 2 - PRODUCTS**

#### **2.1 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.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

#### **2.2 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange.

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- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

## **PART 3 - EXECUTION**

### **3.1 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, cast-brass type with polished, chrome-plated finish.
    - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
  - 2. Escutcheons for Existing Piping:
    - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
    - e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated 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.
  - 2. Existing Piping: Split-casting, floor-plate type.

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**3.2 FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

**END OF SECTION 23 05 18**



## **SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Fiberglass pipe hangers.
  - 4. Metal framing systems.
  - 5. Fiberglass strut systems.
  - 6. Thermal-hanger shield inserts.
  - 7. Fastener systems.
  - 8. Pipe stands.
  - 9. Equipment supports.
- B. Related Sections:
  - 1. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
  - 2. Section 233113 "Metal Ducts" for duct hangers and supports.

#### **1.3 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

#### **1.4 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, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

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2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

## **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  1. Trapeze pipe hangers.
  2. Metal framing systems.
  3. Fiberglass strut systems.
  4. Pipe stands.
  5. 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.
  1. Detail fabrication and assembly of trapeze hangers.
  2. Design Calculations: Calculate requirements for designing trapeze hangers.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

## **1.7 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.

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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 stainless 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.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless 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 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

## 2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

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. Allied Tube & Conduit; a part of Atkore International.

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- b. B-line, an Eaton business.
  - c. Unistrut; Part of Atkore International.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
  3. Standard: MFMA-4.
  4. Channels: Continuous slotted steel channel with inturned lips.
  5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
  7. Metallic Coating: Electroplated zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

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. Anvil International.
  - b. NIBCO INC.
  - c. PHD Manufacturing, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
7. Coating: Zinc.

## 2.5 FIBERGLASS STRUT SYSTEMS

- 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. Allied Tube & Conduit; a part of Atkore International.
  2. B-line, an Eaton business.
  3. Champion Fiberglass, Inc.
- B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.
1. Channels: Continuous slotted fiberglass channel with inturned lips.
  2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

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## 2.6 THERMAL-HANGER SHIELD INSERTS

- 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. PHS Industries, Inc.
  2. Pipe Shields Inc.
  3. Rilco Manufacturing Co., Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## 2.7 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.

## 2.8 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

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## **2.10 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**

- A. Powder Actuated Concrete Fasteners
  - 1. Obtain written approval from the structural engineer before using powder-actuated concrete fasteners.
  - 2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- B. Suspension From Metal Decking
  - 1. Do not use metal decking for suspension of piping, ductwork or equipment. Hang items from top member of joist or provide additional structure to span between top members if needed.

## **3.2 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. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

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- E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.
- F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- G. 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.
- H. Pipe Stand Installation:
  - 1. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. 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.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. 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.
- N. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. 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.
- P. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

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- 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.

### 3.3 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.



### **3.4 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.

### **3.5 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).

### **3.6 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 other sections.]
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### **3.7 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

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- 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, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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. 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. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
  - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8 (DN 20 to DN 200).
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8 (DN 10 to DN 200).

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11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
  12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. 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.
  15. 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.
  16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
  17. 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.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24 (DN 65 to DN 600), from single rod if horizontal movement caused by expansion and contraction might occur.
  19. 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.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 (DN 50 to DN 600) if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 (DN 50 to DN 750) if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. 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.
- L. 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.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

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5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- M. 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-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. 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.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. 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.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

**END OF SECTION 23 05 29**

## **SECTION 23 05 48.13 - VIBRATION CONTROLS FOR HVAC**

### **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. Elastomeric isolation pads.
  - 2. Elastomeric isolation mounts.
  - 3. Restrained elastomeric isolation mounts.
  - 4. Open-spring isolators.
  - 5. Housed-spring isolators.
  - 6. Restrained-spring isolators.
  - 7. Housed-restrained-spring isolators.
  - 8. Pipe-riser resilient supports.
  - 9. Resilient pipe guides.
  - 10. Air-spring isolators.
  - 11. Restrained-air-spring isolators.
  - 12. Elastomeric hangers.
  - 13. Spring hangers.
  - 14. Vibration isolation equipment bases.
  - 15. Restrained isolation roof-curb rails.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
- B. Shop Drawings:
  - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

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- C. Delegated-Design Submittal: For each vibration isolation device.
  - 1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.5 QUALITY ASSURANCE

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

### PART 2 - PRODUCTS

#### 2.1 ELASTOMERIC ISOLATION PADS

- A. Elastomeric Isolation Pads: .
  - 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. Ace Mountings Co., Inc.
    - b. California Dynamics Corporation.
    - c. Isolation Technology, Inc.
    - d. Kinetics Noise Control, Inc.
    - e. Mason Industries, Inc.
    - f. Vibration Eliminator Co., Inc.
    - g. Vibration Isolation.
    - h. Vibration Mountings & Controls, Inc.
  - 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
  - 3. Size: Factory or field cut to match requirements of supported equipment.
  - 4. Pad Material: Oil and water resistant with elastomeric properties.
  - 5. Surface Pattern: Smooth pattern.
  - 6. Infused nonwoven cotton or synthetic fibers.
  - 7. Load-bearing metal plates adhered to pads.
  - 8. Sandwich-Core Material: Resilient and elastomeric.
    - a. Surface Pattern: Smooth pattern.
    - b. Infused nonwoven cotton or synthetic fibers.

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## 2.2 ELASTOMERIC ISOLATION MOUNTS

### A. Double-Deflection, Elastomeric Isolation Mounts: .

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. Ace Mountings Co., Inc.
  - b. California Dynamics Corporation.
  - c. Isolation Technology, Inc.
  - d. Kinetics Noise Control, Inc.
  - e. Mason Industries, Inc.
  - f. Vibration Eliminator Co., Inc.
  - g. Vibration Isolation.
  - h. Vibration Mountings & Controls, Inc.
2. Mounting Plates:
  - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
  - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

### A. Restrained Elastomeric Isolation Mounts: .

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. Ace Mountings Co., Inc.
  - b. California Dynamics Corporation.
  - c. Isolation Technology, Inc.
  - d. Kinetics Noise Control, Inc.
  - e. Mason Industries, Inc.
  - f. Vibration Eliminator Co., Inc.
  - g. Vibration Isolation.
  - h. Vibration Mountings & Controls, Inc.
2. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
  - a. Housing: Cast-ductile iron or welded steel.



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- b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

## 2.4 OPEN-SPRING ISOLATORS

### A. Freestanding, Laterally Stable, Open-Spring Isolators: .

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. Ace Mountings Co., Inc.
  - b. California Dynamics Corporation.
  - c. Isolation Technology, Inc.
  - d. Kinetics Noise Control, Inc.
  - e. Mason Industries, Inc.
  - f. Vibration Eliminator Co., Inc.
  - g. Vibration Isolation.
  - h. Vibration Mountings & Controls, Inc.
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. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

## 2.5 HOUSED-SPRING ISOLATORS

### A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing: .

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. Ace Mountings Co., Inc.
  - b. California Dynamics Corporation.
  - c. Isolation Technology, Inc.
  - d. Kinetics Noise Control, Inc.
  - e. Mason Industries, Inc.
  - f. Vibration Eliminator Co., Inc.
  - g. Vibration Isolation.

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h. Vibration Mountings & Controls, Inc.

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. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
  - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
  - b. Top housing with attachment and leveling bolt.

## 2.6 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

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. Ace Mountings Co., Inc.
  - b. California Dynamics Corporation.
  - c. Isolation Technology, Inc.
  - d. Kinetics Noise Control, Inc.
  - e. Mason Industries, Inc.
  - f. Vibration Eliminator Co., Inc.
  - g. Vibration Isolation.
  - h. Vibration Mountings & Controls, Inc.
2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
  - a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
  - b. Top plate with threaded mounting holes.
  - c. Internal leveling bolt that acts as blocking during installation.
3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

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7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

## 2.7 HOUSED-RESTRAINED-SPRING ISOLATORS

- A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: .
  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. Ace Mountings Co., Inc.
    - b. California Dynamics Corporation.
    - c. Isolation Technology, Inc.
    - d. Kinetics Noise Control, Inc.
    - e. Mason Industries, Inc.
    - f. Vibration Eliminator Co., Inc.
    - g. Vibration Isolation.
    - h. Vibration Mountings & Controls, Inc.
  2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
    - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
    - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
  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.

## 2.8 PIPE-RISER RESILIENT SUPPORT

- A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- (13-mm-) thick neoprene.
  1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
  2. Maximum Load Per Support: 500 psig (3.45 MPa) on isolation material providing equal isolation in all directions.

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## 2.9 RESILIENT PIPE GUIDES

- A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- (13-mm-) thick neoprene.
1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

## 2.10 ELASTOMERIC HANGERS

- A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .
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. Ace Mountings Co., Inc.
    - b. California Dynamics Corporation.
    - c. Isolation Technology, Inc.
    - d. Kinetics Noise Control, Inc.
    - e. Mason Industries, Inc.
    - f. Vibration Eliminator Co., Inc.
    - g. Vibration Mountings & Controls, Inc.
  2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
  3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

## 2.11 SPRING HANGERS

- A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: .
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. Ace Mountings Co., Inc.
    - b. California Dynamics Corporation.
    - c. Kinetics Noise Control, Inc.
    - d. Mason Industries, Inc.
    - e. Vibration Eliminator Co., Inc.
    - f. Vibration Isolation.
    - g. Vibration Mountings & Controls, Inc.

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2. 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.
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.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 VIBRATION CONTROL DEVICE INSTALLATION**

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

**END OF SECTION 23 05 48.13**

## **SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

### **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. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Duct labels.
  - 5. Underground-Type Plastic Line Marker.
  - 6. Utility Service Markers
  - 7. Ceiling Identification Discs
  - 8. Stencils.
  - 9. Valve tags.
  - 10. Warning tags.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

### **PART 2 - PRODUCTS**

#### **2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:

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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. Brady Corporation.
  - b. Seton Identification Products.
2. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. 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).
5. 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-quarters the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brady Corporation.
  - b. Seton Identification Products.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
6. 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).
7. 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-quarters the size of principal lettering.
8. Fasteners: Stainless-steel self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

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- D. 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) and 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
  2. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Yellow.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- F. 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).
- G. 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-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
  2. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.



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- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include 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: Size letters according to ASME A13.1 for piping.

## 2.4 DUCT LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.
  - 2. Seton Identification Products.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Black.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- F. 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).
- G. 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-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel self-tapping screws.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

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1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

## **2.5 UNDERGROUND-TYPE PLASTIC LINE MARKERS:**

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.
- B. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

## **2.6 UTILITY SERVICE MARKERS:**

- A. Markers shall consist of bronze plates, ground and polished, and marked to identify the service. Markers shall also be stamped with arrows indicating the direction the service extends. A typical marker detail is shown on the Drawings.
- B. Markers locating services at the building shall be installed in masonry or concrete walls 2' above grade. Markers locating services elsewhere on the site shall be installed in concrete walks or curbs, or in 6" x 6" steel reinforced concrete posts as detailed.

## **2.7 MARKERS FOR IDENTIFYING EQUIPMENT ABOVE CEILINGS:**

- A. Provide manufacturer's standard laminated plastic, color-coded equipment markers for identifying type and location of mechanical equipment above suspended ceilings. Provide markers with pressure adhesive and engraved as scheduled in this section. Markers shall be narrow enough to fit on exposed ceiling grid and long enough to accommodate specified engraving. Install on ceiling grid closest to equipment above ceiling.

## **2.8 STENCILS**

- A. Stencils for Piping:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brimar Industries, Inc.
    - b. Carlton Industries, LP.
    - c. Champion America.
  2. Lettering Size: Size letters according to ASME A13.1 for piping.
  3. Stencil Material: Fiberboard or metal.

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4. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

B. Stencils for Ducts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brimar Industries, Inc.
  - b. Carlton Industries, LP.
  - c. Champion America.
2. Lettering Size: Minimum letter height of 1-1/4 inches (32 mm) for viewing distances up to 15 feet (4-1/2 m) and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Brimar Industries, Inc.
  - b. Carlton Industries, LP.
  - c. Champion America.
2. Lettering Size: Minimum letter height of 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm) and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.

## 2.9 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Brady Corporation.

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2. Seton Identification Products.

- B. Description: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Fasteners: Brass S-hook.
- C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.10 WARNING TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
  2. Brimar Industries, Inc.
  3. Carlton Industries, LP.
  4. Champion America.
  5. Seton Identification Products.
- B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches (75 by 133 mm) minimum.
  2. Fasteners: Brass grommet and wire.
  3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  4. Color: Safety-yellow background with black lettering.

## 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.

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### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### 3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.4 MECHANICAL EQUIPMENT IDENTIFICATION ABOVE CEILING:

- A. Attach Seton-Ply Discs to ceiling grid under equipment or to access doors in non-accessible ceilings as follows:

	<u>Equipment</u>	<u>Engraved</u>	<u>Background Color</u>	<u>Lettering Color</u>
1.	Valve	V	Yellow	Black
3.	Volume Damper	VD	Black	White

### 3.5 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
  1. Identification Paint: Use for contrasting background.
  2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: 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 and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.

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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.
  8. Space every 10' in mechanical rooms.
- D. Provide piping identification markers in accordance with the following schedule. Provide black lettering on yellow backgrounds and white lettering on backgrounds with other colors.
- E. COMMONWEALTH OF KENTUCKY (STATE). STANDARD COLOR CODING FOR HVAC PIPING
1. Piping Identification Schedule
- | <u>Piping</u>             | <u>Background Color</u> | <u>Letter Color</u> | <u>Legend - Band</u> |
|---------------------------|-------------------------|---------------------|----------------------|
| 2. Relief Valve Discharge | Orange                  | Black               | R.V.D.               |
| 3. Refrigerant Suction    | Yellow                  | Black               | R.S.                 |
| 4. Refrigerant Hot Gas    | Yellow                  | Black               | R.H.G.               |
| 5. Refrigerant Liquid     | Yellow                  | Black               | R.L.                 |
- F. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

### 3.6 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
  1. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.
- C. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

<u>Duct System</u>	<u>Stencil Wording</u>
1. Supply Air	"Supply Air"
2. Return Air	"Return Air"
3. Outside Air	"Outside Air"
4. Exhaust Air	"Exhaust"

### 3.7 UNDERGROUND PIPING IDENTIFICATION:

- A. General: During back-filling/top-soiling of each exterior underground piping systems, install continuous underground-type plastic line marker, located directly over buried line

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at 12" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.

### **3.8 UTILITY SERVICE MARKERS**

- A. Install utility service markers where shown on plans for underground utilities and at building entrance or exit or any change in direction.

### **3.9 VALVE-TAG INSTALLATION**

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.
- C. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.
- D. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. Refrigerant: 1-1/2 inches (38 mm), round.
    - b. Gas: 1-1/2 inches (38 mm), round.
  - 2. Valve-Tag Colors:
    - a. Toxic and Corrosive Fluids: Black letters on a safety-orange background.
    - b. Flammable Fluids: Black letters on a safety-yellow background.
    - c. Combustible Fluids: White letters on a safety-brown background.
    - d. Potable and Other Water: White letters on a safety-green background.
    - e. Compressed Air: White letters on a safety-blue background.
    - f. Defined by User: White letters on a safety-purple background, black letters on a safety-white background, white letters on a safety-gray background, and white letters on a safety-black background

### **3.10 WARNING-TAG INSTALLATION**

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION 23 05 53**

## **SECTION 23 05 93 – TESTING, ADJUSTING AND BALANCING FOR HVAC**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. All Division 23 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.

#### **1.2 SCOPE OF WORK**

- A. The owner will directly contract with a certified testing, adjusting, and balancing (TAB Agency) to test, adjust, and balance the HVAC systems.
- B. This specification section is included herein to assist and inform the Contractor of the standards, requirements and scope of the work to be performed by the Commonwealth's TAB Contractor.

#### **1.3 PREPARATION AND COORDINATION REQUIREMENTS – GENERAL**

- A. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided to the TAB Agency no later than 30 days prior to the start of TAB work.
- B. System installation and equipment startup shall be complete prior to the TAB Agency's being notified to begin.
- C. The building control system shall be complete and operational. The Building Control system contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.
- D. All test points, balancing devices, identification tags, etc. shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
- E. Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

#### **1.4 PREPARATION AND COORDINATION REQUIREMENTS – HVAC CONTROLS**

- A. Written notice shall be submitted through the General Contractor to the Architect stating that the Control System is operating and controlling the HVAC System.



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- B. The control subcontractor shall have entered all data needed for the TAB Agency to begin work.
- C. The Control subcontractor shall be available to correct any problems that the TAB Agency might have with the systems.
- D. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for HVAC controls.

#### **1.5 PREPARATION AND COORDINATION REQUIREMENTS – MECHANICAL**

- A. Written notice shall be submitted through the General Contractor to the Architect stating that the HVAC system is operational and ready for the TAB Agency.
- B. The Mechanical subcontractor shall have proved all units operational and all air outlets in the full open position.
- C. The Mechanical Contractor shall be available to correct any problems that the TAB Agency might have with any equipment or systems.
- D. The Mechanical Contractor shall furnish and install any replacement sheaves, pulleys and drive belts required for flow adjustments, as determined by the TAB Agency. Adjustable sheaves shall be selected so that the final adjustment position is in the middle third of the total adjustment range.
- E. All costs for additional work by the TAB Agency due to the Contractor's failure to comply with the above shall be paid by the Contractor and any subcontractor(s) for mechanical work.

#### **1.6 PREPARATION AND COORDINATION REQUIREMENTS – DUCTWORK**

- A. Ductwork air leakage testing shall be performed by the TAB Agency.
- B. The ductwork/sheetmetal subcontractor shall promptly correct any related problems discovered by the leakage tests.
- C. All costs associated with retesting and/or delays or other problems which impede the TAB Agency from performing such testing shall be paid by the contractor and any subcontractor(s) for ductwork.

#### **1.7 WORK BY TAB AGENCY**

- A. The work included in the remainder of this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements,

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and recording and reporting the results. This work shall be performed by the TAB Agency under direct contract to the owner. The remainder herein is also for the information of the Contractor and all subcontractors.

B. The items requiring testing, adjusting, and balancing include the following:

1. AIR SYSTEMS:
  - a. Supply Fan/Furnace
  - b. Exhaust Fans
  - c. Zone branch and main ducts
  - d. Diffusers, Registers and Grilles
  - e. Coils (Air Temperatures)

## 1.8 QUALIFICATIONS

- A. Agency qualifications: The TAB Agency shall be a current member of a nationally recognized balance organization (“National Organization”). The TAB Agency is to have no association to the installation of any mechanical work including but not limited to ducts, controls, and piping. The TAB Agency is to have no association with any manufacturer of any equipment that is installed including but not limited to controls, pumps, fans, boiler and chillers. This Organization shall provide the owner with National Guarantee document certifying the work of the TAB Agency. Acceptable organizations are Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).
1. The selected TAB Agency must provide proof of certification for the total project (air, water, sound, vibration, etc.).
  2. The selected TAB Agency shall possess computers, cables, and software needed to operate the building control system. This requires the TAB Agency to be properly licensed and/or trained to run the Control contractor’s software.

## 1.9 DEFINITIONS, REFERENCES AND STANDARDS

- A. All work shall be in accordance with the latest edition of the National Standards, as published by the National Organization affiliated with the TAB Agency.

## 1.10 SUBMITTALS

- A. Qualifications: The TAB Agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency’s test and balance engineer (TBE) certificate. Certification in noise, vibration, and air quality shall be submitted as the job requires.
- B. Procedures and agenda: The TAB Agency shall submit the TAB procedures and agenda proposed to be used.

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### **1.11 REPORTS**

- A. Final TAB Report – The TAB Agency shall submit the final TAB report for review by the engineer. All outlets, devices, HVAC equipment, etc., shall be identified, along with a numbering system corresponding to report unit identification. The TAB Agency shall submit an “National Project Performance Guaranty” assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and National Standards.
  - 1. Submit 3 copies of the Final TAB Report.

### **1.12 DEFICIENCIES**

- A. Any deficiencies in the installation or performance of a system or component observed by the TAB Agency shall be brought to the attention of the appropriate responsible person. Also notify the mechanical project representative from the Division of Engineering.
- B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB Agency returns to retest. Unresolved deficiencies shall be noted in the final report.

## **PART 2 - INSTRUMENTATION**

- A. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of the National Standards.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. The specific systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with national Standards. Adjustment tolerances shall be + or – 10% unless otherwise stated.
- B. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.
- C. All information necessary to complete a proper TAB project and report shall be per National Organization’s standards unless otherwise noted. The descriptions for work required, as listed in this section, are guides to the minimum information needed.

### 3.2 DUCT LEAKAGE TESTING:

- A. Pressure test all new ductwork.
- B. Test apparatus shall be a high pressure portable blower with an orifice flow measuring device.
- C. Testing shall be conducted before external insulation is applied and before ducts are connected.
- D. Mechanical Contractor shall close off and seal all openings in the duct section to be tested.
- E. Duct testing will require multiple trips to the project site. Provide for at least two separate trips for duct testing. Provide additional time (and separate trip if necessary) for retesting ductwork that fails initial testing. Coordinate times for testing ductwork with the Contractor.
- F. See the “DUCT SEALING, TESTING AND LEAKAGE TABLES” at the end of the “METAL DUCTS” Specification Section and use the test pressures and allowable leakage rates in the tables. Information is based on SMACNA Table 4-1, SMACNA Fig. 4-1 and ASHRAE/IESNA STANDARD 90.1-2004, Table 6.4.4.2A.
- G. Based on these leakage rates, determine the total allowable leakage for each duct section to be tested by calculating the total duct surface area for each type of duct in the section, and multiplying it by the appropriate leakage rate.
- H. If leakage exceeds calculated allowable leakage for the tested section then provide additional pressure testing as required until leakage rate is acceptable. Provide smoke testing if required to identify leakage points.
- I. Prepare reports of leakage tests. Include for each test section the test pressure, the total allowable leakage, and the measured leakage.

### 3.3 AIR SYSTEMS

- A. The TAB Agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. The TAB Agency shall perform the following TAB procedures in accordance with the National Standards:
  1. For supply fans:
    - a. Fan speeds – Test and adjust fan RPM to achieve maximum or design CFM. Confirm proper rotation direction.
    - b. Current and Voltage – Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
    - c. Pitot-Tube Traverse – Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM.

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- d. Outside Air – Test and adjust the outside air on applicable equipment using a Pitot-tube traverse. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature difference is at least 20 degrees Fahrenheit or use the difference between Pitot-tube traverses of the supply and return air ducts.
  - e. Static Pressure – Test and record system static profile of each supply fan.
2. For exhaust fans:
    - a. Fan speeds – Test and adjust fan RPM to achieve maximum and design CFM. Confirm proper rotation direction.
    - b. Current and Voltage – Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
    - c. Pitot-tube Traverse – Perform a Pitot-tube traverse of main exhaust ducts to obtain total CFM.
  3. For zone, branch and main ducts:
    - a. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
  4. For diffusers, registers and grilles:
    - a. Tolerances – Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts.
    - b. Identification – Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.
  5. For coils:
    - a. Air Temperature – Once air flows are set to acceptable limits, take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

### **3.4 ADDITIONAL TAB SERVICES-----**

- A. Preconstruction Plan Check and Review:
  1. The TAB Agency shall review the project documents and contractor submittals for their effect on the TAB process and overall performance of the HVAC system. It shall submit recommendations for enhancements or changes to the system within 30 days of document review.
- B. Job Site Inspections:
  1. During construction, the TAB Agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of two times. (Typically, these are performed when 60% of the total system is installed and

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again when 90% of the total system is installed, prior to insulation of the duct and piping). The TAB Agency shall submit a written report of each inspection.

**END OF SECTION 23 05 93**

## **SECTION 23 07 13 - DUCT INSULATION**

### **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 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.
  - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
  - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. In duct systems requiring insulation, insulate the entire systems and all components in them (except fire dampers) including but not limited to ducts, fittings, dampers, etc.
- C. Related Sections:
  - 1. Section 230716 "HVAC Equipment Insulation."
  - 2. Section 230719 "HVAC Piping Insulation."

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- 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 elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.

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#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### **1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.



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## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General" and "Indoor 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
  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) Aeroflex USA, Inc.
    - b) Armacell LLC.
    - c) K-Flex USA.
  2. 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.
    - 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) Johns Manville; a Berkshire Hathaway company.
      - 2) Knauf Insulation.
      - 3) Owens Corning.

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3. 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.
  - 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) Johns Manville; a Berkshire Hathaway company.
    - 2) Knauf Insulation.
    - 3) Owens Corning.
  
4. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 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) Johns Manville; a Berkshire Hathaway company.
    - 2) Knauf Insulation.
    - 3) Owens Corning.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
  
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  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. Armacell LLC.
    - b. Foster Brand; H. B. Fuller Construction Products.
    - c. K-Flex USA.
  
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  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. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.

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2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
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. Dow Corning Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. P.I.C. Plastics, Inc.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### 2.3 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. 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. Foster Brand; H. B. Fuller Construction Products.
    - b. Knauf Insulation.
    - c. Vimasco Corporation.
  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.

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- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
  4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  5. Color: White.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. 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. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller Construction Products.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
  4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  5. Color: White.

## 2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
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. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges - Marathon Industries.
    - c. Foster Brand; H. B. Fuller Construction Products.
  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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
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. Childers Brand; H. B. Fuller Construction Products.
  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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 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.

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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 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
  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. Alpha Associates, Inc.

## 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  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. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Knauf Insulation.
  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. 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. Avery Dennison Corporation, Specialty Tapes Division.

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- b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Knauf Insulation.
  - 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. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
- 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. Compac Corporation.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Venture Tape.
  - 2. Width: 2 inches (50 mm).
  - 3. Thickness: 6 mils (0.15 mm).
  - 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
- 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. Avery Dennison Corporation, Specialty Tapes Division.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Knauf Insulation.
  - 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.

## 2.10 SECUREMENTS

- A. Bands:
  - 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. ITW Insulation Systems; Illinois Tool Works, Inc.

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b. RPR Products, Inc.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal.
3. Aluminum: 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.

B. Insulation Pins and Hangers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
  - 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) Hardcast, Inc.
- 2) Midwest Fasteners, Inc.
- 3) Nelson Stud Welding.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, stainless-steel 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) Hardcast, Inc.
- 2) Midwest Fasteners, Inc.
- 3) Nelson Stud Welding.

- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

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, stainless 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.



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## **2.11 CORNER ANGLES**

- A. 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 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. For ducts mounted on trapeze hangers or channel supports, provide rigid foam type insulation inserts at hanger contact points to prevent crushing of insulation.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- C. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- D. 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.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- 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.

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- 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.
- 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). 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 duct 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.

### **3.4 PENETRATIONS**

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

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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 Section 078413 "Penetration Firestopping".
- 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 Section 078413 "Penetration Firestopping."

### **3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION**

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.6 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 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.

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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 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.

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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.

### **3.7 FIELD-APPLIED JACKET INSTALLATION**

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
  1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

### **3.8 FINISHES**

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in other 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.

### **3.9 DUCT INSULATION SCHEDULE, GENERAL**

- A. Plenums and Ducts Requiring Insulation:

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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.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

### 3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed supply-, return-, and outside-air duct and plenum insulation (in conditioned spaces) shall be one of the following:
  1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
  2. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density.
- B. Exposed supply-, return-, and outside-air duct and plenum insulation (in conditioned spaces) shall be one of the following:
  1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density.
  2. Mineral-Fiber Pipe and Tank: 1-1/2 inches (38 mm) thick.
- C. Concealed supply-, return-, and outside-air duct and plenum insulation (in unconditioned spaces) shall be one of the following:
  1. Mineral-Fiber Blanket: 2-1/2 inches thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
  2. Mineral-Fiber Board: 2-1/2 inches thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density.
- D. Exposed supply-, return-, and outside-air duct and plenum insulation (in unconditioned spaces) shall be one of the following:
  1. Mineral-Fiber Board: 2-1/2 inches thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density.
  2. Mineral-Fiber Pipe and Tank: 2-1/2 inches thick.

**END OF SECTION 23 07 13**

## **SECTION 23 07 19 - HVAC PIPING INSULATION**

### **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 insulating the following HVAC piping systems:
  - 1. Condensate drain piping, indoors.
  - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
  - 1. Section 230713 "Duct Insulation."
  - 2. Section 230716 "HVAC Equipment Insulation."

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- 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 attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 4. Detail removable insulation at piping specialties.
  - 5. Detail application of field-applied jackets.
  - 6. Detail application at linkages of control devices.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of



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insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

- C. Field quality-control reports.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## **1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## **1.8 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

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- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come 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. 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.

### **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.

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- B. Flexible Elastomeric 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, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 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. Vapor-Barrier Mastic: Solvent 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.

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- d. Mon-Eco Industries, Inc.; 55-10.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  - 3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor 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. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
  - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 5. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. 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-50 AHV2.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  - 4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  - 5. Color: White.

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## 2.6 SEALANTS

### A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### B. 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, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.7 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.

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## 2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. (271 g/sq. m).
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. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

## 2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
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. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: Color-code jackets based on system. Color as selected by Architect.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Metal Jacket:
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; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.

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2. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
  - a. Sheet and roll stock ready for shop or field sizing.
  - b. Material, finish, and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
  - d. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.10 TAPES

- A. 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.

## 2.11 SECUREMENTS

- A. Bands:
  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.

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2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal.
- 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, stainless 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.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 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.

#### **3.3 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.



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- 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)] [4 inches (100 mm)]** o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.

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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. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.4 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 Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. 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 Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### **3.5 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

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- 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. Use thermal reusable insulation blankets to insulate strainers, steam traps, steam expansion joints, steam pressure reducing valves and steam back pressure regulating valves.
  7. 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.
  8. 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.
  9. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  10. 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.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### **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 FIELD-APPLIED JACKET INSTALLATION**

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  - 1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
  - 2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
  - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end

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joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### 3.8 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  - 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.

### 3.9 PIPING INSULATION SCHEDULE, GENERAL

#### 3.10

- 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. Underground piping.
  - 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

#### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):
  - 1. All Pipe Sizes: Insulation shall be [ **one of** ] the following:
    - a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
- B. Refrigerant Suction and Hot-Gas Piping and Flexible Tubing (pipes sizes listed are minimums; provide additional insulation, if required by equipment manufacturer):
  - 1. Pipe Sizes under 1": Insulation shall be the following:
    - a. Flexible Elastomeric: 1/2 inch thick.

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2. Pipe Sizes 1” and over: Insulation shall be the following:
  - a. Flexible Elastomeric: 1 inch thick.

### **3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE**

- A. Refrigerant Suction and Hot-Gas Piping and Flexible Tubing (pipes sizes listed are minimums; provide additional insulation, if required by equipment manufacturer):
  1. Pipe Sizes under 1”: Insulation shall be the following:
    - a. Flexible Elastomeric: 1/2 inch thick.
  2. Pipe Sizes 1” and over: Insulation shall be the following:
    - a. Flexible Elastomeric: 1 inch thick.

### **3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Exposed piping in any room and all piping in boiler, mechanical rooms, and tunnels shall have an 8 ounce canvas jacket applied over the fiberglass factory ASJ/SSL jacketing to further protect the insulation from abuse. This jacketing must be properly applied with lagging adhesive, such that the outer surface is smooth and free of wrinkles. The canvas jacketing in all mechanical areas is to be prepared for painting, and then painted according to the schedule included in specifications. All cold piping insulation shall be completely sealed so that a perfect vapor barrier is achieved.
- B. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- C. If more than one material is listed, selection from materials listed is Contractor's option.

### **3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  1. Stainless Steel, Type 316, Stucco Embossed with Z-Shaped Locking Seam: 0.010 inch (0.25 mm) thick.
  2. .

### **3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET**

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

**END OF SECTION 23 0719**

## **SECTION 23 31 13 - METAL DUCTS**

### **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. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.
- B. Related Sections:
  - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
  - 3. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### **1.3 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 shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.



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#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of the following products:
  - 1. Sealants and gaskets.
  
- B. Shop Drawings:
  - 1. Fabrication, assembly, and installation, including components and attachments to other work.
  - 2. Factory- and shop-fabricated ducts and fittings.
  - 3. Fittings.
  - 4. Reinforcement and spacing.
  - 5. Seam and joint construction.
  - 6. Penetrations through fire-rated and other partitions.
  - 7. Hangers and supports, including methods for duct and building attachment and vibration isolation.
  
- C. 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.
  - 5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Field quality-control reports.

#### **1.6 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  - 2. AWS 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.
  
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
  
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 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. Ductmate Industries, Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO LLC.
- 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."

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1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) 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 (2286 mm) in diameter with butt-welded longitudinal seams.
  2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) 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 (Z275).
  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 (ASTM B 209M) 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.

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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 (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).

## 2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 6 inches (152 mm).
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. 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).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Base: Synthetic rubber resin.
  3. Solvent: Toluene and heptane.

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4. Solids Content: Minimum 60 percent.
  5. Shore A Hardness: Minimum 60.
  6. Water resistant.
  7. Mold and mildew resistant.
  8. 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).
  9. VOC: Maximum 395 g/L.
  10. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
  11. Service: Indoor or outdoor.
  12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. 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).
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) 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 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

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- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## **PART 3 - EXECUTION**

### **3.1 DUCT INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts 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 (25 mm), 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 (38 mm).

- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### **3.2 INSTALLATION OF EXPOSED DUCTWORK**

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### **3.3 DUCT SEALING**

- A. Seal ducts 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."

### **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 (100 mm) thick.

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4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) 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 (Table 5-1M), "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 (610 mm) of each elbow and within 48 inches (1200 mm) 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 (5 m).
- 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 Section 233300 "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 PAINTING**

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

### **3.7 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Duct System Cleanliness Tests:
  1. Visually inspect duct system to ensure that no visible contaminants are present.
  2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.



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- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.8 DUCT CLEANING

- A. Clean duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
  - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
  - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. 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.
- E. Mechanical Cleaning Methodology:
  - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

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3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

### 3.9 START UP

- A. Air Balance: Comply with requirements in Section "Testing, Adjusting, and Balancing for HVAC."

### 3.10 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  1. Welding Exhaust: Stainless steel.
  2. Shower Exhaust (between shower grille and main duct takeoff): Aluminum.
- B. 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 (5 m/s) or Lower:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 with vanes.
    - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
      - 1) Radius Type RE 1 or 3 with minimum 1.5 radius-to-diameter ratio.
      - 2) 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 (7.6 m/s) or Higher:
      - 1) Radius Type RE 1 or 3 with minimum 1.5 radius-to-diameter ratio.

- 2) 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 or 3 with minimum 1.5 radius-to-diameter ratio.
    - b. 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 (5 m/s) or Lower: 1.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.5 radius-to-diameter ratio and four segments for 90-degree elbow.
      - 3) Velocity 1500 fpm (7.6 m/s) 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 (305 mm) and Smaller in Diameter: Stamped or pleated.
    - c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Welded.
- C. 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 Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.

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**3.11 Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.DUCT SEALING, TESTING AND LEAKAGE TABLES**

Ductwork in Conditioned Spaces

Duct System	Seal Class	Leakage Class	Test Pressure " W.G.	Allowable Leakage CFM/100SF
Welding exhaust duct - round	A	3	6	9.6
Welding exhaust duct - rectangular	A	4	6	12.8
Supply air duct - round	A	3	3	3
Supply air duct - rectangular	A	6	3	6
Exhaust duct - round	A	3	3	3
Exhaust duct - rectangular	A	6	3	6
Return and outside air duct - round	A	3	3	3
Return and outside air duct - rectangular	A	6	3	6

**END OF SECTION 23 31 13**

## **SECTION 23 33 00 - AIR DUCT 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. Takeoff fittings.
  - 2. Manual volume dampers.
  - 3. Control dampers.
  - 4. Fire dampers.
  - 5. Flange connectors.
  - 6. Turning vanes.
  - 7. Duct-mounted access doors.
  - 8. Flexible connectors.
  - 9. Flexible ducts.
  - 10. Duct accessory hardware.
- B. Provide stainless steel duct accessories in stainless steel duct systems. Provide galvanized steel accessories in galvanized steel duct systems. Provide aluminum accessories in aluminum duct systems.

#### **1.3 ACTION SUBMITTALS**

- A. Shop Drawings: For duct accessories. Include 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. Control-damper installations.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Source quality-control reports.

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## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

## PART 2 - PRODUCTS

### 2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish.
- C. 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.
- D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

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- F. 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).

### 2.3 TAKE-OFF 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. Creative Metals
  2. Flexmaster
  3. United Air
- B. Provide spin-collar type take-off fittings where low pressure round branch ducts connect to low pressure rectangular main ducts. Construct fittings of 26 gauge galvanized steel. Provide joint on end of fitting so that fitting can be inserted in round opening in side of rectangular duct and locked in place with one quarter turn. Provide single blade round damper with wing nut and lever type position indicator in each fitting. Provide fittings without scoops or extractors.
- C. Provide standard "extended plenum" type rectangular-to-round take-off fittings with separate single blade volume damper in branch ducts where rectangular duct depth is too shallow to permit the use of spin-collar take-off fittings.

### 2.4 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. McGill AirFlow LLC.
    - b. Nailor Industries Inc.
    - c. Ruskin Company.
  2. Standard leakage rating, with linkage outside airstream.
  3. Suitable for horizontal or vertical applications.
  4. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
    - 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.

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- 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.
  - 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. McGill AirFlow LLC.
    - b. Nailor Industries Inc.
    - c. 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. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
  - 6. Blade Axles: Stainless steel.
  - 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. Low-Leakage, Steel, Manual Volume Dampers:



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1. 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. McGill AirFlow LLC.
  - b. Nailor Industries Inc.
  - c. Ruskin Company.
2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:
  - a. Hat shaped.
  - b. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
  - c. Mitered and welded corners.
  - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized, roll-formed steel, 0.064 inch (1.62 mm) thick.
7. Blade Axles: Galvanized steel.
8. 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.
9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Galvanized steel.
12. Accessories:
  - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

D. Low-Leakage, Aluminum, Manual Volume Dampers:

1. 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. McGill AirFlow LLC.
  - b. Nailor Industries Inc.

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c. Ruskin Company.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. 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.
6. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Extruded-Aluminum Blades: 0.050-inch- (1.2-mm-) thick extruded aluminum.
7. Blade Axles: Stainless steel.
8. 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.
9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Aluminum.
12. Accessories:
  - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

E. Jackshaft:

1. Size: 0.5-inch (13-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.

F. 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.

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## 2.5 CONTROL 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. McGill AirFlow LLC.
  2. Nailor Industries Inc.
  3. Ruskin Company.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Hat shaped.
  2. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
  3. Mitered and welded corners.
- D. Blades:
1. Multiple blade with maximum blade width of 6 inches (152 mm).
  2. Opposed-blade design.
  3. Galvanized-steel.
  4. 0.064 inch (1.62 mm) thick single skin.
  5. Blade Edging: Closed-cell neoprene.
- E. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
- F. Bearings:
1. Oil-impregnated bronze.
  2. 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.
  3. Thrust bearings at each end of every blade.

## 2.6 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. Greenheck Fan Corporation.
  2. Nailor Industries Inc.
  3. Ruskin Company.

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- B. Type: Dynamic; 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 2000-fpm (10-m/s) velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
  - 1. Curtain type fire dampers with blade stack outside of the airstream must have the curtain portion blocked off at the frame, not at the ends of the sleeve.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Minimum Thickness: 0.05 (1.3 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, 0.024-inch- (0.61-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, 212 deg F (100 deg C) rated, fusible links.

## 2.7 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. Hardcast, Inc.
  - 3. Ward Industries; a brand 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.

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## 2.8 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. Hardcast, Inc.
  4. Ward Industries; a brand 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.
- C. 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."
- D. Vane Construction: Single wall.

## 2.9 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. Greenheck Fan Corporation.
  2. McGill AirFlow LLC.
  3. Nailor Industries 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:

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- 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.

## 2.10 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. Hardcast, Inc.
  3. Ward Industries; a brand 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)**] [**5-3/4 inches (146 mm)**] wide attached to two 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. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
  1. Minimum Weight: 14 oz./sq. yd. (474 g/sq. m).
  2. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp and 340 lbf/inch (60 N/mm) in the filling.
  3. Service Temperature: Minus 67 to plus 500 deg F (Minus 55 to plus 260 deg C).

## 2.11 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:

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1. Flexmaster U.S.A., Inc.
  2. McGill AirFlow LLC.
  3. Ward Industries; a brand of Hart & Cooley, Inc.
- B. Noninsulated, 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).
- C. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene 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 <Insert value>.
- D. Flexible Duct Connectors:
1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.

## 2.12 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.
- 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 control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

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- 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 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. At outdoor-air intakes and mixed-air plenums.
  - 2. At seals.
  - 3. Downstream from manual volume dampers, control dampers, and equipment.
  - 4. 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.
  - 5. At each change in direction and at maximum 50-foot (15-m) spacing.
  - 6. Upstream and downstream from turning vanes.
  - 7. Control devices requiring inspection.
  - 8. 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. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect diffusers or light troffer boots to ducts 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.



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- O. Install duct test holes where required for testing and balancing purposes.

### **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 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.

**END OF SECTION 23 33 00**

## **SECTION 23 34 23 - HVAC POWER VENTILATORS**

### **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. Ceiling-mounted ventilators.
  2. Propeller fans.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  1. Certified fan performance curves with system operating conditions indicated.
  2. Certified fan sound-power ratings.
  3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  4. Material thickness and finishes, including color charts.
  5. Dampers, including housings, linkages, and operators.
  6. Fan speed controllers.
- 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.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

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## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Belts: One set(s) for each belt-driven unit.

## 1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

## 1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.

## PART 2 - PRODUCTS

### 2.1 CEILING-MOUNTED VENTILATORS

- A. **Manufacturers:** Subject to compliance with requirements, **[provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
  - 1. Greenheck Fan Corporation.
  - 2. Loren Cook Company.
  - 3. PennBarry.
- B. Housing: Steel, lined with acoustical insulation.

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- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Aluminum, 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. Isolation: Rubber-in-shear vibration isolators.

## 2.2 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. Carnes Company.
  - 2. Greenheck.
  - 3. Loren Cook Company.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Wheel: Replaceable, 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.

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- 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. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 6. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

## 2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "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.

## 2.4 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. Install power ventilators level and plumb.
- B. Equipment Mounting:
  - 1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. 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 Section 230548.13 "Vibration Controls for HVAC."
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

### **3.2 CONNECTIONS**

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "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

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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 Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

**END OF SECTION 23 34 23**

## **SECTION 23 34 39 - HIGH-VOLUME, LOW-SPEED FANS**

### **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 high-volume, low-speed fans.

#### **1.3 DEFINITIONS**

- A. HVLS - High volume, low speed.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, furnished specialties, and accessories for each fan.
  - 2. Certified fan performance curves with system operating conditions indicated.
  - 3. Certified fan sound-power ratings.
  - 4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 5. Material thickness and finishes, including color charts.
  - 6. Fan speed controllers.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and mounting details.
  - 2. Include details of equipment assemblies. Show dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For each HVLS fan.
  - 1. Include design calculations and details for selecting product mounting components complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 2. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation forces required to select mounting components.



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## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data:
  - 1. For Installer: Certificate from HVLS fan manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, controls, and accessories indicated and furnished for installation.
- B. Field quality-control reports.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For HVLS fans to include in emergency, operation, and maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Provide certification that manufacturer complies with the most recent edition of ISO 9001.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by HVLS fan manufacturer.
  - 1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, controls, and accessories indicated and furnished for installation.
  - 2. Installer certification shall be valid and current for duration of Project.
  - 3. Retain copies of Installer certificates on-site and make available on request.
  - 4. Each person assigned to Project shall have demonstrated past experience.
    - a. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
    - b. Demonstrated past experience on five projects of similar complexity, scope, and value.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in a clean and dry place.
- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

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- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
  - 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
  - 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
- E. Replace installed products damaged during construction.

## 1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of fans that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Motor, Including Controls: 10 year(s) from date of Substantial Completion.
    - b. For Parts, Including Blades and Hub: 10 year(s) from date of Substantial Completion.
    - c. For Labor: One year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Listed and labeled to UL 507.
- C. CSA Compliance: Listed and labeled to CSA C22.2, No. 113.
- D. AMCA Compliance:
  - 1. Test HVLS fans according to AMCA 230.
  - 2. Certify HVLS fan performance according to AMCA 211.
- E. Performance Data: Comply with ANSI 230 test procedure standard, based on five rating points: 20-, 40-, 60-, 80-, and 100-percent of maximum speed. Comply with AMCA 211 for publication of performance data.
- F. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design HVLS ceiling fans.

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## 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Big Ass Fans.
  2. Greenheck
  3. MacroAir.
- B. Source Limitations: Obtain HVLS fans from single source from single manufacturer.

## 2.3 HIGH-VOLUME, LOW-SPEED FANS

- A. Description: Factory-assembled and -tested horizontal, non-ducted fan unit, consisting of large-diameter blade set, direct-drive electric motor, with variable-speed motor controller.
1. Provide fan designed to circulate large air volume, vertically, at low velocity.
  2. Maximum Operating Temperature: 140 (60) deg F (deg C).
  3. Frame:
    - a. Material: Galvanized steel.
      - 1) Finish: Paint.
  4. Diameter: 14 (4.3) feet (m).
  5. Blades: Airfoil type.
    - a. Quantity: 5.
    - b. Material: Aluminum.
      - 1) Blade Finish: Anodized.
  6. Motor: IP54 Enclosure.
  7. Wiring and Controls Enclosure:
    - a. NEMA 250, Class 4.
    - b. Material: Aluminum.
      - 1) Enclosure Finish: Paint.
    - c. Grounded.
  8. Controls: Provide wall-mounted keypad.
    - a. Provide variable speed motor controller speed control.
  9. Maximum Sound Power Level: 42 dBA.
  10. Standard Mounting Bracket: Steel beam/steel angle.

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11. Mounting Bracket: As recommended by manufacturer for building structure and mounting location.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting HVLS fan performance, maintenance, and operations.
  1. Fan locations indicated on Drawings are approximate. Determine exact locations before roughing-in for mounting, control, and electrical connections.
- B. Examine roughing-in for mounting location, anchor-bolt sizes, and locations, to verify actual locations for mounting connections before installation of fan.
- C. Examine areas for suitable conditions where fan will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION OF HIGH-VOLUME LOW-SPEED FANS**

- A. Install fan according to manufacturer's published instructions.
- B. Comply with NECA 1 and NFPA 70.
- C. Comply with NFPA 72 and interlock HVLS fans to shut down upon receiving an alarm from fire alarm system.
- D. Equipment Mounting:
  1. Anchor fan to building structure with manufacturer's recommended mounting bracket for installed condition.
  2. Consult a licensed professional structural engineer for mounting methods and approval for mounting to the structure. Structure must be able to withstand the torque and forces generated by the fan.
  3. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
  4. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
  5. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install unit to permit access for maintenance.
- F. Install parts and accessories shipped loose.

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### **3.3 ELECTRICAL CONNECTIONS**

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
- E. Install power wiring to field-mounted electrical devices, furnished by fan manufacturer, but not factory mounted.

### **3.4 CONTROL CONNECTIONS**

- A. Connect control wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."
- C. Connect control interlock wiring between HVLS fan and other equipment to provide a complete and functioning system.
- D. Install control devices furnished by manufacturer, but not factory mounted.
- E. Install control wiring to field-mounted control devices, furnished by fan manufacturer, but not factory mounted.
- F. Protect installed units from damage caused by other work.

### **3.5 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
  - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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- B. Fan or components will be considered defective if fan or components do not pass tests and inspections.
- C. Prepare and submit test and inspection reports.

### **3.6 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Verify that fan is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers and switches.
  - 3. Verify proper motor rotation direction and free fan rotation.
  - 4. Check bearing lubrication.
  - 5. Verify proper fan rotation. Set rotation selector to blow vertically downward during heating season, and vertically upward during cooling season.

### **3.7 ADJUSTING**

- A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

### **3.8 CLEANING**

- A. Clean equipment externally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions. Following manufacturer's cleaning procedures, and clean with manufacturer-recommended cleaning products.

### **3.9 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVLS fans.
- B. Video training sessions, and provide electronic copy of video to Owner.

**END OF SECTION 23 34 39**

## **SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES**

### **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. Round ceiling diffusers.
  - 2. Rectangular and square ceiling diffusers.
  - 3. Perforated diffusers.
  - 4. Louver face diffusers.
  - 5. Adjustable bar registers and grilles.
  - 6. Fixed face registers and grilles.
- B. Related Sections:
  - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Source quality-control reports.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

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1. Anemostat Products: a Mestek company
2. Price
3. Titus

## **2.2 DIFFUSERS, REGISTERS AND GRILLES**

- A. Diffusers, registers, and grilles are scheduled on Drawings.

## **2.3 SOURCE QUALITY CONTROL**

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### **3.3 ADJUSTING**

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

**END OF SECTION 23 37 13**



## **SECTION 23 51 23 - GAS VENTS**

### **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. Listed double-wall vents.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.
- B. Shop Drawings: For vents.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Detail fabrication and assembly of hangers.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Sample Warranty: For special warranty.

#### **1.5 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  - 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

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- B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

## **PART 2 - PRODUCTS**

### **2.1 LISTED TYPE B AND BW VENTS**

- 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. Metal-Fab, Inc.
  - 2. Selkirk Corporation.
  - 3. Van-Packer Company, Inc.
- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F (248 deg C) continuously for Type B or 550 deg F (288 deg C) continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch (6-mm) airspace.
- D. Inner Shell: ASTM B 209 (ASTM B 209M), Type 1100 aluminum.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

### **2.2 LISTED SPECIAL GAS VENTS**

- 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. Heat-Fab, Inc.
  - 2. Metal-Fab, Inc.
  - 3. Selkirk Corporation.
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F (248 deg C) continuously, with positive or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch (13-mm) airspace.

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- D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.
- E. Outer Jacket: Aluminized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 APPLICATION**

- A. Listed Type B and BW Vents: Vents for certified gas appliances.
- B. Listed Special Gas Vent: Condensing gas appliances.

#### **3.3 INSTALLATION OF LISTED VENTS**

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations..
- B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- E. Lap joints in direction of flow.

#### **3.4 CLEANING**

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

**END OF SECTION 23 51 23**

## **SECTION 23 55 33.16 - GAS-FIRED UNIT HEATERS**

### **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 gas-fired unit heaters.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of gas-fired unit heater.
  - 1. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: For gas-fired unit heaters. Include plans, elevations, sections, and attachment details.
  - 1. Prepare by or under the supervision of a qualified professional engineer detailing fabrication and assembly of gas-fired unit heaters, as well as procedures and diagrams.
  - 2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 4. Include diagrams for power, signal, and control wiring.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members to which equipment will be attached.
  - 2. Items penetrating roof and the following:
    - a. Vent and gas piping rough-ins and connections.
- B. Field quality-control reports.

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- C. Sample Warranty: For special warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gas-fired unit heaters to include in emergency, operation, and maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fan Belts: One for each belt-driven fan size.

## 1.7 QUALITY ASSURANCE

- A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Modine Manufacturing Company.
  - 2. Reznor/Thomas & Betts Corporation.
  - 3. Sterling HVAC Products; Div. of Mestek Technology Inc.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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### 2.3 MANUFACTURED UNITS

- A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.
- B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- C. Type of Venting: Indoor, separated combustion, power vented.
- D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
  - 1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
  - 2. Discharge Louvers: Independently adjustable, horizontal blades.
- E. Accessories:
  - 1. Four-point suspension kit.
  - 2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.
  - 3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.
- F. Heat Exchanger: Aluminized steel.
- G. Burner Material: Aluminized steel with stainless-steel inserts.
- H. Motors:
  - 1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 2. Enclosure Materials: Rolled steel.
  - 3. Efficiency: Premium efficient.
- I. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
  - 1. Gas Control Valve: Two stage.
  - 2. Ignition: Electronically controlled electric spark with flame sensor.
  - 3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
  - 4. Vent Flow Verification: Differential pressure switch to verify open vent.
  - 5. Control transformer.
  - 6. High Limit: Thermal switch or fuse to stop burner.
  - 7. Wall-Mounted Thermostat:
    - a. Two stage.

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- b. Fan on-off-automatic switch.
  - c. 24-V ac.
  - d. 50 to 90 deg F (10 to 32 deg C) operating range.
- J. Electrical Connection: Factory wire motors and controls for a single electrical connection.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

### **3.2 EQUIPMENT MOUNTING**

- A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
- B. Substrate-Mounted Units: Provide supports connected to substrate. Secure units to supports.
- 1. Spring hangers are specified.
  - 2. Threaded Rods, Spring Hangers, and Building Attachments: Comply with requirements.

### **3.3 CONNECTIONS**

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.
- C. Gas Piping: Comply with Section 221623 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- D. Vent Connections: Comply with Section 235100 "Breechings, Chimneys, and Stacks."
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

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### **3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
  - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 2. Verify bearing lubrication.
  - 3. Verify proper motor rotation.
  - 4. Test Reports: Prepare a written report to record the following:
    - a. Test procedures used.
    - b. Test results that comply with requirements.
    - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### **3.5 ADJUSTING**

- A. Adjust initial temperature and humidity set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

### **3.6 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

**END OF SECTION 23 55 33.16**



## **SECTION 23 74 16.11 - PACKAGED, SMALL-CAPACITY, CENTRAL-STATION AIR-CONDITIONING UNITS**

### **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 packaged, small-capacity, Central-Station air-conditioning units (CENTRAL STATION AIR HANDLING UNITS) with the following components and accessories:
  - 1. Casings.
  - 2. Fans.
  - 3. Motors.
  - 4. Coils.
  - 5. Refrigerant circuit components.
  - 6. Air filtration.
  - 7. Gas furnaces.
  - 8. Dampers.
  - 9. Electrical power connections.
  - 10. Controls.
  - 11. Accessories.

#### **1.3 DEFINITIONS**

- A. ECM: Electronically commutated motor.
- B. MERV: Minimum efficiency reporting value.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. CENTRAL STATION AIR HANDLING UNIT: Central-Station unit. As used in this Section, this abbreviation means packaged, small-capacity, Central-Station air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

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- E. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- F. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each Central Station Air Handling Unit.
  - 1. Include manufacturer's technical data.
  - 2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Include diagrams for power, signal, and control wiring.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members to which Central Station Air Handling Units will be attached.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For CENTRAL STATION AIR HANDLING UNITS to include in emergency, operation, and maintenance manuals.

#### **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: One set(s) of filters for each unit.

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## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of CENTRAL STATION AIR HANDLING UNITS that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
  2. Warranty Period for Gas Furnace Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
  3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
  4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 DESCRIPTION

- A. AHRI Compliance:
1. Comply with AHRI 210/240 for testing and rating energy efficiencies for CENTRAL STATION AIR HANDLING UNITS.
  2. Comply with AHRI 270 for testing and rating sound performance for CENTRAL STATION AIR HANDLING UNITS.
  3. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.
- B. AMCA Compliance:
1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
  2. Damper leakage tested according to AMCA 500-D.
  3. Operating Limits: Classify according to AMCA 99.
- C. ASHRAE Compliance:
1. Comply with ASHRAE 15 for refrigeration system safety.
  2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
  3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and StaCentral Station Air Handling Unitp."
- D. ASHRAE/IES Compliance: Comply with applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. NFPA Compliance: Comply with NFPA 90A or NFPA 90B.
- F. UL Compliance: Comply with UL 1995.

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- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. AAON.
  2. Carrier Corporation; a unit of United Technologies Corp.
  3. Daikin Applied.
  4. YORK; a Johnson Controls company.

## 2.3 CASINGS

- A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
- B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
- C. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
1. Materials: ASTM C 1071, Type I.
  2. Thickness: 1 inch (25 mm).
  3. Liner materials shall have airstream surface coated with erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
  4. Liner Adhesive: Comply with ASTM C 916, Type I.
- D. Condensate Drain Pans: Fabricated using G-90-coated galvanized-steel sheet 0.028 inch (0.70 mm) thick, a minimum of 2 inches (50 mm) deep, and complying with ASHRAE 62.1 for design and construction of drain pans.
1. Drain Connections: Threaded nipple.
- E. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## 2.4 FANS

- A. Supply-Air Fans: Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.
1. Direct-Driven Supply-Air Fans: Motor shall be resiliently mounted in the fan inlet.

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- B. Condenser-Coil Fan: propeller, mounted on shaft of permanently lubricated motors.

## 2.5 MOTORS

- A. Comply with Section 230513 "Common Motor Requirements for HVAC Equipment" and the requirements of this Article.
- B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- C. Service Factor: 1.15.
- D. Efficiency: Premium efficient.

## 2.6 COILS

- A. Supply-Air Refrigerant Coil:
  - 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
- B. Outdoor-Air Refrigerant Coil:
  - 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
- C. Hot-Gas Reheat Refrigerant Coil:
  - 1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

## 2.7 REFRIGERANT CIRCUIT COMPONENTS

- A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.
- B. Refrigeration Specialties:
  - 1. Refrigerant: R-410A.
  - 2. Expansion valve with replaceable thermostatic element.
  - 3. Refrigerant filter/dryer.
  - 4. Manual-reset high-pressure safety switch.
  - 5. Automatic-reset low-pressure safety switch.
  - 6. Minimum off-time relay.
  - 7. Automatic-reset compressor motor thermal overload.
  - 8. Brass service valves installed in compressor suction and liquid lines.
  - 9. Low-ambient kit high-pressure sensor.
  - 10. Hot-gas reheat solenoid valve with a replaceable magnetic coil.

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## **2.8 AIR FILTRATION**

- A. Minimum arrestance and MERV according to ASHRAE 52.2.

## **2.9 GAS FURNACE**

- A. Description: Factory assembled, piped, and wired; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.
  - 1. CSA Approval: Designed and certified by and bearing label of CSA.
- B. Burners: Stainless steel.
  - 1. Fuel: Natural gas.
  - 2. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
- C. Heat-Exchanger and Drain Pan: Stainless steel.
- D. Venting: Gravity vented.
- E. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.
- F. Gas Valve Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

## **2.10 DAMPERS**

- A. Leakage Rate: Comply with ASHRAE/IES 90.1.
- B. Damper Motor: Modulating with adjustable minimum position.

## **2.11 ELECTRICAL POWER CONNECTIONS**

- A. CENTRAL STATION AIR HANDLING UNIT shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

## **2.12 CONTROLS**

- A. Basic Unit Controls:
  - 1. Control-voltage transformer.
  - 2. Wall-mounted seven day programmable thermostat with the following features:
    - a. Heat-cool-off switch.

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- b. Fan on-auto switch.
- c. Fan-speed switch.
- d. Automatic changeover.
- e. Adjustable deadband.
- f. Exposed set point.
- g. Exposed indication.
- h. Degree F indication.
- i. Unoccupied-period-override push button.
- j. Data entry and access port to input temperature and humidity set points, occupied and unoccupied periods, and output room temperature and humidity, supply-air temperature, operating mode, and status.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of CENTRAL STATION AIR HANDLING UNITS.
- B. Examine roughing-in for CENTRAL STATION AIR HANDLING UNITS to verify actual locations of piping and duct connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Equipment Mounting:
  - 1. Install CENTRAL STATION AIR HANDLING UNITS on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified.

#### **3.3 CONNECTIONS**

- A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:
  - 1. Connect supply ducts to CENTRAL STATION AIR HANDLING UNITS with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- C. Where installing piping adjacent to CENTRAL STATION AIR HANDLING UNITS, allow space for service and maintenance.

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1. Gas Piping: Comply with applicable requirements in Section 221623 "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- D. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  1. Nameplate shall be laminated acrylic or melamine plastic signs as specified in Section 260553 "Identification for Electrical Systems."
  2. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch (13 mm) high.
  3. Locate nameplate where easily visible.

### **3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:
  1. After installing CENTRAL STATION AIR HANDLING UNITS and after electrical circuitry has been energized, test units for compliance with requirements.
  2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. CENTRAL STATION AIR HANDLING UNIT will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.



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### 3.5 STACENTRAL STATION AIR HANDLING UNITP SERVICE

- A. Engage a factory-authorized service representative to perform staCentral Station Air Handling Unitp service.
1. Complete installation and staCentral Station Air Handling Unitp checks according to manufacturer's written instructions.
  2. Inspect for visible damage to unit casing.
  3. Inspect for visible damage to furnace combustion chamber.
  4. Inspect for visible damage to compressor, coils, and fans.
  5. Inspect internal insulation.
  6. Verify that labels are clearly visible.
  7. Verify that clearances have been provided for servicing.
  8. Verify that controls are connected and operable.
  9. Verify that filters are installed.
  10. Clean condenser coil and inspect for construction debris.
  11. Clean furnace flue and inspect for construction debris.
  12. Connect and purge gas line.
  13. Remove packing from vibration isolators.
  14. Inspect operation of barometric relief dampers.
  15. Verify lubrication on fan and motor bearings.
  16. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
  17. Adjust fan belts to proper alignment and tension.
  18. Start unit according to manufacturer's written instructions.
    - a. Start refrigeration system.
    - b. Do not operate below recommended low-ambient temperature.
    - c. Complete staCentral Station Air Handling Unitp sheets and attach copy with Contractor's staCentral Station Air Handling Unitp report.
  19. Inspect and record performance of interlocks and protective devices; verify sequences.
  20. Operate unit for an initial period as recommended or required by manufacturer.
  21. Perform the following operations for both minimum and maximum firing. Adjust burner for peak efficiency:
    - a. Measure gas pressure on manifold.
    - b. Inspect operation of power vents.
    - c. Measure combustion-air temperature at inlet to combustion chamber.
    - d. Measure flue-gas temperature at furnace discharge.
    - e. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    - f. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
  22. Calibrate thermostats.
  23. Adjust and inspect high-temperature limits.
  24. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.

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25. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:
  - a. Coil leaving-air, dry- and wet-bulb temperatures.
  - b. Coil entering-air, dry- and wet-bulb temperatures.
  - c. Outdoor-air, dry-bulb temperature.
  - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
26. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
27. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
  - a. Supply-air volume.
  - b. Return-air volume.
  - c. Relief-air volume.
  - d. Outdoor-air intake volume.
28. Simulate maximum cooling demand and inspect the following:
  - a. Compressor refrigerant suction and hot-gas pressures.
  - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
29. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
  - a. High-temperature limit on gas-fired heat exchanger.
  - b. Low-temperature safety operation.
  - c. Filter high-pressure differential alarm.
  - d. Economizer to minimum outdoor-air changeover.
  - e. Relief-air fan operation.
  - f. Smoke and firestat alarms.
30. After staCentral Station Air Handling Unitp and performance testing and prior to Substantial Completion, replace existing filters with new filters.

### **3.6 CLEANING AND ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months from 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.
- B. After completing system installation and testing, adjusting, and balancing CENTRAL STATION AIR HANDLING UNIT and air-distribution systems, clean filter housings and install new filters.

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**3.7 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain CENTRAL STATION AIR HANDLING UNITS.

**END OF SECTION 23 74 16.11**

## **DIVISION 26 – ELECTRICAL**

### **SECTION 26 00 00 – GENERAL ELECTRICAL PROVISIONS**

#### **PART 1 - GENERAL**

##### **1.1 GENERAL**

- A. The General Conditions, Special Conditions, Supplemental Conditions, Instructions to Bidders, and other Contract Documents apply to this branch of the work as well as to the other branches.
- B. The Contractor shall familiarize himself with the work of all other trades, general type construction, and the relationship of his work to other sections. He shall examine all working drawings, specifications and conditions affecting his work. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, verify all dimensions in the field and advise the Engineer of any discrepancy before fabricating or performing any work.
- C. The work shall include complete testing of all equipment, conduit and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment.
- D. Perform any necessary temporary work during construction.
- E. Work under this section shall conform to governing codes, ordinances and regulations of the City, County and State.
- F. The Contractor shall be responsible for any errors in fabrication, for the correct fitting, installation and erection of the various electrical systems.

##### **1.2 SCOPE**

- A. Furnish and install all wiring devices and equipment, etc., unless otherwise indicated, for the complete electrical systems. It is the intent that the entire electrical work and all electrical systems shall be complete in every respect and that all outlets, receptacles, fixtures, motors, equipment, devices, etc., shown, noted, or required shall be completely connected from source of power to final connection, ready for satisfactory operation.

##### **1.3 ELECTRICAL MATERIALS**

- A. It is the intent of these specifications that the conductive materials used in the manufacture of, but not limited to, the following types of equipment be of copper construction:
  - 1. Electrical Power Conductors and Cables (all voltages)

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2. Panelboards
3. Transfer Switches

#### **1.4 CONCRETE FOUNDATION PADS**

- A. The Contractor under this Division will provide all concrete curbs, bases and pads for all electrical equipment shown on the Drawings.
- B. The Contractor for this Division shall verify the sizes and locations of all supports, curbs, bases and pads prior to the pouring of same to be certain that the installed units will fit.
- C. The Contractor for this Division shall set anchor bolts in exact position prior to pouring of concrete. Sizes and locations of bolts shall be determined by the manufacturer's recommendations for the equipment served.
- D. All concrete pads shall be installed prior to setting equipment in place.

#### **1.5 PROTECTION**

- A. All work, equipment and materials shall be protected at all times. All conduit openings shall be closed with caps or plugs during construction. All equipment and accessories shall be tightly covered and protected against dirt, water or other injury during the period of construction.

#### **1.6 AUTOMATIC TEMPERATURE AND ASSOCIATED SYSTEMS CONTROLS**

- A. All wiring associated with the automatic temperature controls system and all associated conduit not specifically designated to be provided shall be included by others and specified under division of these specifications including motor starter interlock wiring.

#### **1.7 EQUIPMENT FURNISHED BY OTHERS**

- A. It shall be the responsibility of this Contractor to check voltage and current ratings of motors, relays, starters, switches, etc., of equipment furnished by others not connected under this section of the specifications. Nominal motor voltage ratings should be as follows:
  1. For connection to 480V system – NEMA 460 volts
  2. For connection to 208V system - NEMA 200 volts.
  3. For connection to 110 volt system - NEMA 115 volt.
- B. Motors not conforming to these ratings shall be called to the attention of the related subcontractor and the Owner/Architect.

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## **1.8 EQUIPMENT INSTALLATION INSTRUCTIONS**

- A. Install electrical conduit, wiring and equipment in strict accordance with manufacturer's recommendations. Provide equipment accessories necessary for proper operation or recommended by the manufacturer, even if such accessories are not shown on the drawings or mentioned in the specifications.

## **1.9 INSTALLATION OF EQUIPMENT**

- A. All appliances, materials and equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturers' instructions and recommendations. All electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

## **1.10 EQUIPMENT CONNECTIONS**

- A. Make connections to equipment furnished by others whenever such equipment is shown on any part of the drawings or mentioned in any section of the specifications.
- B. Verify equipment locations and the sizes, number, locations, and types of connections to be made before installation of any such equipment.

## **1.11 BELT AND MACHINERY GUARDS**

- A. Belt Guards
  - 1. Each belt drive shall be equipped with a guard, constructed of 12-gauge sheet steel, and designed to enclose all moving parts. Tops and bottoms of guards shall be of 18-gauge sheet steel.
  - 2. Guards shall be designed with adequate provision for motor adjustments. Means shall also be provided to permit oiling, use of speed counters, and other maintenance and testing operations with the guard in place.
- B. Machinery Guards
  - 1. Each rotating shaft flexible coupling shall be provided with a removable protective guard constructed of a U-shaped 16-gauge sheet steel plate with securing flange to floor or base. Length of guards shall be sufficient to overhang rotating couplings a minimum of 1" on each side.
  - 2. Guards shall be secured to the foundations or floors by heavy angle supports and anchor bolts. Braces or supports secured to motors will not be permitted, and braces or supports must not "bridge" the sound and vibration isolators.

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## 1.12 OPENINGS

- A. The Contractor under this Division shall be responsible for the openings he may require in floors, walls or ceilings of any type construction whether or not shown on the Architectural and/or Structural Drawings.
- B. Openings that have been shown on the Architectural and/or Structural Drawings will be provided under other Divisions; however, the responsibility for the correct size and location of such openings shall be that of the Contractor under this Division.
- C. Openings that have not been shown on the Architectural and/or Structural Drawings shall be provided by the Contractor under this Division as directed by the Architect.

## 1.13 FIRE BARRIER PENETRATION SEALS:

- A. Provide seals for any opening through any walls, floors, or ceilings used as passage for electrical components such as conduit, cabling, etc.
- B. General: Provide manufacturer's standard fire-stopping sealant, with accessory materials, having fire-resistance ratings as established by testing identical assemblies per ASTM E 814 by Underwriters' Laboratories, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction. Sealant shall provide protection equal or exceeding the fire resistance rating of fire rated walls, partitions, ceilings or floors. Use two-part or one part sealants as required to meet required fire resistance ratings.
- C. Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place, silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.
- D. One-Part Fire-Stopping Sealant: One part elastomeric sealant formulated for use in a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.
- E. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
- F. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Foamed-in-Place Fire-Stopping Sealant:
    - a. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
    - b. "Pensil 85I"; General Electric Co.
  - 2. One-Part Fire-Stopping Sealant:
    - a. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
    - b. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
    - c. "RTV 7403"; General Electric Co.
    - d. "Fyre Putty"; Standard Oil Engineered Materials Co.

- G. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

#### **1.14 SINGULAR NUMBER**

- A. In all cases where a device or piece of equipment is referred to in the singular number (such as a light fixture, etc.), it is intended that such reference shall apply to as many such items as are required to complete the installation.

#### **1.15 UTILITY SERVICE MARKERS**

- A. The Contractor under this Division shall furnish and install markers for underground electrical utility services at the locations shown on the Drawings. The exact location of services shall be determined at the time of installation by triangulation.
- B. Markers shall consist of bronze plates, ground and polished, marked to identify the service. Markers shall also be stamped with arrows indicating the direction the service extends. A typical marker detail is shown on the Drawings.
- C. Markers locating services at the building shall be installed in masonry or concrete walls two feet (2') above grade. Markers locating services elsewhere on the site shall be installed in concrete walks or curbs, or in 6" x 6" steel reinforced concrete posts as detailed.
- D. One marker may be used for a maximum of two (2) common services such as primary and secondary duct banks. Where one marker is used, it shall be labeled with both services.

#### **1.16 SPECIAL NOTE**

- A. All openings in electrical equipment, enclosures, cabinets, outlet and junction boxes shall be by means of standard knockouts, or shall be sawed or drilled. The use of a cutting torch is prohibited.

#### **1.17 EQUIPMENT IDENTIFICATION**

- A. The Contractor for this Division shall furnish and install on all electrical equipment such as switches, starters, panelboards, etc., a nameplate giving its name and function.
- B. Nameplates shall be engraved bakelite (white letters on black background) and shall be equal to Seton Nameplate, C. H. Hanson or Identifications.



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### **1.18 MOTOR PROTECTION INFORMATION**

- A. The Contractor for this Division shall provide the following information for each motor installed on this project, regardless of the supplying Contractor:
  - 1. Motor full load current
  - 2. Motor starter heater size - where applicable
  - 3. Fuse size
- B. This information shall be provided in tabulation form before final payment will be made to the Contractor.

### **1.19 EQUIVALENT MATERIAL AND EQUIPMENT**

- A. The material and equipment described herein have been specified according to particular trade names or makes; however, the Contractor may offer substitute material and equipment in lieu of that specified, provided such material and equipment meet all the requirements of those specified and are approved by the Architect. /Engineer. The manufacturer's warranty covering each item of substituted material or equipment shall be equal to the warranty covering the material or equipment specified.
- B. Where equipment is approved which requires different arrangement of connections from those shown, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the intent of the Drawings and Specifications, and to make all changes in the work required by the different arrangement of connections.

### **1.20 PERMITS, CODES AND APPROVALS**

- A. Permits
  - 1. All permits necessary for the complete Electrical systems shall be obtained by the Contractor for Division 26 from the authorities governing such work. The cost of all permits shall be borne by this Contractor.
- B. Codes and Rules and Regulations
  - 1. The minimum standard for all electrical work shall be the latest revision of the National Electrical Code. Whenever and wherever state and/or local laws and/or regulations require a higher standard than the current National Electrical Code, then these laws and/or regulations shall be followed.
- C. Approvals
  - 1. All work must be approved by the Architect /Engineer and the Owner before final payment will be made.

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### **1.21 INSPECTIONS**

- A. Electrical inspections will be performed throughout the course of construction by an electrical inspector from the State Fire Marshal's office. Upon project completion, and when wiring, equipment and fixtures have been installed, inspected and found to be in compliance with the National Electrical Code, the inspector will issue a certificate of compliance to the Owner. There will be no charge to the Contractor for the electrical inspection.
- B. The inspection shall be scheduled for rough as well as finished work. The rough inspection shall be divided into as many inspections as may become necessary to cover all roughing-in. A punch list inspection shall be scheduled with a representative of the Architect /Engineer present. The punch list inspection shall be made with panelboard and junction box covers removed.
- C. Before final acceptance, the Contractor for Division 26 shall furnish a Certificate of Final Approval by the Electrical Inspector to the Architect /Engineer and the Owner.

### **1.22 UL LISTINGS**

- A. Materials and appliances for the type for which there are Underwriters' Laboratories standard requirements listings and labels, shall have listing of Underwriters' Laboratories and shall be so labeled, or shall conform to their requirements, in which case certified statements to that effect shall be furnished by the manufacturer with a copy of an examination report by a recognized testing laboratory acceptable to the Engineer.

### **1.23 WORKMANSHIP**

- A. Competent workmen shall be employed on all phases of the work. Poor workmanship will be rejected and will constitute cause for removal of the individual performing the work.

### **1.24 COOPERATION WITH OTHER CONTRACTORS**

- A. Each Contractor shall demand and examine all Drawings and Specifications pertaining to the construction before installing the work described and shown under these Drawings and Specifications. Each Contractor shall cooperate with all other Contractors in locating piping, conduit, openings, chases and equipment in order to avoid conflict with any other Contractor's work. All work installed above a lay-in ceiling must be coordinated and installed so there is a minimum of 4 inches between the top of the ceiling grid and the bottom of the installation.
- B. If any discrepancies occur between the accompanying Drawings and these Specifications and Drawings and Specifications covering other Contracts, each Contractor shall report such discrepancies to the Architect /Engineer far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of piping, ductwork, conduit and equipment not installed in accordance with

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the above instructions, and which interferes with work and equipment of other Contractors.

#### **1.25 COORDINATION OF WORK ABOVE LAY-IN CEILING**

- A. All work installed above a lay-in ceiling must be coordinated and installed so there is a minimum of 4 inches between the top of the ceiling grid and the bottom of the installation. Installation shall not obstruct equipment access space or equipment removal space.

#### **1.26 CLEANING**

- A. After the Architect /Engineer has completed examination, the Contractor shall remove all stickers, tags, etc., and shall thoroughly clean all equipment, fixtures and materials installed under his section of the work.
- B. Surplus material, rubbish and equipment resulting from the work shall be removed from the building and premises by the respective Contractors upon completion of the work in accordance with the General Conditions.

#### **1.27 PAINTING**

- A. All exposed conduit and equipment installed under this Division, where required, shall be thoroughly cleaned and readied for painting.
- B. Painting in new areas and in existing building areas shown to be remodeled on the Architectural Drawings will be done by the Contractor under Division 9.
- C. Painting in all other areas of the existing building which have been cut and patched under this Division shall be painted to match exactly the existing adjacent surfaces. Where a match cannot be made, the entire surface shall be repainted. All painting shall be performed in strict accordance with the Specifications in Division 9. All exposed electrical work in these areas shall also be painted to match adjacent surfaces.

#### **1.28 WORKMANSHIP**

- A. Work shall be performed by mechanics skilled in their respective trades and shall present appearance typical of best trade practice. Work not installed in this manner shall be repaired, removed or replaced, or otherwise remedied as directed by the Architect/Engineer.

#### **1.29 SUPERVISION**

- A. The Contractor shall personally supervise the work or have a competent superintendent, satisfactory to the Architect/Engineer and Owner on the work at all times during progress with full authority to act.

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- B. The Contractor shall lay out his work and be responsible for any necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so. Work at the site of the project shall be observed by the Architect/Engineer or his representative.
- C. Final Inspection: At the time of final inspection of the work performed under this Contract, systems shall be complete in every respect and in perfect operating condition. Surplus materials of every character resulting from work of this section shall have been removed. Sanitary sewers shall be free from sand, silt or other obstructions. Any defect discovered in the utilities subsequent to this inspection shall have been corrected.

### **1.30 INTERPRETATIONS**

- A. Wherever in these Specifications, the term "General Contractor" is used, it shall be understood to mean the Contractor engaged in the general construction portion of the work. Similarly, wherever the "Heating and Air Conditioning Contractor," "Plumbing Contractor," "Sprinkler Contractor," or "Contractor for Division 26" is mentioned as such, it shall be understood to refer to the Contractor engaged in that particular branch of the work.
  - 1. It shall also be clearly understood that all Contractors for all branches of the work shall cooperate with each other in the coordination of the construction.
  - 2. It shall also be clearly understood that the entire construction is one responsibility and all Contractors for all branches of the work shall cooperate with each other in the coordination of the construction.

### **1.31 WORKING DRAWINGS**

- A. Scale of drawings is approximate. Do not scale the drawings to determine locations of electrical work. Exact locations, dimensions and elevations shall be governed by field conditions. Make field measurements of building before fabricating or installing equipment or materials.
- B. Drawings are based on physical dimensions of one or more manufacturer's equipment. Other approved equipment shall be of such dimensions that it can be readily installed in available space, leaving ample clearance for proper maintenance.
- C. Intent of drawings is to show systems and sizes. Drawings do not necessarily show all required offsets. Work shall be installed to conform with space limitations. Offsets, transitions, fittings, etc., shall be provided as part of the Contract where required to attain this objective.

### **1.32 ELECTRICAL DRAWINGS AND SPECIFICATIONS**

- A. The Drawings and Specifications are intended to cover all work enumerated under the respective headings. The Drawings are diagrammatic only. The Contractor shall not

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take advantage of conflict or error between the Drawings and Specifications, but shall request a clarification of such before making his proposal.

### 1.33 ARCHITECTURAL DRAWINGS AND SPECIFICATIONS

- A. The Contractor shall refer to the Architectural and Structural Drawings and Specifications for the general construction of the building, for floor and ceiling heights, for location of walls, partitions, beams, etc., and shall be guided accordingly for the setting of all sleeves, inserts and equipment.
- B. Under no circumstances shall a Contractor scale the Drawings for the location of equipment and work.

### 1.34 DISCREPANCIES

- A. If any discrepancies occur between the accompanying Drawings and these Specifications and Drawings and Specifications covering other Contracts, report such discrepancies to the Architect/Engineer far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of piping, ductwork, conduit and equipment not installed in accordance with the above instructions, and which interferes with work and equipment of other Contractors.

### 1.35 RESTORATION OF SURFACES

- A. The Contractor shall restore to their original conditions all paving, curbing, sidewalks, surfaces, drainage ditches, and structures, fences, shrubs, and other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match material employed in the original construction of the item to be replaced.

### 1.36 EXCAVATION, TRENCHING AND BACKFILLING

- A. Photographs: The contractor shall photograph all underground utilities before backfilling. Photographs shall be oriented and labeled so that the locations, all crossings and depths of the utilities can be determined from the photographs
- B. General: **Excavate in accordance with requirements of Division Section “EARTHWORK” and “EARTH MOVING”** and requirements of this Section. Lay the conduit in open trench except when the Architect/Engineer gives written permission for tunneling. Open the trench sufficiently ahead of pipe laying to reveal obstructions. Maintain easy access to fire hydrants by fire fighting apparatus.
- C. Provide trench crossing as necessary to accommodate public travel.
- D. Separate Trenches: Unless otherwise shown or requested, provide separate trenches for communication and power feeders, respectively, with a minimum of 3' of undisturbed

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earth between trenches. Always place gas lines in a separate trench from electrical lines.

- E. Width of Trench: Excavate trenches of sufficient width for proper installation of work. When the depth of backfill over sewer pipe exceeds 10', keep the trench at the level of the top of the pipe as narrow as possible.
- F. Sheet piling and Bracing: Sheet and brace trenches as necessary to protect workmen and adjacent structures. Comply with local regulations or, in the absence thereof, with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc. Do not remove sheet piling until trench is backfilled sufficiently to protect pipe and prevent injurious caving. When ordered in writing by the Architect/ Engineer, leave sheet piling in place and the Contract will be adjusted (See General Conditions): cut off such sheet piling not to be removed at least 3' below finished grade.
- G. Water Removal: Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipes. Conduct the discharge from trench dewatering to drains or natural discharge channels.
- H. Disposition of Utilities: Observe rules and regulations governing the respective utilities in executing work under this heading. Protect active utilities from damage or remove in accordance with written instructions of the Architect/Engineer (See General Conditions). Plug, cap or remove inactive and abandoned utilities encountered in trenching operations. In absence of specific requirements, plug or cap such utility line at least 3' from utility line to be installed or as required by local regulations.
- I. Rock Excavation: Materials to be excavated shall include earth and any other material including rock encountered within the limits of trench excavation for the utilities to the depth and extent indicated on the drawings and herein specified. In case of any change ordered by the Owner or Architect/Engineer in the quantity of excavation, the contract price will be adjusted by unit price or as described under Excavation, Filling and Grading of Division Site Work of these specifications. The term "rock" as used is defined to be hard material in nature that cannot be dislodged from its bed and removed therefrom without blasting or drilling. Any other is "earth" insofar as removal of the material to be excavated is concerned.
- J. Blasting: See Division Section "EARTHWORK" to see if blasting is allowed. If blasting is allowed, obtain written approval of method from Architect/Engineer before proceeding with rock excavation.
- K. Trench Bottoms: Lay all conduit, unless otherwise noted or detailed, in undisturbed earth. Bedding shall be in place and graded before pipe is installed.
- L. Special Supports: Whenever, in the option of the Architect/Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting duct banks or other utilities and appurtenances specified in this section, provide special support as the Architect/Engineer may direct and the Contract Price will be adjusted. (See General Conditions).

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- M. Tree Protection: Exercise care to protect the roots of trees to remain. Within the branch spread of such trees, perform trenching by hand. Open the trench only when the utility can be installed immediately; prune injured roots cleanly and backfill as soon as possible. Perform this work under the direction of the Architect/Engineer.
- N. Backfilling: Inspect and test piping and record locations of pipe lines and appurtenances before backfilling.
- O. Trenches Under Floor Slabs: Backfill under floor slab on grade to a point 5'-0" outside of perimeter building wall with fill as specified in Division Section "EARTHWORK". Remove excess excavation materials from the site daily unless otherwise instructed.
- P. Trenches in Other Areas: Backfill with materials in accordance with Division Section "EARTHWORK". Compact backfill thoroughly with a heavy tamper.
- Q. The Contractor, at his option, may backfill the remaining depth of the trench from 12" above top of piping to 12" below finished grade with sand, wash gravel, or fine rock chat. The remaining depth of the trench would then be backfilled as specified in the preceding specification.

### **1.37 SHOP DRAWINGS**

- A. Equipment and material shop drawings, catalog sheets and descriptive data shall be submitted, each with a cover sheet first listing the project name, the Contractors, Architect and Engineer, and date of submittal. Next the section of the Specifications shall be listed stating the section for which the equipment is being proposed. Next, outline equipment showing compliances to the specification requirements, such as capacities, special accessories, options, model, sizes, etc. Reverse side of cover sheet shall be left for Contractors' stamps showing review and space for Engineers' review stamp. Catalog sheets shall be marked showing equipment proposed.
- B. Materials submitted without cover sheet or Contractor review stamp and without required information will be returned to the Contractor.

### **1.38 PHASING OF WORK**

- A. The Contractor under this Division shall refer to Division 1, Section 01100, for a complete description of the schedule for phasing of work on this project.

### **1.39 STRUCTURAL RESPONSIBILITY**

- A. The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing, or weakening. No structural member shall be cut or otherwise weakened in any manner without the written consent of the Architect/Engineer.

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- B. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Owner or Architect/Engineer, without cost to either the Owner or the Architect/ Engineer.

#### **1.40 ASBESTOS**

- A. If during the course of his work the Contractor observes the existence of asbestos, or asbestos-bearing materials, the Contractor shall immediately terminate further work on the project and notify the Owner of the condition. The Owner will, after consultation with the Engineer, determine a further course of action.

#### **1.41 OWNER INSTRUCTION**

- A. Conduct a full-day walk-through instruction seminar for the Owner's personnel to be involved in the continued operation and maintenance of mechanical equipment and systems. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems.
- B. All training shall be video recorded for future use by the Owner in training new personnel.

#### **1.42 ACCESS UNITS**

- A. General: The work of this article is limited to the provisions for access through other work for access to electrical work, and does not include internal access provisions (within the electrical work). In general and where possible, furnish or furnish-and-mount required access units in other trades' work prior to their work, so that cutting and patching for the subsequent installation of such access units will not be required. In occupied spaces, provide finished access units of the maximum concealment type, including locks where appropriate, and matching access units provided in the same expanse of finish (for non-mechanical access, if any).
- B. The scope of access units to be furnished or provided as electrical work includes those units indicated on the electrical drawings or specified in Division 26 sections, and those additional units required for adequate access to electrical work and not shown or specified individually.
- C. Access Doors: Standard welded-steel construction, 16-gage frames and 14 gage door panels, 175 degree concealed spring hinges, rust-inhibitive prime coat, flush cam lock (for screw-driver operation where keyed lock is not required), recessed to receive applied finish where applicable (such as in concealed spline ceilings).
- D. Removable Access Plates: Where only hand access is sufficient, provide removable plate-type access unit, or minimum size which will facilitate the required access. Provide units of the type, style, design, material and finish appropriate for the location and exposure in each instance. In exposed surfaces of occupied spaces provide round plate



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units, flush floor units and frameless low-profile wall units, primed-for-paint in painted surfaces and polished chrome or stainless steel finish in other surfaces.

- E. Access Thru Fire Rated Walls or Ceilings: Where access doors or plates are required in fire rated partitions or ceilings, provide U.L. listed "B" Label doors or plates rated for 1-1/2 hours. Furnish doors with automatic closers and key operated latches that latch automatically when door closes.

#### **1.43 PROVIDING AIRTIGHT SPACES**

- A. In rooms where room walls extend above ceiling to the floor or roof above, caulk around all new and existing penetrations through walls, ceilings, floors and/or roofs to make completely airtight rooms. Seal penetrations both above and below suspended ceilings. Seal any openings left by removal of any existing or new work. Caulking used shall be the same type as specified in the Architectural Specifications.
- B. Patch around rough openings of penetrations to form a tight fit before caulking.

#### **1.44 LINTELS:**

- A. General: Provide lintels for penetration of electrical systems through masonry walls if not provided elsewhere in these specifications. Lintels shall be type and size required to span the required openings.
- B. Lintels will not be required for openings 16 inches length or less.

### **PART 2 - PRODUCTS**

2.1 Not Applicable

### **PART 3 - EXECUTION**

3.1 Not Applicable

**END OF SECTION 26 00 00**

## **SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL**

### **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. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electrical installation requirements.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### **1.4 SUBMITTALS**

- A. Product Data: For sleeve seals.

#### **1.5 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

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- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## **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. Calpico, Inc.
    - c. Metraflex Co.
    - d. 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.

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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.

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- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway 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 raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. 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."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways 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 (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."

**END OF SECTION 26 05 00**

## **SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

### **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. Copper building wire rated 600 V or less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

### **PART 2 - PRODUCTS**

#### **2.1 COPPER BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. RoHS compliant.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
  - 1. **[Type THHN] [and] [Type THWN-2]**: Comply with UL 83.

#### **2.2 CONNECTORS AND SPLICES**

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

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- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
  - 1. Material: Copper.
  - 2. Type: One hole with standard barrels.
  - 3. Termination: Compression.

## **PART 3 - EXECUTION**

### **3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### **3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 2/3 0-10V Dimming Control Circuits: Type THHN-THWN, in dedicated raceway separate from line voltage conductors or Type MC cable with separately jacketed, dedicated 0-10V dimming conductors designed to be code compliant.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.



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**C. END OF SECTION 26 05 19**

## **SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes grounding and bonding systems and equipment.

### **PART 2 - PRODUCTS**

#### **2.1 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

#### **2.2 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 2. Siemens Industry, Inc., Energy Management Division.
  - 3. Thomas & Betts Corporation; A Member of the ABB Group.

#### **2.3 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.

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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.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.4 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. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.
- G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- H. Straps: Solid copper, cast-bronze clamp copper lugs. Rated for 600 A.
- I. Water Pipe Clamps:
  1. Mechanical type, two pieces with zinc-plated bolts.
    - a. Material: Die-cast zinc alloy.
    - b. Listed for direct burial.
  2. U-bolt type with malleable-iron clamp and copper ground connector.

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## **2.5 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

## **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 barecopper conductor, No. 2/0 AWG minimum.
  - 1. Bury at least 24 inches (600 mm) below grade.
  - 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in electrical equipment rooms, at bottom of data/voice backboard, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### **3.2 GROUNDING AT THE SERVICE**

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### **3.3 GROUNDING SEPARATELY DERIVED SYSTEMS**

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

### 3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
- C. 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.

### 3.5 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 Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. 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. Use exothermic welds for all below-grade connections.
  - 3. 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.
- D. 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.
- E. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

**END OF SECTION 26 05 26**

## SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
1. Steel slotted support systems.
  2. Conduit and cable support devices.
  3. Mounting, anchoring, and attachment components, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

### PART 2 - PRODUCTS

#### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
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. B-line, an Eaton business.
    - b. G-Strut.
    - c. Thomas & Betts Corporation; A Member of the ABB Group.
    - d. Unistrut; Part of Atkore International.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Material for Channel, Fittings, and Accessories: Galvanized steel.
  4. Channel Width: Selected for applicable load criteria.
  5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

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- C. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F 3125/F 3125M, Grade A325 (Grade A325M).
  - 5. Toggle Bolts: All-steel springhead type.
  - 6. Hanger Rods: Threaded steel.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA 101
  - 3. NECA 102.
  - 4. NECA 105.
  - 5. NECA 111.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- E. 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 may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (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. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  - 6. To Light Steel: Sheet metal screws.
  - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Anchor equipment to concrete base as follows:
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

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**END OF SECTION 26 05 29**

## **SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Metal wireways and auxiliary gutters.
  - 3. Boxes, enclosures, and cabinets.

### **PART 2 - PRODUCTS**

#### **2.1 METAL CONDUITS AND FITTINGS**

- A. Metal Conduit:
  - 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. Allied Tube & Conduit; a part of Atkore International.
    - b. Calconduit.
    - c. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 3. GRC: Comply with ANSI C80.1 and UL 6.
  - 4. EMT: Comply with ANSI C80.3 and UL 797.
  - 5. FMC: Comply with UL 1; zinc-coated steel.
  - 6. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings:
  - 1. Comply with NEMA FB 1 and UL 514B.
  - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
  - 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

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5. Fittings for EMT:
  - a. Material: die cast.
  - b. Type: Compression type for Conduit sizes 2-1/2" and smaller, set-screw or compression type for conduit sizes larger than 2-1/2".
6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

## 2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
  1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

## 2.3 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

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- H. Gangable boxes are allowed.
- I. Hinged-Cover Enclosures: Comply with UL 50 and 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. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- J. 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.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## **PART 3 - EXECUTION**

### **3.1 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: GRC.
  - 2. Concealed Conduit, Aboveground: GRC.
  - 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): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Exposed in the garage bays: GRC.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 6. Boxes and Enclosures: NEMA 250, Type 1.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size and 1" trade size for telecommunication conduits.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.

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1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. EMT: Use **Compression type for Conduit sizes 2-1/2" and smaller, set-screw or compression type for conduit sizes larger than 2-1/2"**. Comply with NEMA FB 2.10.
  3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

### 3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. 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.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

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- J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- L. Stub-Ups to Above Recessed Ceilings:
  - 1. Use EMT for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Q. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- R. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- S. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- T. 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. Cap underground raceways designated as spare above grade alongside raceways in use.
- U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

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1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Conduit extending from interior to exterior of building.
  4. Conduit extending into pressurized duct and equipment.
  5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  6. Where otherwise required by NFPA 70.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- X. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC 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). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - 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 Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    - d. Attics: 135 deg F (75 deg C) temperature change.
  3. 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 for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
  2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.



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- Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
- AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- CC. Locate boxes so that cover or plate will not span different building finishes.
- DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- FF. Set metal floor boxes level and flush with finished floor surface.

### **3.3 INSTALLATION OF UNDERGROUND CONDUIT**

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
  - 2. Install backfill as specified in Section 312000 "Earth Moving."
  - 3. 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 Section 312000 "Earth Moving."
  - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
  - 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a

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minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

**END OF SECTION 26 05 33**

## **SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Labels.
  - 2. Utility service markers

### **PART 2 - PRODUCTS**

#### **2.1 COLOR AND LEGEND REQUIREMENTS**

- A. Equipment Identification Labels:
  - 1. Black letters on a white field.

#### **2.2 UTILITY SERVICE MARKERS:**

- A. Markers shall consist of bronze plates, ground and polished, and marked to identify the service. Markers shall also be stamped with arrows indicating the direction the service extends. A typical marker detail is shown on the Drawings.
- B. Markers locating services at the building shall be installed in masonry or concrete walls 2' above grade. Markers locating services elsewhere on the site shall be installed in concrete walks or curbs, or in 6" x 6" steel reinforced concrete posts as detailed.

#### **2.3 MARKERS FOR IDENTIFYING EQUIPMENT ABOVE CEILINGS:**

- A. Provide manufacturer's standard laminated plastic, color-coded equipment markers for identifying type and location of electrical equipment above suspended ceilings. Provide markers with pressure adhesive and engraved as scheduled in this section. Markers shall be narrow enough to fit on exposed ceiling grid and long enough to accommodate specified engraving. Install on ceiling grid closest to equipment above ceiling.

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## 2.4 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
    - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
    - c. Self-adhesive.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- G. Self-Adhesive Labels:
  - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (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.
- H. Baked-Enamel Signs:

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1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.
- I. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

**3.3 ELECTRICAL EQUIPMENT IDENTIFICATION ABOVE CEILING:**

- A. Attach Seton-Ply Discs to ceiling grid under equipment or to access doors in non-accessible ceilings as follows:

	Equipment	Engraved	Background Color	Lettering Color
1.	Lighting Control Device	LCD	Green	White
2.	Emergency Transfer Relay	ETR	Green	White
3.	Disconnect	DSC	Purple	White
4.	Power Supply	PS	Purple	White
5.	Duct Smoke Detector	DSD	Orange	White
6.	Data Port	DP	Grey	White
7.	4" Comm Conduit End	CMC	Grey	White

- B. Disconnect Switches serving equipment above ceiling (such as HVAC equipment that is already tagged) do not require identification discs.

**3.4 IDENTIFICATION SCHEDULE**

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- C. Arc Flash Warning Labeling: Self-adhesive labels.
- D. Equipment Identification Labels:
1. Indoor Equipment: Self-adhesive label Laminated acrylic or melamine plastic sign.

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2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Emergency system boxes and enclosures.
  - d. Enclosed switches.
  - e. Contactors.
  - f. Remote-controlled switches, dimmer modules, and control devices.

### **3.5 PROJECT SPECIFIC REQUIREMENTS**

- A. All wiring device covers shall be labeled to indicated panel and circuit number. Labels shall be machine printed, self-adhesive labels, typed and laminated. The inside of the box shall be labeled with permanent marker.
- B. Label all circuits entering each lighting control relay with a permanent marker on the door of the relay cabinet/enclosure.

**END OF SECTION 26 05 53**

## **SECTION 26 09 23 - LIGHTING CONTROL DEVICES**

### **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. Indoor occupancy and vacancy sensors.
  2. Switchbox-mounted occupancy sensors.

### **PART 2 - PRODUCTS**

#### **2.1 INDOOR OCCUPANCY AND VACANCY SENSORS**

- 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. Intermatic, Inc.
  2. Lithonia Lighting; Acuity Brands Lighting, Inc.
  3. Lutron Electronics Co., Inc.
- B. General Requirements for Sensors:
1. Wall and Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
  2. Dual technology.
  3. Integrated power pack.
  4. Hardwired connection to switch and BAS; and BAS and lighting control system.
  5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  6. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

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- c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 7. Power: Line voltage.
  - 8. Power Pack: Dry contacts rated for 20-A ballast or LED load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  - 9. 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.
  - 10. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
  - 11. Bypass Switch: Override the "on" function in case of sensor failure.
- C. Dual-Technology Type: Wall and Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
- 1. Sensitivity Adjustment: Separate for each sensing technology.
  - 2. 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), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
  - 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet (110 square meters) when mounted 48 inches (1200 mm) above finished floor.

## 2.2 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- 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. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 2. Lutron Electronics Co., Inc.
  - 3. Sensor Switch, Inc.



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- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
  4. Switch Rating: Not less than 800-VA ballast or LED load at 120 V, 1200-VA ballast or LED load at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft. (84 sq. m).
  2. Sensing Technology: Dual technology - PIR and ultrasonic.
  3. Switch Type: SP, field-selectable automatic "on," or manual "on," automatic "off."
  4. Capable of controlling load in three-way application.
  5. Voltage: Match the circuit voltage.
  6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
  7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
  8. Color: Match wiring devices.
  9. Faceplate: Match wiring device covers.

## 2.3 ASTRONOMIC TIME SWITCHES

- 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. Cooper Industries, Inc.
  2. Intermatic, Inc.
  3. Leviton Manufacturing Co., Inc.
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
1. Listed and labeled as defined in NFPA 70 and marked for intended location and application.
  2. Contact Rating: 20-A ballast load, 120-/240-V ac.
  3. Programs: Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
  4. Astronomic Time: All channels.
  5. Automatic daylight savings time changeover.

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6. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 SENSOR INSTALLATION**

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. 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.

#### **3.3 WIRING INSTALLATION**

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

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### **3.4 IDENTIFICATION**

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
  
- B. Label time switches and contactors with a unique designation.

**END OF SECTION 26 09 23**

## **SECTION 26 24 16 - PANELBOARDS**

### **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. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

#### **1.3 DEFINITIONS**

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

### **PART 2 - PRODUCTS**

#### **2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS**

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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- C. Comply with NFPA 70.
- D. Enclosures: Flush and Surface-mounted, dead-front 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,.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - 2. Height: 84 inches (2.13 m) maximum.
  - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
  - 4. Finishes:
    - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel.
- E. Incoming Mains:
  - 1. Location: Top or Bottom.
  - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- F. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Terminations shall allow use of 75 deg C rated conductors without derating.
  - 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.

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4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
  6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- H. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- I. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 10 percent.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
  2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

## 2.3 POWER PANELBOARDS

- 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. Eaton.
  2. General Electric Company; GE Energy Management - Electrical Distribution.
  3. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, distribution type.

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- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: As scheduled.
- 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.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- 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. Eaton.
  - 2. General Electric Company; GE Energy Management - Electrical Distribution.
  - 3. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: As scheduled.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.5 SPD.

- 1. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- 2. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
  - a. Line to Neutral: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
  - b. Line to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
  - c. Neutral to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
  - d. Line to Line: 2000 V for 480Y/277 V or 1200 V for 208Y/120 V.
- 3. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
  - a. Line to Neutral: 700 V.

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- b. Line to Ground: 700 V.
  - c. Neutral to Ground: 700 V.
  - d. Line to Line: 1200 V.
4. SCCR: Equal to the SCCR of the panelboard in which installed or exceed 200 kA.

## 2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
- 1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  - 3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 4. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

## 2.7 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
- 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.



## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Equipment Mounting:
  - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- E. Mount panelboard cabinet plumb and rigid without distortion of box.
- F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

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- I. Install filler plates in unused spaces.
- J. Stub four 1-inch (25 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (25 mm) empty conduits into raised floor space or below slab not on grade.

### **3.3 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### **3.4 PROTECTION**

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

**END OF SECTION 26 24 16**

## **SECTION 26 27 26 - WIRING DEVICES**

### **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. Standard-grade receptacles, 125 V, 20 A.
  - 2. GFCI receptacles, 125 V, 20 A.
  - 3. Pendant cord-connector devices.
  - 4. Cord and plug sets.
  - 5. Toggle switches, 120/277 V, 20 A.
  - 6. Occupancy sensors.
  - 7. Wall plates.

#### **1.3 DEFINITIONS**

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL WIRING-DEVICE REQUIREMENTS**

- 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:

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- a. Hubbell Incorporated; Wiring Device-Kellems.
  - b. Leviton Manufacturing Co., Inc.
  - c. Pass & Seymour/Legrand (Pass & Seymour).
- B. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Comply with NFPA 70.
- D. Devices for Owner-Furnished Equipment:
1. Receptacles: Match plug configurations.
  2. Cord and Plug Sets: Match equipment requirements.
- E. Device Color:
1. Wiring Devices Connected to Normal Power System: Gray unless otherwise indicated or required by NFPA 70 or device listing.
  2. Wiring Devices Connected to Essential Electrical System: Red.
- F. Wall Plate Color: Stainless Steel
- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## **2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A**

- A. Duplex Receptacles, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Standards: Comply with UL 498 and FS W-C-596.
- B. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Standards: Comply with UL 498.
  4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

## **2.3 GFCI RECEPTACLES, 125 V, 20 A**

- A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Type: Feed through.

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4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

## **2.4 USB RECEPTACLES**

- A. USB Charging Receptacles:
  1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
  2. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
  3. Standards: Comply with UL 1310 and USB 3.0 devices.

## **2.5 PENDANT CORD-CONNECTOR DEVICES**

- A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.
- B. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.
- C. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
- D. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.
- E. Standards: Comply with FS W-C-596.

## **2.6 CORD AND PLUG SETS**

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## **2.7 TOGGLE SWITCHES, 120/277 V, 20 A**

- A. Single-Pole Switches, 120/277 V, 20 A:
  1. Standards: Comply with UL 20 and FS W-S-896.
- B. Three-Way Switches, 120/277 V, 20 A:
  1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

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2. Comply with UL 20 and FS W-S-896.

C. Four-Way Switches, 120/277 V, 20 A:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Standards: Comply with UL 20 and FS W-S-896.

## 2.8 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology:

1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
2. Standards: Comply with UL 20.
3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
4. Adjustable time delay of 15 minutes.
5. Able to be locked to Manual-On mode.
6. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
7. Connections: Provisions for connection to BAS.
8. Connections: RJ-45 communications outlet.
9. Connections: Integral wireless networking.

## 2.9 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished and unfinished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.
3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

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1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
  - a. Cut back and pigtail, or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.
  - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles **up**, and on horizontally mounted receptacles to the **right**.

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2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### **3.2 GFCI RECEPTACLES**

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.
- B. Where GFCI receptacles are behind appliances, provide remote GFCI test reset switch accessible above the counter.

### **3.3 IDENTIFICATION**

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
- C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

**END OF SECTION 26 27 26**



## **SECTION 26 28 13 - FUSES**

### **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. Cartridge fuses rated 600 V ac and less for use in the following:
    - a. Enclosed switches.

#### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

#### **1.4 FIELD CONDITIONS**

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Bussmann, an Eaton business.
  2. Edison; a brand of Bussmann by Eaton.
  3. Littelfuse, Inc.

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- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

## 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
  1. Type RK-1: 250-V, zero- to 600-A rating, 200 kAIC, time delay.
  2. Type RK-5: 250-V, zero- to 600-A rating, 200 kAIC, time delay.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

## 2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
  1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  2. Finish: Gray, baked enamel.
  3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
  4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

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- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 FUSE APPLICATIONS**

- A. Cartridge Fuses:
  - 1. Motor Branch Circuits: Class RK1, time delay.
  - 2. Large Motor Branch (601-4000 A): Class L, time delay.
  - 3. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

### **3.3 INSTALLATION**

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Architect.

### **3.4 IDENTIFICATION**

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

**END OF SECTION 26 28 13**

## **SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Enclosures.

#### **1.3 DEFINITIONS**

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL REQUIREMENTS**

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

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## 2.2 FUSIBLE SWITCHES

- A. Manufacturers include, but are not limited to:
  - 1. Square D
  - 2. General Electric
  - 3. Eaton
  
- B. Type HD, Heavy Duty:
  - 1. Single throw.
  - 2. Three pole.
  - 3. 240-V ac.
  - 4. 1200 A and smaller.
  - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
  - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
  
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
  - 6. Service-Rated Switches: Labeled for use as service equipment.

## 2.3 NONFUSIBLE SWITCHES

- A. Manufacturers include, but are not limited to:
  - 1. Square D
  - 2. General Electric
  - 3. Eaton
  
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
  
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 4. Lugs: Mechanical type, suitable for number, size, and conductor material.

5. Service-Rated Switches: Labeled for use as service equipment.

## **2.4 ENCLOSURES**

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### **3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS**

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

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1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

### **3.3 INSTALLATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

### **3.4 IDENTIFICATION**

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### **3.5 ADJUSTING**

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

**END OF SECTION 26 28 16**

## **SECTION 26 36 00 - TRANSFER SWITCHES**

### **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 nonautomatic transfer switches rated 600 V and less.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.
- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
  - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
  - 2. Short-time withstand capability for three cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.



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- I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- K. Service-Rated Transfer Switch:
  - 1. Comply with UL 869A and UL 489.
  - 2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
  - 3. In systems with a neutral, the bonding connection shall be on the neutral bus.
  - 4. Provide removable link for temporary separation of the service and load grounded conductors.
  - 5. Surge Protective Device: Service rated.
- L. Neutral Terminal: Solid and fully rated unless otherwise indicated.
- M. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed tape markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."
  - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
  - 4. Accessible via front access.
- N. Enclosures: General-purpose NEMA 250, Type 1 and Type 3R, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## 2.2 NONAUTOMATIC TRANSFER SWITCHES

- 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. ASCO: a brand of Vertiv.
  - 2. Caterpillar, Inc.; Electric Power Division.
  - 3. Eaton.
  - 4. Russelectric, Inc.
- B. Manual and Electrically Operated: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Manual handle provides quick-make, quick-

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break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.

- C. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.
- D. Pilot Lights: Indicate source to which load is connected.
- E. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternative-source sensing circuits.
  - 1. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
  - 2. Emergency Power Supervision: Red light with nameplate engraved "Alternative Source Available."
- F. Unassigned Auxiliary Contacts: Switch shall have one set of normally closed contacts for each switch position, rated 10 A at 240-V ac.
- G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Switch Action: Double throw; mechanically held in both directions.
  - 2. Contacts: Silver composition or silver alloy for load-current switching.
  - 3. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 4. Material: Hard-drawn copper, 98 percent conductivity.
  - 5. Main and Neutral Lugs: Mechanical type.
  - 6. Ground Lugs and Bus-Configured Terminators: Mechanical type.
  - 7. Ground bar.
  - 8. Connectors shall be marked for conductor size and type according to UL 1008.

## **2.3 SOURCE QUALITY CONTROL**

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Identify components according to Section 260553 "Identification for Electrical Systems."
- B. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

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- C. Comply with NECA 1.

### **3.2 CONNECTIONS**

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring Method: Install cables in raceways except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
  - 1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- F. Route and brace conductors according to manufacturer's written instructions and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- G. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches (457 mm) in length.

### **3.3 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

### **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.

**END OF SECTION 26 36 00**

## **SECTION 26 51 19 - LED INTERIOR LIGHTING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### **1.3 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

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## 1.5 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

### 2.2 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Steel:
  - 1. ASTM A 36/A 36M for carbon structural steel.
  - 2. ASTM A 568/A 568M for sheet steel.
- C. Stainless Steel:
  - 1. 1. Manufacturer's standard grade.
  - 2. 2. Manufacturer's standard type, ASTM A 240/240 M.

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- D. Galvanized Steel: ASTM A 653/A 653M.
- E. Aluminum: ASTM B 209.

### **2.3 METAL FINISHES**

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

### **2.4 LUMINAIRE SUPPORT**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

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### 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaires:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaires:
  - 1. Attached to structural members in walls.
  - 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaires:
  - 1. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
  - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
  - 4. Support luminaires from structure independent of ceiling system using minimum of two support wires and diagonally opposite corners of fixtures.
- I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

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### **3.4 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### **3.5 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

**END OF SECTION 26 51 19**



## **SECTION 26 52 13 - EMERGENCY AND EXIT LIGHTING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Emergency lighting units.
  - 2. Exit signs.
  - 3. Luminaire supports.

#### **1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### **1.4 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## 1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.
  - 2. Warranty Period for Self-Powered Exit Sign Batteries: Two years from date of Substantial Completion. Full warranty shall apply for the entire warranty period.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.
  - 1. Emergency Connection: Operate lamp(s) continuously at an output of 1400 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.

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2. 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.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
  - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
  - c. Humidity: More than 95 percent (condensing).
  - d. Altitude: Exceeding 3300 feet (1000 m).
4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
  - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
5. Battery: Sealed, maintenance-free, nickel-cadmium type.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response. Provide and install remote test switch for fixtures mounted above 10' AFF.
8. 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.

## 2.2 MATERIALS

### A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

### B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

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### **2.3 METAL FINISHES**

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### **2.4 LUMINAIRE SUPPORT COMPONENTS**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire and emergency power unit weight.
  - 2. Able to maintain luminaire position when testing emergency power unit.
  - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.

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4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

F. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

### 3.5 STARTUP SERVICE

- A. Perform startup service:
1. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
  2. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

**END OF SECTION 26 52 13**

## **SECTION 26 56 19 - EXTERIOR LIGHTING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
  - 2. Luminaire supports.
  - 3. Luminaire-mounted photoelectric relays.

#### **1.3 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

#### **1.5 FIELD CONDITIONS**

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

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- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

## 1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including luminaire support components.
    - b. Faulty operation of luminaires and accessories.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. <
  - 2. Warranty Period: 2 year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. UL Compliance: Comply with UL 1598 and listed for wet location.
- D. CRI of minimum 80. CCT of 4100 K.
- E. L70 lamp life of 50,000 hours.
- F. Internal driver.
- G. In-line Fusing: Separate in-line fuse for each luminaire.
- H. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

### 2.2 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.

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- B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- D. Housings:
  - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
  - 2. Provide filter/breather for enclosed luminaires.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. 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 characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage and coating.
    - c. CCT and CRI for all luminaires.

## 2.3 FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
  - 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  - 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural



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Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

- D. 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, 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 or SSPC-SP 8.
  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.

## **2.4 LUMINAIRE SUPPORT COMPONENTS**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings, and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Comply with NECA 1.

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- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Fasten luminaire to structural support.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Support luminaires without causing deflection of finished surface.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
- F. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.
- H. Coordinate layout and installation of luminaires with other construction.
- I. 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.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### **3.4 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.

**END OF SECTION 26 56 19**

## **SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS**

### **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. Communications equipment coordination and installation.
  - 2. Common communications installation requirements.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### **1.4 COORDINATION**

- A. Coordinate arrangement, mounting, and support of communications equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

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## **PART 2 - PRODUCTS**

## **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.

**END OF SECTION 27 05 00**

## **SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS**

### **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. Backboards.
  - 2. Boxes, enclosures, and cabinets.
  - 3. Power strips.

#### **1.3 DEFINITIONS**

- A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.
- B. BICSI: Building Industry Consulting Service International.
- C. RCDD: Registered communications distribution designer.
- D. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.
- E. TGB: Telecommunications grounding bus bar.
- F. TMGB: Telecommunications main grounding bus bar.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
  - 2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.

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## **PART 2 - PRODUCTS**

### **2.1 BACKBOARDS**

- A. Backboard Paint: Light-colored fire-retardant paint.

## **PART 3 - EXECUTION**

### **3.1 ENTRANCE FACILITIES**

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

### **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.
- C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Coordinate layout and installation of communications equipment in tracks and in room. Coordinate service entrance configuration with service provider.
  - 1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
  - 2. Record agreements reached in meetings and distribute them to other participants.
  - 3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
  - 4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.
- F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
- G. Backboards:
  - 1. Install from 6 inches (150 mm) to 8 feet, 6 inches (2588 mm) above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.

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2. Paint all sides of backboard with two coats of paint, leaving fire rating stamp visible.
3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

**END OF SECTION 27 11 00**

## **SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING**

### **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. Category 3 twisted pair cable.
  - 2. Category 6 twisted pair cable.
  - 3. Twisted pair cable hardware, including plugs and jacks.

#### **1.3 DEFINITIONS**

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. FTP: Shielded twisted pair.
- D. F/FTP: Overall foil screened cable with foil screened twisted pair.
- E. F/UTP: Overall foil screened cable with unscreened twisted pair.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. Jack: Also commonly called an "outlet," it is the fixed, female connector.
- I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.
- J. RCDD: Registered Communications Distribution Designer.
- K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
- L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.



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- M. S/FTP: Overall braid screened cable with foil screened twisted pair.
- N. S/UTP: Overall braid screened cable with unscreened twisted pairs.
- O. UTP: Unscreened (unshielded) twisted pair.

#### **1.4 COPPER HORIZONTAL CABLING DESCRIPTION**

- A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
  - 1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the equipment outlets to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment or in the horizontal cross-connect.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

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## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

## **1.7 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## **1.8 COORDINATION**

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.
- B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.
- C. Grounding: Comply with TIA-607-B.

### **2.2 GENERAL CABLE CHARACTERISTICS**

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  - 1. Communications, Plenum Rated: Type CMP complying with UL 1685.
- B. RoHS compliant.

### **2.3 CATEGORY 3 TWISTED PAIR CABLE**

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 3 cable at frequencies up to 16MHz.
- B. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 3 cables.

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- C. Conductors: 100-ohm, 24 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating: Plenum.
- F. Jacket: White thermoplastic.

## **2.4 CATEGORY 6 TWISTED PAIR CABLE**

- A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- C. Conductors: 100-ohm, 23 AWG solid copper.
- D. Shielding/Screening: Unshielded twisted pairs (UTP).
- E. Cable Rating: Plenum.
- F. Jacket: Blue thermoplastic.

## **2.5 TWISTED PAIR CABLE HARDWARE**

- A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.
- B. 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. AMP NETCONNECT; a TE Connectivity Ltd. company.
  2. CommScope, Inc.
  3. Panduit Corp.
- C. General Requirements for Twisted Pair Cable Hardware:
  1. Comply with the performance requirements of Category 6.
  2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.
- E. Connecting Blocks:
  1. 110-style IDC for Category 6.

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2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
1. Number of Terminals per Field: One for each conductor in assigned cables.
- G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
1. Features:
    - a. Universal T568A and T568B wiring labels.
    - b. Labeling areas adjacent to conductors.
    - c. Replaceable connectors.
    - d. 24 or 48 ports.
  2. Construction: 16-gauge steel and mountable on 19-inch (483 mm) equipment racks.
  3. Number of Jacks per Field: One for each four-pair cable indicated.
- H. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with an eight-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
  2. Patch cords shall have color-coded boots for circuit identification.
  3. Provide one patch cord for each cable wired to the telecommunication rack.
- I. Plugs and Plug Assemblies:
1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
  2. Standard: Comply with TIA-568-C.2.
  3. Marked to indicate transmission performance.
- J. Jacks and Jack Assemblies:
1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
  2. Designed to snap-in to a patch panel or faceplate.
  3. Standard: Comply with TIA-568-C.2.
  4. Marked to indicate transmission performance.
- K. Faceplate:

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1. Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
3. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.
  - a. Flush mounting jacks, positioning the cord at a 45-degree angle.

L. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

## **2.6 IDENTIFICATION PRODUCTS**

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## **2.7 GROUNDING**

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

## **2.8 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA-568-C.1.
- C. Factory test twisted pair cables according to TIA-568-C.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 WIRING METHODS**

- A. Wiring Method: Install cables in raceways, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

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1. Install plenum cable in environmental air spaces, including plenum ceilings.
  2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

### 3.2 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.
  2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
  3. Install 110-style IDC termination hardware unless otherwise indicated.
  4. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
  5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  6. MUTOA shall not be used as a cross-connect point.
  7. Consolidation points may be used only for making a direct connection to equipment outlets:
    - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    - b. Locate consolidation points for twisted-pair cables at least 49 feet (15 m) from communications equipment room.
  8. 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.
  9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
  10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual , Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
  11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
  12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

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13. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
  3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Group connecting hardware for cables into separate logical fields.
- E. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 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 (300 mm).
  4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.

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- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
  6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### 3.3 GROUNDING

- A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

### 3.4 IDENTIFICATION

- A. Cable and Wire Identification:
  1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
  3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
  4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.



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- B. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
  - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### **3.5 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

**END OF SECTION 27 15 13**

## **SECTION 27 15 33 - COMMUNICATIONS COAXIAL HORIZONTAL CABLING**

### **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. Communications coaxial cable.
  - 2. Coaxial cable hardware.
  - 3. Grounding.

#### **1.3 DEFINITIONS**

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. LAN: Local area network.
- E. RCDD: Registered Communications Distribution Designer.

#### **1.4 COAXIAL HORIZONTAL CABLING DESCRIPTION**

- A. Coaxial horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C and the equipment outlet, otherwise known as "Cabling Subsystem 1" in the telecommunications cabling system structure. Cabling system consists of horizontal cables, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
  - 1. Test each coaxial cable on the reel for continuity.

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## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## PART 2 - PRODUCTS

### 2.1 GENERAL CABLE CHARACTERISTICS

- A. CATV Cable: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
  - 1. CATV Plenum Rated: Type CATVP installed in riser raceways or cable routing assemblies, complying with NFPA 262.

### 2.2 CATV COAXIAL CABLE

- A. Description: Coaxial cable with a 75-ohm characteristic impedance designed for CATV transmission.
- B. 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. Alpha Wire.
  - 2. Belden CDT Networking Division/NORDX.
  - 3. CommScope, Inc.
- C. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Community Antenna Television and Radio Distribution Systems" Article. Types are as follows:
  - 1. RG-6/U: UL Type CATVP.
    - a. No. 18 AWG, solid, copper-covered steel conductor.
    - b. Plenum rated.
    - c. Gas-injected, foam-PE insulation.
    - d. Double shielded with 100 percent aluminum foil shield, 60 percent aluminum braided inner shield, and 40 percent aluminum braided outer shield.
    - e. Jacketed with black PVC or PE.
    - f. Suitable for indoor installations.

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### **2.3 COAXIAL CABLE HARDWARE**

- A. Description: Hardware designed to connect, splice, and terminate coaxial cable with a 75-ohm characteristic impedance.
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.
- C. Jacks and Jack Assemblies: Modular, color-coded, with female Type BNC connectors.
- D. Patch Cords: Factory-made cables in 36-inch (900-mm) lengths; terminated with a male Type BNC connector at each end.
- E. Faceplates:
  - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
  - 2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
  - 3. For use with snap-in jacks accommodating any combination of twisted pair, optical-fiber, and coaxial work area cords.
    - a. Flush-mounted jacks, positioning the cord at a 90-degree angle from faceplate surface.

### **2.4 GROUNDING**

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

### **2.5 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 ENTRANCE FACILITIES**

- A. Coordinate horizontal cabling with the protectors and demarcation point provided by communications service provider.

### 3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
- B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.3 INSTALLATION OF PATHWAYS

- A. Drawings indicate general arrangement of pathways and fittings.
- B. Comply with NFPA 70 for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- D. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where 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 when entering room from overhead.
  - 4. Extend conduits 3 inches (76 mm) above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

### 3.4 INSTALLATION OF COAXIAL HORIZONTAL CABLES

- A. Comply with NECA 1 and NECA/BICSI 568.
- B. General Requirements for Cabling:
  - 1. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
  - 2. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and patch panels.
  - 3. 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.

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4. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  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 ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use 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. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Pulling Cable" Section. Monitor cable pull tensions.
- C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend coaxial cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
  3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- D. Group connecting hardware for cables into separate logical fields.
- E. Separation from EMI Sources:
1. 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 (300 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
  2. 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 (300 mm).

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3. 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 (76 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
4. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
5. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### **3.5 GROUNDING**

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with TIA-607-B and NECA/BICSI-607.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### **3.6 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections.
- B. Tests and Inspections:
  1. Visually inspect coaxial jacket materials for NRTL certification markings.
  2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  3. Test coaxial horizontal copper 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.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

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- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

**END OF SECTION 27 15 33**



# **SOLID GROUND**

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## **REPORT OF GEOTECHNICAL EXPLORATION**

NOTE: This report is provided for information purposes only and is NOT to be considered a part of the Contract Documents.



### **Proposed KYTC Casey County Maintenance Facility**

Liberty, Kentucky

Prepared for: Mr. Bill Novak

Finance & Administration Cabinet

Department for Facilities & Support Services

Division of Engineering & Contract Administration

September 30, 2020

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## APPENDICES

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### Appendix A            BORING LOGS



September 30, 2020

Mr. Bill Novak  
Finance & Administration Cabinet  
Department for Facilities & Support Services  
Division of Engineering & Contract Administration, Bush Building

Subject: **Report of Geotechnical Exploration  
KYTC Casey Co. Maintenance Facility  
Liberty, Kentucky  
20-0296**

Mr. Novak,

Solid Ground Consulting Engineers, PLLC (Solid Ground) is pleased to present our Report of Geotechnical Exploration. This report is for the proposed building at the Casey County Maintenance Facility located in Liberty, Kentucky. The geotechnical exploration was conducted in general accordance with the scope of work agreed upon in Solid Ground Proposal 20-147 dated September 3, 2020.

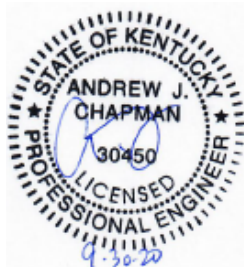
This report contains our findings and recommendations for the referenced project detailed above. Once completed, it is recommended that Solid Ground have the opportunity to review plans and specifications. In addition, it is recommended that Solid Ground be retained to perform observations during earthwork, shallow foundation and slab on grade construction. Solid Ground will not be held responsible for interpretations and field observations made by others.

We appreciate the opportunity to provide our consulting services to you. We look forward to working with you on this and future projects.

Sincerely,

**SOLID GROUND CONSULTING ENGINEERS, PLLC**

Andrew J. Chapman, PE  
Kentucky License Number 30450



## **1.0 Executive Summary**

Solid Ground performed a geotechnical exploration in support of the proposed structure for the existing maintenance facility located at 1090 S. Wallace Wilkinson Blvd. in Liberty, Kentucky. The approximate coordinates of the site are 37°18'14.98"N, - 84°56'47.22"W.

### **1.1 Summary of Findings**

Solid Ground drilled a total of seven (7) soil test borings at the site. The boring locations were predetermined by others. Six borings were advanced to a depth of 11.5 feet; one boring was extended to auger refusal encountered at a depth of approximately 15 feet. It is our understanding that the borings were located in the footprint of the proposed structure.

The soil overburden generally consisted of moderately plastic fat clay fill and native fat clay soils (CH) to depths of 10 to 14 feet. The proposed finished floor elevation (FFE) for the proposed building was unknown at the time of this report. We anticipate that it will be constructed near El. 825, requiring up to 2 to 12 feet of new engineered fill to establish final grades within the building area. If our assumptions are incorrect we request the opportunity to provide additional recommendations or modifications to this report.

### **1.2 Recommendations**

Solid Ground recommends the following general recommendations for design and construction of the proposed building. However, this report should be read in its entirety and the recommendations contained therein fully implemented.

- ▲ The in-situ soils are suitable for structural fill and support of floor slabs and foundations if the recommendations detailed in this report are followed.
- ▲ The foundations may be designed as shallow spread footings bearing on stiff or better natural soils or engineered fill. Foundations bearing on these materials may be designed for a maximum net allowable bearing pressure of 2,500 psf.
- ▲ Foundations should bear 36 inches below the proposed finished grade.
- ▲ We recommend undercutting an additional 12 inches below bottom of slab and replacing with suitable material.
- ▲ A seismic site classification of "C" is recommended for foundation design.

## **2.0 Project Information**

### **2.1 Purpose and Scope of Services**

The purpose of this subsurface exploration was to prepare recommendations for design and construction of foundations, floor slabs, pavement and drive areas for the proposed building. Our scope of work included the following:

- ▲ A discussion of site surface conditions.
- ▲ A discussion of subsurface conditions encountered and published geologic conditions at the site.
- ▲ A summary of field and laboratory testing results including a brief review of test procedures.
- ▲ Boring logs and laboratory tests will be summarized in the report and included in the appendix.
- ▲ A discussion of specific geotechnical conditions and concerns which may affect the design or construction of the project.
- ▲ Recommendations for site preparation and construction of compacted fills.
- ▲ Recommended general design and construction criteria for the project foundations.
- ▲ Recommended general design and construction criteria for the pavement.
- ▲ A recommendation for seismic site class according to International Building Code which was adopted by the 2018 Kentucky Building Code (KBC).

### **2.2 Project Description**

It is our understanding the project will consist of a replacement structure occupying a footprint of approximately 8,000 square feet. Mass grading of the site is anticipated to achieve the required design elevations. New soil fill thickness are expected to be about 10 to 15 feet. Construction of the building is understood to be wood or metal framing with slab on grade. The approximate site location is shown below.



**Approximate Site Location – Liberty, Kentucky (Google Earth)**

### **2.3 Site Conditions**

Solid Ground personnel visited the site on September 15, 2020 to observe existing conditions, to help interpret the subsurface data, and to detect conditions which could affect recommendations.

The site consists of gently sloping terrain from east to west and is currently covered with asphalt pavement and gravel. No visible signs of ponded water were observed on the property.





**General Site of Proposed Building Site (Google Earth)**

## **2.4 Structural Loading Information**

We understand the structural loading includes column loads of up to 35 kips/foot with continuous wall loads in the range of 1.5 kips/foot. The slab is anticipated to have maximum loads not exceeding 100 psf.

## **2.5 Site Grading and Topography**

We anticipate that finished floor elevation for the building site will be approximately El. 825. Current topography at the site slopes downward from El. 830 at the driveway to S. Wallace Wilkinson Blvd on the east to El. 812 at the west end of the existing parking lot. Elevations at the boring locations ranged from approximately El. 813 to 823. Therefore, 2 to 12 feet of newly placed engineered fill is anticipated to be required to achieve the anticipated finished floor elevation in the building area.



### **3.0 Subsurface Findings and Encountered Conditions**

#### **3.1 Review of Previous Site Development and Historical Information**

Based on review of historical maps provided by the United States Geological Survey (USGS) and Google Earth Imagery, it appears the site has remained mostly unchanged since 1997.

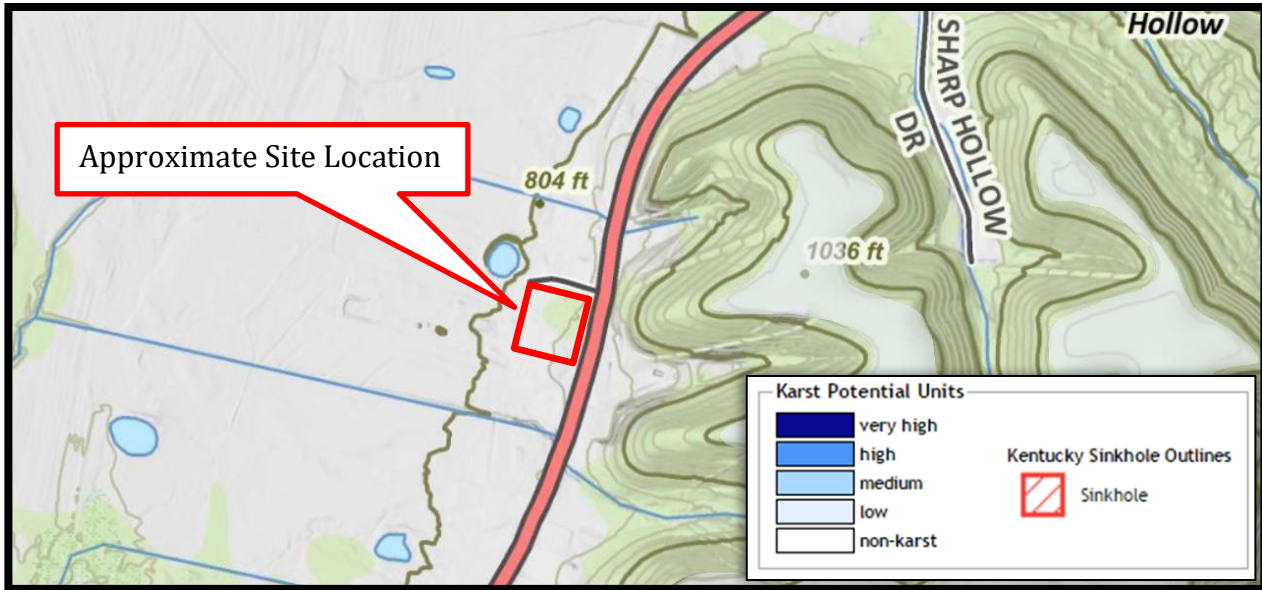
#### **3.2 Published Geologic Information**

Geologic information was referenced from the Kentucky Geological Survey (KGS), geologic Maps of the Liberty Quadrangle, Casey County, Kentucky. Materials underlying the site are mapped as the Borden Formation composed of Siltstone, shale, and chert, with minor limestone ledges.



#### ***KGS Geologic Mapping***

The KGS mapping indicates that the underlying rock units have no karst potential (non-karst). Solid Ground should be contacted if any karst activity is encountered in construction.



### ***KGS Karst Potential Mapping***

#### **3.3 Subsurface Exploration Program**

A drill rig was used to conduct soil test borings to explore the site subsurface conditions. It should be noted that, upon completion, each boring was backfilled with onsite materials. The boring logs attached to this report provide specific details at the individual boring locations.

A total of 7 borings were drilled to explore the subsurface conditions within the building area. Boring locations are shown in image below. Boring surface elevations were measured in the field by Solid Ground using Carlson GPS Equipment. Therefore, the boring locations and surface elevations should be considered approximate. The stratification lines shown on the boring logs represent approximate boundaries between soil types. It should be noted that the subsurface conditions will vary between borings and the representative profile is based upon the number of borings drilled during the field operations. The soil samples were visually classified by Solid Ground personnel according to the Unified Soil Classification System (USCS, ASTM D2487).



**Approximate Boring Locations (Map provided by Brown and Kubican RFP)**

### 3.4 Subsurface Conditions

A description of each soil layer as follows.

**Asphalt/DGA** – The borings generally encountered a layer of asphalt or dense grade aggregate (DGA). Asphalt thicknesses ranged from 2 to 10 inches; DGA thickness varied from 3 to 10 inches. It should be noted that asphalt and gravel thicknesses may vary across the site. The thicknesses presented in this report should be considered approximate.

**Existing Fill, Fat Clay (CH)** – The borings generally encountered soil described as brown and gray fat clay (CH) underlying the pavement. The Standard Penetration Test (SPT) N-values ranged from 3 to 23 blows per foot, 13 average. The soil consistencies were judged to be soft to very stiff.

**Natural Soils, Fat Clay (CH)** – The borings generally encountered soil described as mottled brown and gray fat clay (CH) underlying the fill. The Standard Penetration Test (SPT) N-values ranged from 12 to 50+ blows per foot, 34 average. The soil consistencies were judged to be stiff to hard.

Detailed descriptions and strength characteristics are included on the boring logs in Appendix A.

**Auger Refusal** – One boring (B-4) encountered auger refusal at a depth of 14 feet.

**Groundwater** – Groundwater was encountered in three of the borings at depths of 2.5 and 5 feet below grade. Free groundwater levels fluctuate with seasonal weather conditions and may vary. Therefore, the borings may not be representative of the actual free water levels. To achieve an accurate measurement of free groundwater levels, water wells or piezometers should be installed.

Solid Ground should be contacted if groundwater is encountered during earthwork operations. Please note, the groundwater table can fluctuate significantly which could have an impact on the subsurface soils. The following table summarizes our findings.

**Table 1. Boring Summary**

Boring Number	Approximate Surface Elev. (ft)	Boring Depth (ft)	Approximate Boring Termination Elev. (ft)
B-1	822.6	10.0	812.6
B-2	818.7	10.0	808.7
B-3	813.4	10.0	803.4
B-4	819.7	14.0	804.7*
B-5	813.4	10.0	803.4
B-6	819.8	10.0	809.8
B-7	822.9	10.0	812.9

\* Auger refusal elevation.



## **4.0 Geotechnical Concerns and Construction Considerations**

Based on the results of the subsurface exploration and experience with similar past projects, we believe the project site is generally suitable for the proposed development. However, some concerns exist with the subsurface conditions as discussed below.

### **4.1 Asphalt/DGA**

Based on the information gathered from the soil borings, the site has a surficial layer of asphalt and aggregate. Asphalt thicknesses are representative of conditions encountered at the boring locations only, thickness and extent of the asphalt may vary across the site. Construction plans should adequately address stripping and the disposal of the asphalt prior to earthwork operations. The underlying aggregate may be used as engineered fill.

### **4.2 Undocumented Fill**

Undocumented fill material was encountered in each of the borings to depths of approximately 4.0 feet. There is no available documentation of fill placement for the site. Undocumented fill can contain heterogenous and/or deleterious materials, and loose or wet zones. Bearing on these materials can lead to structural damage from differential settlement. The fill encountered in the borings appeared to be homogenous in composition and consistency.

The soil fill is generally firm to stiff and should be suitable to support pavements and new engineered fill. Proofrolling of the existing fill is recommended for pavement areas and areas to receive new fill within the building pad areas to identify any soft/unstable zones.

### **4.3 High Plasticity Clay**

The subsurface soils were field classified as fat clay (CH) to auger refusal or termination depths. The plasticity generally increases with depth. Based on past experience with the local geology, there is some potential to encounter higher plasticity fat clays during construction. These soils are subject to volume changes with fluctuations in moisture content. The soils are also known to have strength loss with increases in moisture content. If encountered during construction, the following remediation methods are effective in mitigating the risk of shrink and swell potential:

- ▲ Fill placement or undercut/replace with lean clay – Slab on grade should be undercut an additional 12 inches below bottom of slab and be replaced with a suitable structural fill as detailed in this report.

- ▲ Foundations should extend to 36 inches below exterior grade.
- ▲ Improved site drainage to minimize exposure of these soils to moisture fluctuations, especially near building foundations and slab on grade.
- ▲ Minimize exposure of these soils to excessive wetting or drying.

#### **4.4 Shallow Bedrock**

Bedrock was encountered in one boring location at a depth of 14 feet within proposed building locations. Rock coring was beyond our scope of work. Based on past experience with local geology, the bedrock likely consists of sandstone and shale. Some rock at the site may be rippable in part with a large trackhoe. However, it should be expected that the bedrock will likely require the use of pneumatic hammers, blasting or similar methods for efficient excavation.

#### **4.5 Blasting**

If blasting is utilized, care should be taken in blasting operations not to heave the rock below the foundation bearing level. Any rock heaved below foundation bearing levels should be removed and replaced with lean concrete. The excavation of rock, if required, should be accomplished in accordance with the *Laws and Regulations Governing Blasting and Explosives*, latest revision, prepared by the Commonwealth of Kentucky, Department of Mines and Minerals, Division of Explosives and Blasting. Pre-blast surveys, blast monitoring, and post-blast surveys are suggested to qualify potential damage to nearby structures. We can provide this service, if desired.

#### **4.6 Underground Utility Installation**

Final site grading and underground utility plans were unavailable at the time of this report. Bedrock may be encountered in some of the utility excavations. Installation of underground utilities within the anticipated bedrock elevations will require trenching into the bedrock and backfilling with structural fill. The structural fill may consist of shot rock or compacted clay meeting criteria set forth in Section 5.1.2 of this report.

#### **4.7 Existing Underground Utilities**

Existing underground utilities may be present within the footprint of the proposed addition. Construction plans should include provisions for complete removal and/or relocation of utility lines encountered during site grading operations.

#### 4.8 Construction in Cut/Fill Areas

Cut areas have the potential to be overcut, disturbing the in-situ soils to depths below proposed finished grade. Areas to receive fill are stripped of gravel and are also sometimes disturbed to depths deeper than intended. Both cut and fill areas shall be proof-rolled prior to construction taking place. Soft, loose, or wet areas shall be identified and remediated in accordance with the recommendations provided in the “Earthwork” section of this report.

#### 4.9 Construction During Wet Conditions

Based on past experience with construction projects during wet conditions, subgrade remediation is often required. In addition, delays of earthwork/foundation operations should be anticipated. This is due to the onsite soils characterized as clay. Clays lose cohesive strength when high moisture conditions are present. To stabilize the clay, drying would be required. During wet conditions, the clays may become saturated and are unable to dry in a timely manner.

If this project is expedited, with construction potentially occurring during wet conditions, we anticipate remediation methods to occur. Typically, remediation methods consist of undercutting soft and/or saturated soils and replacing with a granular stone that is “capped” with DGA. The extent and depth of the undercut is on a case by case basis depending on the soil conditions. We recommend contracting Solid Ground to observe earthwork operations and foundation and slab on grade construction. In addition, we recommend that the earthwork contractor and the design team adequately budget for remediation repairs.

**It is recommended that each spread footing and continuous footing have Dynamic Cone Penetrometer testing performed once foundation excavation is completed to ensure bearing is within the recommended net allowable as detailed in this report.**

#### 4.10 Preliminary Liquefaction Potential

Liquefaction is the phenomenon where saturated soils develop high pore-water pressures during seismic shaking and lose their strength characteristics. This phenomenon generally occurs in areas of high seismicity where groundwater is shallow. Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow spread foundations.

Three conditions are generally required for liquefaction to occur:

1. The soil must be saturated (relatively shallow groundwater)
2. The soil must be loosely packed (low density)
3. Ground shaking of sufficient intensity must occur to function as a trigger mechanism.

Our exploration encountered clay soils with limited groundwater, and with bedrock at a depth of about 11 to 15 feet, therefore, the soils should be considered to have low to non-liquefaction potential.

#### **4.11 Settlement**

In addition to the foundation loads, settlement due to the weight of up to 15 feet of newly placed structural fill must be considered in the western portion of the building footprint. The fill should be placed as early as possible in the construction schedule to allow time for the underlying natural soils to consolidate under the weight of the fill pad. We estimate the total settlement due to the newly placed structural fill along the western portion of the building to be 1 inch or less if our recommendations are followed in this report. We further estimate that sufficient consolidation should be completed within 30 to 45 days to allow foundation construction to then proceed without detrimental settlement. If it is desired to proceed with foundation construction sooner, the actual amount and rate of settlement should be measured in the field by placing approximately four settlement plates across the addition area prior to placement of the fill, and/or surficial settlement points following placement of the fill, and monitoring their settlement with time.

**It is critical for the performance of the development that Solid Ground be retained to observe earthwork operations.**

#### **4.12 Construction within a Demolition Zone**

Demolition and razing are proposed for the project. Demolition plans should include provisions for complete removal of foundations and underground utilities encountered during preparation for site grading.

Demolition and removal of old foundations/utilities frequently disturb soils to depths greater than intended. It should be anticipated that soils underlying the existing building will need to be undercut to the depths to which they are disturbed then replaced as engineered fill in accordance with the recommendations set forth in this report.



#### 4.13 Site and Foundation Drainage

Past experience has shown that the onsite materials are prone to degradation during wet periods of the year and/or under heavy traffic. Surface and ground water should be controlled while the subgrade fill materials are exposed and use only enough compactive effort to achieve stability and job site requirements for compaction. In addition, it is recommended that foundation concrete, or a concrete bearing medium, be placed the same day that foundation excavation is performed. It is imperative that dewatering be maintained during construction and after the development.

The final grade should be sloped away from the structure and pavements a minimum of two percent to promote positive drainage. Roof drains and foundation drains should be installed and should discharge surface runoff away from the structure to provide positive site drainage. It should be noted that drainage should be designed and constructed without impacting neighboring properties. Drainage design is beyond our scope of work.

**It is imperative that dewatering be maintained during construction and after development. If positive dewatering methods are not continually applied and maintained, the potential of remedial subgrade measures is greatly increased.**

### 5.0 Recommendations

The following recommendations are based on the information gathered and subsurface conditions encountered during this exploration. It should be noted that Solid Ground cannot be held liable for fill placed or performance of the subgrade without observations. **It is recommended to retain Solid Ground to perform proofrolling of the building pads and pavement areas, prior to the beginning of fill placement and during fill placement (if required).**

#### 5.1 Earthwork

##### 5.1.1 Site Preparation

- ▲ Asphalt materials should be stripped to prepare the site for construction.
  - The stripping should extend a minimum of five feet outside of the proposed pavement and building areas.
- ▲ After stripping and cutting operations, **the subgrade should be evaluated by Solid Ground by proofrolling methods with a fully loaded dump truck.**

- Possible remediation methods may be required if the subgrade and site soils are exposed to wet weather conditions.
- ▲ If final grading plans require only minimal new engineered fill thicknesses, remediation of the existing fat clay fill or native fat clay soil should be performed as described in Section 4.2.
  - The remediation of the fat clay should extend a minimum of five feet outside of the proposed building footprint.

### 5.1.2 Structural Fill Placement

Backfill materials for structural fill placement may consist of soil or durable crushed stone. The following steps are recommended for fill placement within the building pad. **The onsite soils are expected to meet the requirements for structural fill if recommendations are followed in this report.**

Structural fill material, if required, is defined as the following:

- ▲ Inorganic natural soil with maximum particle sizes of 3 inches.
- ▲ Plasticity Index of no greater than 30 percent and liquid limit less than 50.
- ▲ Solid Ground should observe to ensure the soils meet applicable standards for structural fill.
- ▲ Other sources of structural fill should be verified by Solid Ground.
  - If other sources of structural fill are anticipating, Solid Ground should collect a bulk sample for standard Proctor testing.

The following are recommendations for placement of soil structural fill:

- ▲ Structural fill should be placed in 6-inch to no greater than 8-inch-thick layers.
- ▲ Structural fill should be compacted to at least 98 percent of the soil's maximum dry density as determined by the standard Proctor compaction test (ASTM D698).
- ▲ The moisture content of the fill material should be maintained about 2 percent (above or below) of its standard Proctor optimum moisture content depending on the results of the Proctor tests.
- ▲ In-place density testing must be performed as a check that the previously recommended compaction criteria have been achieved.

- ▲ Fill placement should be monitored on a full-time basis by Solid Ground during site grading.

- ▲ Fill placement should extend to a minimum of 5 feet beyond the building footprint.

Solid Ground should be contacted if any unexpected subsurface conditions are encountered during earthwork construction. It is important that Solid Ground observe earthwork construction.

## 5.2 Foundations - Shallow Spread Footings

### 5.2.1 Discussion

It is recommended that foundations bear on remediated in-situ soils or new engineered fill. **We recommend the use of a maximum net allowable bearing pressure of 2,500 psf (pounds per square foot) for foundations bearing on these materials.**

A detailed settlement analysis was beyond the scope of this report. Based on the assumed structural loads, the available site grading information, the recommended bearing pressure, knowledge of the site's development and empirical correlation for the subsurface conditions encountered beneath the proposed structure, we estimate the total settlements of the foundation to be about one-inch or less. Differential settlements are estimated to be about ½ inch or less.

Once the design is finalized, we recommend allowing Solid Ground the opportunity to review the plans and specifications.

### 5.2.2 Construction Considerations

The following construction considerations are recommended:

- ▲ Column footings and strip footings should be at least 24 inches wide and 12 inches thick.
- ▲ All exterior footings should bear at least 36 inches below the lowest adjacent exterior grade for protection against frost penetration.
- ▲ Clean the foundation bearing area so it is nearly level and is free of ponded water and loose material.
- ▲ Dewatering methods may be necessary if the foundation excavation takes place during wet weather.
- ▲ **Solid Ground should be on site while the foundation construction is performed.**

### 5.3 Slab on Grade

We assume that the slab on grade will have vehicular loading. The loading is unknown at this time. If this assumption is incorrect, Solid Ground should be contacted to modify recommendations. The following recommendations should be followed:

- ▲ Solid Ground should observe the finished subgrade utilizing proofrolling once grading is completed. If excessive pumping and/or rutting is observed remediation may be required. Typical remediation methods consist of undercutting the unsuitable soil and placing re-compacted soil or granular material.
- ▲ If construction is to take place during wet periods of the year, there is a potential that remediation methods will be required to stabilize the soil subgrade. Solid Ground should be consulted to assist in selecting the method most appropriate for site conditions. These methods may consist of any or combination of the following:
  - Tensar geogrid reinforcement.
  - “Walking” No. 2 stone into the soft subgrade.
  - Application of compacted No. 57 stone.
- ▲ ***It is imperative that quality control be performed to ensure that moisture contents, as well as compaction efforts, are within optimum. If clay fill material is placed above optimum, there is potential of settlement within the newly placed fill.***
- ▲ It is recommended that the floor slab be constructed with a DGA stone base of a minimum of **12 inches** in thickness. The floor slab should be constructed with a minimum of **8 inches** of reinforced concrete. These recommendations are a minimum, concrete slab thickness and type of reinforcement should be designed by a structural engineer based on loading requirements.
- ▲ A subgrade modulus,  $k$ , of 60 pounds per cubic inch (pci) for design of the floor slab supported by granular material.
- ▲ It is recommended to utilize a minimum 12 mil vapor barrier between bottom of concrete slab and stone subbase.
- ▲ Control joints should be placed in the slab around any columns and along footing supported walls so these elements may move independently.
- ▲ Place horizontal control joints into the slab, spaced approximately 12 feet apart to control cracking.
- ▲ The floor slab should be fully ground-supported. This will reduce the possibility of cracking and displacement of the floor slab due to differential settlement.

- ▲ It is recommended to perform proofrolling prior to placing stone to serve as the slab working base, and again immediately prior to constructing the slab.

## 5.4 Seismic Site Classification

This classification is based on the seismic standards and design values from the 2009 NEHRP Recommended Seismic Provisions and the 2010 ASCE-7 Standard. Based on the results of our exploration and the geology of the area, we assign a site seismic classification of “C”. Seismic Site Class and design parameters are summarized in Table 2 below.

**Table 2. Seismic Site Class Information**

Seismic Design Parameters - Provided by USGS	
<b>Code Used</b>	2009 NEHRP
<b>Site Classification</b>	Site Class “C”
<b>Occupancy Risk Category</b>	II
<b>Location</b>	37.304161°N, - 84.94645°W
<b>F<sub>a</sub></b>	1.2
<b>F<sub>v</sub></b>	1.7
<b>S<sub>DS</sub></b>	0.147g
<b>S<sub>D1</sub></b>	0.113g

## 5.5 Pavement Recommendations

### 5.5.1 General

Based on past experience with similar traffic loading (assumed) and subsurface conditions, the subgrade soils are assumed to have a CBR of 3.0 for the pavement analysis based on SPT correlation. American Association of State Highway and Transportation Officials (AASHTO) Guide for Design of Pavement Structures (1993) was used for the analysis. The assumptions are listed below for the pavement analysis.

***If the following assumptions are incorrect, Solid Ground should be contacted to provide additional recommendations.***

- ▲ Initial Serviceability of 4.2
- ▲ Resilient Modulus of 3,000
- ▲ Terminal Serviceability of 2.0

- ▲ Reliability of 90%
- ▲ Life of 15 years
- ▲ Maximum Estimated Equivalent Single Axle Load (ESAL's) of 20,000 for Light Duty with following assumptions:
  - 10 Maintenance Vehicles per day
  - 200 Passenger Cars per day
- ▲ Maximum Estimated Equivalent Single Axle Load (ESAL's) of 80,000 for Heavy Duty, with following assumptions:
  - 2 Garbage Trucks per week
  - 15 Maintenance Vehicles per day
  - 200 Passenger Cars per day

### 5.5.2 Flexible Asphalt Pavements

Based on the design assumptions detailed above, we recommend the following asphalt pavement sections:

**Table 3. Light Duty Asphalt Pavement Section**

Material	Light Duty Thickness (Inches)
<b>Asphalt Surface Course</b>	1.5
<b>Asphalt Base Course</b>	2.0
<b>Compacted Crushed Stone Base</b>	12.0
<b>*Walk #2 into subgrade and observe proofroll to identify unsuitable areas</b>	

*\*Indicates typical remediation methods for soft soils identified during proofrolling. Not required if proofrolls indicate stable subgrade conditions.*

**Table 4. Heavy Duty Asphalt Pavement Section**

Material	Heavy Duty Thickness (Inches)
Asphalt Surface Course	2.0
Asphalt Base Course	3.0
Compacted Crushed Stone Base	12.0
<b>*1 Layer of Tensar BX1200 and Geogrid Filter Fabric</b>	
<b>*Walk #2 into subgrade and observe proofroll to identify unsuitable areas</b>	

*\*Indicates typical remediation methods for soft soils identified during proofrolling. Not required if proofrolls indicate stable subgrade conditions.*

### 5.5.3 Rigid Concrete Pavements

Based on the assumptions given in Section 5.5.1, the following concrete pavement sections are recommended:

**Table 5. Light Duty Rigid Concrete Pavement**

Material	Light Duty Thickness (Inches)	Designed Compressive Strength (psi)
Concrete	6.0	4,000
Compacted Crushed Stone Base	12.0	
<b>*1 Layer of Tensar BX1200 and Geogrid Filter Fabric</b>		
<b>*Compacted Crushed Stone Base</b>	12.0	
<b>*1 Layer of Tensar BX1200 and Geogrid Filter Fabric</b>		
<b>*Walk #2 into subgrade and observe proofroll to identify unsuitable areas</b>		

*\*Indicates typical remediation methods for soft soils identified during proofrolling. Not required if proofrolls indicate stable subgrade conditions.*

**Table 6. Heavy Duty Rigid Concrete Pavement**

Material	Heavy Duty Thickness (Inches)	Designed Compressive Strength (psi)
Concrete	8.0	4,000
Compacted Crushed Stone Base	12.0	
*1 Layer of Tensor BX1200 and Geogrid Filter Fabric		
*Compacted Crushed Stone Base	12.0	
*1 Layer of Tensor BX1200 and Geogrid Filter Fabric		
*Walk #2 into subgrade and observe proofroll to identify unsuitable areas		

*\*Indicates typical remediation methods for soft soils identified during proofrolling. Not required if proofrolls indicate stable subgrade conditions.*

We recommend the dumpster pad be constructed of concrete:

- ▲ The dumpster pad apron should extend the entire length of the garbage truck beyond the face of the dumpster.

## 5.6 Below Grade Walls

We recommend that below grade walls be designed in accordance with the following recommendations. The walls should also be designed to provide sufficient drainage at the rear of the wall to relieve hydrostatic pressure.

- ▲ We recommend the walls be backfilled using a compacted granular material. The granular material should preferably be "SP" or "GW" as classified by the USCS, so that it will be clean, free draining, and exhibit an angle of shear resistance of 30 degrees or more. KDOH No. 57 stone is suitable for this purpose.
- ▲ To utilize the following granular material earth pressure values, the granular material must occupy a triangular shaped minimum backfill zone. The minimum zone starts at the base of the wall from the outside face of the footing. At the top of the backfill, the zone should extend from the edge of footing a distance of three-fifths of the backfill height.



- ▲ The backfill zone may be drained using a perforated pipe placed at the base of the footing. Either gravity drainage or a sump pump system should be used to remove accumulated water.
- ▲ A minimum thickness of two feet of low plasticity clay should be provided on top of the granular wall backfill material where the backfill material will be exposed to the weather. This low plasticity clay cap is recommended to minimize the potential for infiltration of surface water runoff behind below grade walls. The onsite residual soils are suitable for this purpose.
- ▲ The coefficient of friction of concrete over soil utilized for design consideration should be 0.35.

The following Table 7 presents granular backfill, earth pressure design parameters for Equivalent Hydrostatic Pressures (EHP) and Earth Pressure coefficients. The values given assume the backfill surface is level, the backfill is drained, the zone of backfill conforms to the minimum zone size given above, and no surcharge is placed on the backfill.

**Table 7. Granular Backfill Material**

Condition	EHP (pcf)	Coefficients
Active	40	$K_a = 0.30$
At Rest	65	$K_o = 0.50$
Passive	400	$K_p = 3.0$

## 5.7 Plan Review

To better assure conformance of the final design documents with the recommendations contained in this report, and to better comply with the building department's requirements, Solid Ground should review the completed project plans prior to construction. The plans should be made available for our review as soon as possible after completion so that we can better assist in keeping your project schedule on track.

We recommend that the following project-specific note be added to the architectural, structural, and civil plans: "The geotechnical aspects of the project, including site grading,

utility and foundation excavations, slab on grade construction, placement and compaction of engineered fill, installation of site drainage should be performed in accordance with the recommendations of the *“Geotechnical Report prepared by Solid Ground Consulting Engineers, PLLC, dated September 30, 2020.”*

## 5.8 Construction Monitoring and Observations

Based on past experience, in order to obtain the Certificate of Occupancy for this development, you will be required to directly contract a qualified and certified inspection firm to provide special inspection items consisting of observing the following:

- ▲ Soil Construction
- ▲ Foundation Construction
- ▲ Concrete Placement
- ▲ Reinforcement Placement
- ▲ Steel Construction

**It is advantageous to the owner to contract with Solid Ground Engineering, Inc. to provide construction monitoring and observations for this project.** Some of those benefits are as follows:

- ▲ As the Geotechnical Engineer of Record (GER) for this project, we will provide confirmation that subsurface conditions exposed during construction are substantially the same as those interpolated from our limited subsurface exploration, on which the analysis and design were based.
- ▲ The recommendations in this report are based on limited subsurface information. The nature and extent of variation across the site may not become evident until construction. If variations are then exposed, it will be necessary to re-evaluate our recommendations. In the event that subsurface conditions differ from those anticipated, we as the GER will provide recommendations if deemed necessary.

## **6.0 Report Limitations**

This report has been prepared for the exclusive use of the KYTC Department for Facilities & Support Services Division of Engineering & Contract Administration for specific application to the project site. Our recommendations have been prepared using generally accepted standards of geotechnical engineering practice in the Commonwealth of Kentucky. No other warranty is expressed or implied.

The recommendations provided are based on the subsurface information and other findings obtained by Solid Ground as well as information provided by you. If there are revisions to the plans for this project or if subsurface conditions detailed in this report are encountered during construction that are different than our exploration, we should be notified immediately to modify the foundation recommendations if deemed necessary. We cannot be held responsible for the impact of those conditions on the project if those impacts are not made known to us.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials. Any statements in this report or on the test pit logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

### **7.0 Associated Geotechnical Risks**

The analytical tools which are used by the geotechnical engineer in this area are generally empirical and must be used in conjunction with professional engineering judgment and experience. Therefore, the recommendations presented in this geotechnical exploration should not be considered risk-free and are not a guarantee that the proposed structure will perform as planned. The engineering recommendations presented in this are based on the information gathered during the subsurface exploration, information provided by you and past experience with similar projects.


**APPENDICES**

**APPENDIX A – BORING LOGS**



## APPENDIX A – BORING LOGS




<b>Project Number: 20-296</b>	<b>Boring Log B-1</b>	 <p><b>SOLID GROUND</b> CONSULTING ENGINEERS, PLLC <small>Engineering Innovation; Providing Solutions to Your Challenges.</small></p>
<b>Project Name: KYTC Casey County Maintenance Facility</b>		

Weather: Sunny/80's	Date: September 15, 2020	*Approximate Surface Elevation: 822.6 feet
Location of Boring: As Mapped	Drill Rig: Lonestar LST1G+HDA	
Auger Size: 3.25 ID	Method: Hollow Stem Auger	Hammer Type: Automatic
Groundwater ▼: Not Encountered	Engineer: Eric C. Haley, PE	Driller: Solid Ground

*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
822.6	0.0	ASPHALT (8 INCHES)										
821.6	1.0	AGGREGATE (5 INCHES)		1.0	SS	16, 7, 3,	10			21.2		
820.6	2.0	FILL: firm to stiff, brown, FAT CLAY (CH), moist										
819.6	3.0		2.5	SS	4, 3, 4,	7			23.2			
818.6	4.0		5.0	SS	5, 6, 11,	17			17.3			
817.6	5.0											
816.6	6.0	VERY STIFF to HARD, mottled brown and gray, FAT CLAY (CH), moist with sandstone fragments										
815.6	7.0		7.5	SS	11, 11, 13,	24			17.1			
814.6	8.0											
813.6	9.0											
812.6	10.0				10.0	SS	11, 11, 19,	30				
811.6	11.0	<b>Boring Terminated at 11.5 feet.</b>										
810.6	12.0											
809.6	13.0											
808.6	14.0											
807.6	15.0											
806.6	16.0											
805.6	17.0											
804.6	18.0											
803.6	19.0											
802.6	20.0											
801.6	21.0											
800.6	22.0											
799.6	23.0											
798.6	24.0											
797.6	25.0											
	26.0											


**Boring Logs are for informational purposes only.**  
**Boring includes conditions observed during the site visit and for this particular location.**  
**Soil was visually classified in the field.**  
**\*Depths are considered approximate.**

<b>Project Number: 20-296</b>	<b>Boring Log B-2</b>	
<b>Project Name: KYTC Casey County Maintenance Facility</b>		

Weather: Sunny/80's	Date: September 15, 2020	*Approximate Surface Elevation: 818.7 feet
Location of Boring: As Mapped	Drill Rig: Lonestar LST1G+HDA	
Auger Size: 3.25 ID	Method: Hollow Stem Auger	Hammer Type: Automatic
Groundwater ▼: Not Encountered	Engineer: Eric C. Haley, PE	Driller: Solid Ground

*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
818.7	0.0	ASPHALT (8 INCHES)										
817.7	1.0	AGGREGATE (3 INCHES)		1.0	SS	8, 7, 7,	14					
816.7	2.0	FILL: firm to stiff, brown, FAT CLAY (CH), moist										
815.7	3.0			2.5	SS	6, 6, 6,	12					
814.7	4.0											
813.7	5.0			5.0	SS	3, 3, 6,	9					
812.7	6.0	VERY STIFF to HARD, mottled brown and gray, FAT CLAY (CH), moist with sandstone fragments										
811.7	7.0			7.5	SS	15, 16, 20,	36					
810.7	8.0											
809.7	9.0											
808.7	10.0			10.0	SS	16, 10, 12,	22					
807.7	11.0	<b>Boring Terminated at 11.5 feet.</b>										
806.7	12.0											
805.7	13.0											
804.7	14.0											
803.7	15.0											
802.7	16.0											
801.7	17.0											
800.7	18.0											
799.7	19.0											
798.7	20.0											
797.7	21.0											
796.7	22.0											
795.7	23.0											
794.7	24.0											
793.7	25.0											
	26.0											

**Boring Logs are for informational purposes only.**  
**Boring includes conditions observed during the site visit and for this particular location.**  
**Soil was visually classified in the field.**  
**\*Depths are considered approximate.**


<b>Project Number: 20-296</b>	<b>Boring Log B-3</b>	
<b>Project Name: KYTC Casey County Maintenance Facility</b>		

Weather: Sunny/80's	Date: September 15, 2020	*Approximate Surface Elevation: 813.4 feet
Location of Boring: As Mapped	Drill Rig: Lonestar LST1G+HDA	
Auger Size: 3.25 ID	Method: Hollow Stem Auger	Hammer Type: Automatic
Groundwater ▼: Not Encountered	Engineer: Eric C. Haley, PE	Driller: Solid Ground





*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
813.4	0.0	ASPHALT (2 INCHES)										
812.4	1.0	AGGREGATE (3 INCHES)		1.0	SS	3, 3, 7,	10			14.9		
811.4	2.0	FILL: firm to very stiff, brown, FAT CLAY (CH), moist										
810.4	3.0			2.5	SS	7, 11, 11,	22			20.9		
809.4	4.0											
808.4	5.0			5.0	SS	7, 11, 12,	23			20.5		
807.4	6.0	FIRM TO VERY STIFF, mottled brown and gray, FAT CLAY (CH), moist with sandstone fragments										
806.4	7.0			7.5	SS	9, 6, 6,	12			20.9		
805.4	8.0											
804.4	9.0											
803.4	10.0			10.0	SS	8, 8, 10,	18					
802.4	11.0	<b>Boring Terminated at 11.5 feet.</b>										
801.4	12.0											
800.4	13.0											
799.4	14.0											
798.4	15.0											
797.4	16.0											
796.4	17.0											
795.4	18.0											
794.4	19.0											
793.4	20.0											
792.4	21.0											
791.4	22.0											
790.4	23.0											
789.4	24.0											
788.4	25.0											
	26.0											

**Boring Logs are for informational purposes only.**  
**Boring includes conditions observed during the site visit and for this particular location.**  
**Soil was visually classified in the field.**  
**\*Depths are considered approximate.**




<b>Project Number: 20-296</b>	<b>Boring Log B-4</b>	
<b>Project Name: KYTC Casey County Maintenance Facility</b>		

Weather: Sunny/80's	Date: September 15, 2020	*Approximate Surface Elevation: 819.7 feet
Location of Boring: As Mapped	Drill Rig: Lonestar LST1G+HDA	
Auger Size: 3.25 ID	Method: Hollow Stem Auger	Hammer Type: Automatic
Groundwater ▼: Not Encountered	Engineer: Eric C. Haley, PE	Driller: Solid Ground

*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
819.7	0.0	AGGREGATE (10 INCHES)		1.0	SS	6, 5, 4,	9					
818.7	1.0											
817.7	2.0	FILL: firm to stiff, brown, FAT CLAY (CH), moist		2.5	SS	3, 8, 7,	15					
816.7	3.0											
815.7	4.0											
814.7	5.0											
813.7	6.0	VERY STIFF to HARD, mottled brown and gray, FAT CLAY (CH), moist with sandstone fragments		7.5	SS	8, 11, 12,	23					
812.7	7.0											
811.7	8.0											
810.7	9.0											
809.7	10.0											
808.7	11.0	<b>Boring Terminated at 14 feet.</b>		10.0	SS	19, 15, 50,	65					
807.7	12.0											
806.7	13.0											
805.7	14.0											
804.7	15.0											
803.7	16.0											
802.7	17.0											
801.7	18.0											
800.7	19.0											
799.7	20.0											
798.7	21.0											
797.7	22.0											
796.7	23.0											
795.7	24.0											
794.7	25.0											
	26.0											


**Boring Logs are for informational purposes only.**  
**Boring includes conditions observed during the site visit and for this particular location.**  
**Soil was visually classified in the field.**  
**\*Depths are considered approximate.**

<b>Project Number: 20-296</b>	<b>Boring Log B-5</b>	 <p><b>SOLID GROUND</b> CONSULTING ENGINEERS, PLLC <small>Engineering Innovation; Providing Solutions to Your Challenges.</small></p>
<b>Project Name: KYTC Casey County Maintenance Facility</b>		

Weather: Sunny/80's	Date: September 15, 2020	*Approximate Surface Elevation: 813.4 feet
Location of Boring: As Mapped	Drill Rig: Lonestar LST1G+HDA	
Auger Size: 3.25 ID	Method: Hollow Stem Auger	Hammer Type: Automatic
Groundwater ▼: 5 feet	Engineer: Eric C. Haley, PE	Driller: Solid Ground

*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
813.4	0.0	ASPHALT (10 INCHES)										
812.4	1.0	AGGREGATE (5 INCHES)		1.0	SS	12, 7, 11,	18			17.1		
811.4	2.0	FILL: stiff to very stiff, brown, FAT CLAY (CH), moist		2.5	SS	7, 6, 7,	13			19.6		
810.4	3.0			2.5	SS	7, 6, 7,	13			19.6		
809.4	4.0			2.5	SS	7, 6, 7,	13			19.6		
808.4	5.0			2.5	SS	4, 7, 7,	14			18.8		
807.4	6.0	VERY STIFF to HARD, mottled brown and gray, FAT CLAY (CH), moist with sandstone fragments		7.5	SS	14, 18, 15,	33			24.4		
806.4	7.0			7.5	SS	14, 18, 15,	33			24.4		
805.4	8.0			7.5	SS	14, 18, 15,	33			24.4		
804.4	9.0			7.5	SS	14, 18, 15,	33			24.4		
803.4	10.0		7.5	SS	9, 9, 10,	19						
802.4	11.0		7.5	SS	9, 9, 10,	19						
801.4	12.0	<b>Boring Terminated at 11.5 feet.</b>										
800.4	13.0											
799.4	14.0											
798.4	15.0											
797.4	16.0											
796.4	17.0											
795.4	18.0											
794.4	19.0											
793.4	20.0											
792.4	21.0											
791.4	22.0											
790.4	23.0											
789.4	24.0											
788.4	25.0											
	26.0											


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**Soil was visually classified in the field.**  
**\*Depths are considered approximate.**

<b>Project Number: 20-296</b>	<b>Boring Log B-6</b>	 <div style="display: inline-block; vertical-align: middle;"> <p style="margin: 0;"><b>SOLID GROUND</b></p> <p style="margin: 0; font-size: small;">CONSULTING ENGINEERS, PLLC</p> <p style="margin: 0; font-size: x-small;">Engineering Innovation; Providing Solutions to Your Challenges.</p> </div>
<b>Project Name: KYTC Casey County Maintenance Facility</b>		

Weather: Sunny/80's	Date: September 15, 2020	*Approximate Surface Elevation: 819.8 feet
Location of Boring: As Mapped	Drill Rig: Lonestar LST1G+HDA	
Auger Size: 3.25 ID	Method: Hollow Stem Auger	Hammer Type: Automatic
Groundwater ▼: 2.5 feet	Engineer: Eric C. Haley, PE	Driller: Solid Ground

*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
819.8	0.0	AGGREGATE (10 INCHES)										
818.8	1.0											
817.8	2.0	FILL: soft to stiff, brown, FAT CLAY (CH), moist										
816.8	3.0											
815.8	4.0											
814.8	5.0	VERY STIFF to HARD, mottled brown and gray, FAT CLAY (CH), moist  with sandstone fragments										
813.8	6.0											
812.8	7.0											
811.8	8.0											
810.8	9.0											
809.8	10.0			10.0	SS	18, 17, 50,	67					
808.8	11.0	<b>Boring Terminated at 11.5 feet.</b>										
807.8	12.0											
806.8	13.0											
805.8	14.0											
804.8	15.0											
803.8	16.0											
802.8	17.0											
801.8	18.0											
800.8	19.0											
799.8	20.0											
798.8	21.0											
797.8	22.0											
796.8	23.0											
795.8	24.0											
794.8	25.0											
	26.0											

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**Boring includes conditions observed during the site visit and for this particular location.**  
**Soil was visually classified in the field.**  
**\*Depths are considered approximate.**

<b>Project Number: 20-296</b>	<b>Boring Log B-7</b>	
<b>Project Name: KYTC Casey County Maintenance Facility</b>		

Weather: Sunny/80's	Date: September 15, 2020	*Approximate Surface Elevation: 822.9 feet
Location of Boring: As Mapped	Drill Rig: Lonestar LST1G+HDA	
Auger Size: 3.25 ID	Method: Hollow Stem Auger	Hammer Type: Automatic
Groundwater ▼: 5 feet	Engineer: Eric C. Haley, PE	Driller: Solid Ground

*Approximate Surface Elevation (ft.)	*Approximate Depth from existing grade (ft.)	Material Description	Symbol	Sample Depth (ft)	Sample Type	Blows per 6 inch increment	SPT "N" Value	Recovery (inches)	Atterberg Limits	Moisture Content (%)	Percent Fines	Approximate Peak Stress (PSF)
822.9	0.0	ASPHALT (8 INCHES)										
821.9	1.0	AGGREGATE (3 INCHES)		1.0	SS	8, 7, 4,	11			21.7		
820.9	2.0	FILL: firm to stiff, brown, FAT CLAY (CH), moist		2.5	SS	3, 2, 3,	5			19.0		
819.9	3.0			4.0	SS	8, 7, 9,	16			23.0		
818.9	4.0			5.0	SS	19, 19, 50,	69			16.0		
817.9	5.0	VERY STIFF to HARD, mottled brown and gray, FAT CLAY (CH), moist with sandstone fragments		7.5	SS							
816.9	6.0			10.0	SS	50,						
815.9	7.0											
814.9	8.0											
813.9	9.0											
812.9	10.0											
811.9	11.0	<b>Boring Terminated at 11.5 feet.</b>										
810.9	12.0											
809.9	13.0											
808.9	14.0											
807.9	15.0											
806.9	16.0											
805.9	17.0											
804.9	18.0											
803.9	19.0											
802.9	20.0											
801.9	21.0											
800.9	22.0											
799.9	23.0											
798.9	24.0											
797.9	25.0											
	26.0											

**Boring Logs are for informational purposes only.**  
**Boring includes conditions observed during the site visit and for this particular location.**  
**Soil was visually classified in the field.**  
**\*Depths are considered approximate.**

## **SECTION 31 10 00 - SITE CLEARING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Clearing and grubbing.
  2. Stripping and stockpiling topsoil.
  3. Removing above- and below-grade site improvements.
  4. Disconnecting, capping or sealing, removing site utilities and abandoning site utilities in place.
  5. Temporary erosion- and sedimentation-control measures.

#### **1.2 DEFINITIONS**

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Refer to Geotech report for thicknesses.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### **1.3 MATERIAL OWNERSHIP**

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site and disposed of in a lawful manner.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Existing Conditions (Optional): Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
1. Use sufficiently detailed photographs, videotape or plans.

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2. If the Contractor elects not to submit documentation, any existing damage adjacent to the project that can be misconstrued as construction damage will be repaired at no cost to the Owner.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

## 1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
- B. All work, work operations, and disposal of debris relative to erosion and sediment control shall be in accordance with all applicable regulations, codes, ordinances and laws relative to pollution of lakes, streams, or wetlands, including Kentucky Best Management Practices for Construction Activities (KY BMP) as published by the Natural Resources and Environment Protection Cabinet, Commonwealth of Kentucky, Frankfort, Kentucky and General Conditions of the KY R10 permit. Refer to SWPPP Plans (C101) for additional information.
- C. The Contractor shall maintain a Maintenance Log Book on site as provided on the last page of this section and fill out to record inspections as noted in the following paragraph.
- D. Erosion and sediment control devices shall be inspected by the Contractor and the results recorded in the Maintenance Log Book at the following intervals:
  1. Every seven (7) days
  2. Prior to a forecast storm
  3. After a 1/2 inch or greater rain event or an event that causes measurable runoff from the site.
  4. At 24-hour intervals during extended rain events, etc.
- E. Erosion control devices shall be repaired immediately if a failure is noted. Silt shall be removed in a timely manner.
- F. Contractor shall provide and maintain a rain gauge on site for monitoring rainfall.

## 1.6 PROJECT CONDITIONS

- A. **The site in its current condition (at time of preparation of bid documents) has an existing building that is fire damaged. The building will be removed by the Owner prior to start of construction. There will be void areas left from the removal of the building foundations. Visit the site to observe the area.**
- B. Obtain and pay for all permits to perform the work required by any and all agencies and authorities having jurisdiction.
- C. Hazardous Materials: In the event the Contractor encounters hazardous material or pollutants on the site which have not been rendered harmless, the Contractor shall

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immediately stop work in the area affected and report the condition to the Architect and Owner. The work in the affected area shall be resumed in the absence of a hazardous material or pollutant, or when it has been rendered harmless. The Contractor shall not be required to perform any work relating to hazardous materials unless specifically addressed in other sections of the Contract Documents.

- D. Contractor shall be required to sign certification statement for Owner to obtain grading permit certifying that they understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.
- E. The Contractor shall file Notice of Intent for storm water discharge (NOI) for the Owner. The Contractor shall post a copy of NOI on site in a conspicuous location. Notice shall be submitted on the Kentucky Pollutant Discharge Elimination System form NOI-SW.
- F. When disturbed soils have been stabilized and construction is completed, the Contractor shall submit a Notice of Termination (NOT) form when the site is ready to close out.
- G. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner, Architect and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner, Architect or authorities having jurisdiction.
  - 3. Coordinate construction deliveries with the Owner so that deliveries do not interfere with morning drop off and afternoon pickup of students.
  - 4. Erect barricades and institute other measures as required for the protection and safety of the public, students, faculty and staff.
- H. Improvements on Adjoining Property: No work shall be performed on adjoining properties unless written approval is issued by the Architect.
- I. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
  - 1. Locate all privately owned utilities for the project site. Employ a utility location service as required.
    - a. Coordinate with Owner Representatives as needed to assist with locating private utilities.
  - 2. Locate all Utility Company, Municipal or other entity owned utility lines.
- J. Do not commence site clearing operations until temporary erosion- and sedimentation-control (BMP's) and plant-protection measures are in place.
  - 1. Not all required erosion control measures can be installed at the start of the project. Install those directly related to site clearing operations.

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2. Install required BMP measures as project develops.
- K. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

### **2.2 SILT FENCE**

- A. Silt fence shall be made of geotextile fabric as detailed on the drawings and manufactured for this type of use.
1. Provide post, stakes and wire reinforcement per the KY BMP requirements.

### **2.3 INLET PROTECTION (Silt Traps)**

- A. Supply all parts as required to protect all inlet types during construction.
- B. The following measures are approved for use as inlet protection measures.
1. Inlet Guard by J.R. Hoe & Sons, [www.jrhoe.com](http://www.jrhoe.com), 1-800-245-5521. The Inlet Guard shall be supplied to protect all storm water inlets.
  2. Dandy Erosion Control Products by Dandy Products, Inc. [www.dandyproducts.com](http://www.dandyproducts.com), 1-800-591-2284. The Dandy Bag, Dandy Curb bag and the Dandy Pop shall be supplied to protect all storm water inlets.
  3. Flex Storm Inlet Filters as manufactured by ADS, [www.ads-pipe.com](http://www.ads-pipe.com), 1-800-821-6710. Provide products and parts as required to protect all storm water inlets.
  4. KYTC Silt Trap Type C and straw bales used in conjunction with silt fence and or filter fabric over the grates.

### **2.4 MISCELANEOUS PRODUCTS**

- A. Type III geotextile fabric per the KYTC Standard Specification for Road and Bridge Construction (843).
1. For use under the concrete wash pits and construction entrance.



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- B. No 2 or No 3 stone per KYTC standards for use on the construction entrance.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
  - 1. Protect Permanent benchmarks from disturbance.
  - 2. Protect temporary layout benchmarks until they can be removed or relocated.
- B. Protect existing site improvements to remain from damage during construction.
  - 1. Layout and clearly define on the ground the limits of construction to insure that no site improvements or vegetation are removed outside the limits of construction.
  - 2. Restore damaged improvements to their original condition, as acceptable to Owner and Architect at no cost to the Owner.
  - 3. Wet down demolition areas as required to prevent dust and dirt from rising.

#### **3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the sediment and erosion control plan (C101) that complies with EPA 832/R-92-005 or Kentucky Best Management Practices for Construction Activities (KY BMP) and other authorities having jurisdiction, whichever is more stringent.
- B. The contractor shall not employ any construction method that violates a rule, regulation, guideline or procedure established by Federal, State or local agencies having jurisdiction over the environmental effects of construction.
- C. Provide temporary seeding, mulching, sodding, etc. on disturbed areas where construction is inactive for 21 days in accordance with KY BMP requirements.
- D. The Contractor shall remove silt and sediment from the site as it accumulates at construction entrances, concrete washout area and erosion checks and repair damaged checks during construction as noted on drawings and elsewhere in this section.
- E. The Contractor shall use any of the acceptable methods necessary to control soil erosion and prevent the flow of sediment to the maximum extent possible. These methods shall include, but not be limited to, the use of silt fence, water diversion structures, temporary re-vegetation, diversion ditches and settling basins.
- F. Excavated soil material shall not be placed adjacent to watercourses/storm drainage structures in a manner that will cause it to be washed away by high water or runoff. Earth berms or diversions shall be constructed to intercept and divert runoff water away from

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critical areas. Diversion outlets shall be stable or shall be stabilized as acceptable. If, for any reason, construction materials are washed away during the course of construction, the Contractor shall remove those materials from the fouled areas as required by the authorities having jurisdiction.

- G. Prohibited construction procedures include, but are not limited to the following:
1. Dumping of spoil material into any streams, wetlands, surface waters, or unspecified locations.
  2. Disposal of trees, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, wash water from concrete trucks or hydro seeders, or any other pollutant in wetlands, surface waters, or unspecified locations.

### 3.3 EXISTING UTILITIES

- A. Refer to Utility specifications for additional information.
- B. Contractor will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing. Coordinate with the Owner prior to disconnecting utilities servicing the existing building or separate structures.
1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- C. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
1. Arrange with utility companies to shut off indicated utilities.
  2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- D. Locate, identify, and disconnect utilities indicated to be abandoned in place.
1. Identify abandoned utilities on the as-built set of plans.
- E. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect and Owner not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Architect's written permission.
- F. Excavate for and remove underground utilities indicated to be removed.
- G. Removal of underground utilities, and related backfilling operations is included in earthwork sections and applicable utility sections.

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1. Backfill voids left from utility removal with engineered fill under areas of fill, pavements, structures/building pad and walks.
- H. Where storm drainage structures, pipes etc, are removed from the site, backfill with engineered fill under the building pad, pavement areas and areas of fill.

### **3.4 CLEARING AND GRUBBING**

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction. NIC. (BY OTHERS)
1. Completely remove all vegetation and organic matter below structures, pavements, walks and areas to receive engineered fill. The site should be clear at time construction begins. Notify the Architect/Owner/User Agency if areas need to be cleared.
  2. Notify the Architect if large root masses are still present at time work begins.
  3. Contractor shall be responsible for removing topsoil and top section of roots within the topsoil.
- B. Fill depressions caused by clearing and grubbing operations with specified soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.
  2. Place engineered fill in voids that will be under fill, pavements, structures and walks.
  3. Any large voids left from tree removal within the project limits (after earth moving operations) will need to be filled with engineered fill.

### **3.5 TOPSOIL STRIPPING**

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depths encountered (refer to Geotechnical Report for approximate topsoil thickness – for borings without a noted topsoil zone – assume 12”) in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Remove subsoil and non soil materials from topsoil, including clay lumps, gravel, and other objects more than 1 inch in diameter; trash, debris, weeds, roots and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 72 inches
  2. Do not stockpile topsoil within protection zones.

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3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. **DO NOT REMOVE TOPSOIL FROM SITE UNTIL ALL LAWN AND PLANTING AREAS HAVE BEEN ESTABLISHED AND TOPSOIL IS NO LONGER NEEDED. EXCESS TOPSOIL MAY BE USED AS BACKFILL UNDER LAWN AREAS AS LONG AS IT IS MIXED WITH OTHER SUITABLE SOILS AND THE SPECIFIED DEGREE OF COMPACTION CAN BE ACHIEVED.**
5. Check with the Owner to see if they want to keep the excess topsoil prior to hauling off site.

### **3.6 SITE IMPROVEMENTS**

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

### **3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Burial of debris on Owner's property will not be permitted.
- C. Separate recyclable materials produced during site clearing from other non recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

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**3.8 SAMPLE MAINTENANCE LOG SHEET**

<b>MAINTENANCE LOG SHEET</b>	Sheet 1 of 1
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Project: ACME Buggy Whip Manufacturing Plant, East Wing Expansion  
 Location: 1234 Old River Road, Frankfort, Ky Contractor: Jones, Jones, and Jones Contractors  
 Insp Date: 12/14/03 Log Date: 12/15/03 By: Bill Smith Title: Superintendent  
 Storm Date: 12-12-03 Duration: 8:30 AM-2:00 PM Amt Rain: 1.5 in.  
 Remarks: Tuesday some sleet, then steady light rain for 2.5 hours; no work

BMP	INSPECTION FREQUENCY	MAINTENANCE ACTION
Silt Fences 1. north boundary 2. along entrance drive 3. around retention basin	1. Weekly 2. After a significant rain event	1. N Boundary surplus silt against SF, cleaned out with backhoe, 12/16 2. Entr. Dr. OK 3. Retn Basin, 30 lf down; replaced, 12/16
Entrance drive	1. Weekly 2. After a significant rain event	1. Replaced some #2 stone, 12/16 2. Scraped, swept surrounding streets where mud tracked
Sediment Basin	1. Bi-weekly	1. Limited siltation in basin; monitor next week for possible cleanout
<h1>SAMPLE</h1>		
Straw Bale Barriers	1. Weekly 2. After a significant rain event 3. Prior to forecast storm	1. Bales around Curb Inlet #4 shifted some by storm, repositioned, retied, 12/15 2. Bales around retention basin outlet pipe clogged with silt; replaced and added another ring of bales, two-high, 12/15
Vehicle storage and fueling station	1. Monthly	1. OK, no maintenance req'd
Vegetative Filter Strip	2. Monthly	1. Minor silt accumulation, but no need to clean out
Erosion Control Blankets	1. Weekly 2. After a significant rain event	1. All fill slopes completed by mass grading OK except N.slope behind administ. office wing; some blankets washed down hill; re-staked, 12/15
Rock check dams	1. Weekly 2. After a significant rain event	1. All RCD's OK

**END OF SECTION 31 10 00**

## **SECTION 31 20 00 - EARTH MOVING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
1. Preparing subgrades for slabs-on-grade, walks, pavements and lawns.
  2. Excavating and backfilling for buildings, structures and foundations.
  3. Base course for asphalt/concrete pavements and walks.
  4. Excavating and backfilling trenches for utilities and pits for buried utility structures.
  5. Existing Conditions of the site after work performed by others.

#### **1.2 DEFINITIONS**

- A. Backfill: Soil material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subgrade and paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil from designated area on site or imported from off-site for use as fill or backfill.
- E. Building Pad: The building pad extends 5 feet outside the entire perimeter of the proposed structures. Extend the building pad 5'-0" out from the outside face of the footing.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

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- G. Fill - Earth: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base course, geogrid, geofabrics or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of the following manufactured products required:
  - 1. Geotextiles.
- B. Samples for Verification: For the following products, in sizes indicated below:
  - 1. Geotextile: 6 by 6 inches

### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and offsite borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D 2487.
  - 2. Laboratory compaction curve according to ASTM D 698.
  - 3. Proof roll reports, compaction testing reports and or letters stating the installed works meet the specified compactions.
- C. Pre-excavation Photographs or Videotape: Refer to Section 31 10 00 Site Clearing.

### **1.5 QUALITY ASSURANCE**

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- B. Pre-excavation Conference: Conduct conference at Project site.

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## 1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
  - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active. Refer to the Utility plans and specifications for additional information.
- C. Removal of existing structures, pavements and other above ground and below ground improvements are covered in Division 31, "Site Clearing."
- D. The site has moderately plastic fat clays and native fat clay soils (CH) present at the site. The existing in-situ soils are suitable for use as fill and engineered fill as long as they meet the requirements outlined below for Satisfactory and Engineered Fill soil materials.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: In-situ fat clay (CH) soils, free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils:
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
  - 2. On site topsoil and the top section of the soils where rootlets extend and any other organic-containing soils are not suitable for use as engineered fill in structural areas. These soils can be used for fill in lawn areas only.
  - 3. Highly plastic soils CH are not suitable for use as engineered fill material under structures and pavements unless they meet the requirements herein.
  - 4. Soils with organic matter are not suitable under structures, pavements or engineered fill.
  - 5. Frozen soils.
  - 6. Construction/demolition debris, asphalt and concrete pavement millings/debris.



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- D. Base Course – Concrete and Asphalt Pavements: Dense graded aggregate (DGA) shall meet the requirements set forth by the Kentucky Transportation Cabinet "Standard Specifications for Road and Bridge Construction."
- E. Base Course – Walks: Dense graded aggregate (DGA) shall meet the requirements set forth by the Kentucky Transportation Cabinet "Standard Specifications for Road and Bridge Construction."
- F. No. 57 Stone. Shall consist of open-graded stone and meet KYTC Standards.
- G. Engineered Fill shall be approved and tested by the onsite inspector prior to placement, after each lift or as determined by the onsite special inspector and Architect and per requirements below:
  - 1. On-site fat clay (CH) soils may be used for engineered fill material and shall meet the requirements below:
    - a. Free of topsoil, organic materials, trash, debris and other deleterious materials.
    - b. Durable rock fragments less than 3 inches in any dimension.
    - c. Soils are within 2 percent of optimum moisture content as determined by ASTM D-698.
    - d. Plasticity index of no greater than 30 percent.
    - e. Liquid Limit of less than 50.
    - f. Standard Proctor maximum dry density over 90.0 pounds per cubic foot.
  - 2. Imported Fill Materials:
    - a. Imported fill materials shall meet the requirements of the on site fat clays to provide a consistent soil profile for the building and pavements to sit on.
  - 3. Naturally or artificially graded mixture Dense Graded Aggregates. **No. 2's and No. 57's should not be used as fill beneath structure foundations.**
- H. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve. For use in foundation drain applications.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

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## 2.2 GEOTEXTILES

- A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
  2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
  3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
  4. Tear Strength: 90 lbf; ASTM D 4533.
  5. Puncture Strength: 90 lbf; ASTM D 4833.
  6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
  7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
  8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Thrace-LINQ, Needlepunched Nonwoven 140EX, 4 ounce fabric or an approved equal.
    - a. For use to separate drainage stone from adjacent soils as identified on the plans and associated details.
    - b. For use to separate pipe backfill stone from the adjacent soils.

## 2.3 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.

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## PART 3 - EXECUTION

### 3.1 EXISTING CONDITIONS

- A. The existing building (walls, floor slabs, building structure, etc) will be removed by Others prior to the start of this project.
  - 1. Refer to the plans for additional information.
  - 2. The General Contractor shall expect large open trenches to be left in place from the removal of the existing building footings.
- B. The existing contaminated soils will be removed by Others prior to the start of this project.
  - 1. Refer to the plans for additional information.
  - 2. The General contractor shall expect to find an approximate 5'x5' by 8' deep hole that has been backfilled with uncompacted crushed stone.
  - 3. It is anticipated that a portion of the stone backfill will be removed during earth moving operations to achieve designed subgrade elevations. Contractor shall segregate the stone from the soil materials.
  - 4. Dig out the remainder of the stone down to undisturbed soils and backfill with engineered fill soil materials to required subgrade elevations. Special Inspector shall oversee and test the installed fill materials.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures, frost, rain and runoff.
- E. Strip and stockpile topsoil within the limits of construction, in location approved by the Architect, on site prior to beginning mass earth moving operations. **Do not haul off or remove topsoil from the site until all areas have been properly filled with topsoil and finished grades have been achieved.**
- F. The combination of heavy construction equipment traffic and excess surface moisture can cause pumping and deterioration of the near surface soils (prepared subgrade).

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1. The site subgrades should be maintained by the contractor by grading out ruts or areas that will collect water. The site subgrades should not be allowed to pond surface water and should be dewatered as necessary.
- G. Any rocks larger than 12 inches in any directions uncovered during excavation should be segregated from the excavated material and hauled off site.
- H. Refer to the plans for locations where finished grades are shown for work installed by others (gravel pavements as identified on plans by KYTC). Establish subgrade elevations for KYTC installed gravel pavements. Coordinate work with KYTC and lawn finished grading to ensure smooth transition between the work.

### **3.3 DEWATERING**

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  1. Positive surface and subsurface drainage should be established at the start of construction, maintained during the work and incorporated into the final design to prevent surface water ponding and saturation of subgrade and in place engineered fill.
  2. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  3. Reroute surface water runoff from the existing uphill area, away from new construction and other areas as required.
  4. Utilize temporary diversion ditches or permanent drainage swales per the grading plans, to direct surface water away from and around the building pad area. Should diversion ditches be needed, provide as required to direct water away from new construction area.
  5. Problems with compaction should be anticipated because the moisture content range necessary for satisfactory compaction should be narrow. The contractor will be required to maintain positive drainage away from the prepared subgrades to prevent degradation to the installed soils/exposed subgrades. Failure to properly dewater the site will result in subgrade failure. Repair to acceptable proof rolls of subgrades will be the responsibility of the contractor to repair at no cost to the Owner.

### **3.4 EXPLOSIVES**

- A. Explosives: Do not use explosives.

### **3.5 EXCAVATION, GENERAL**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
  - 2. Remove rock to lines and grades indicated to permit installation of permanent construction. Refer to Geotechnical Report for approximate rock depths.
  - 3. Removal of existing structures, foundation, basements etc. is covered under Division 31 "Site Clearing."

### **3.6 EXCAVATION FOR STRUCTURES**

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

### **3.7 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.8 EXCAVATION FOR UTILITY TRENCHES**

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line where required.
- B. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
- C. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe where applicable.

### **3.9 SUBGRADE INSPECTION**

- A. Notify Architect when excavations have reached required subgrade.

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- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Remove all loose surface soil, topsoil and other unsuitable materials prior to placement of engineered fill.
- D. When excavations have reached subgrade elevations, proof-roll subgrade below the concrete/asphalt pavements, gravel pavements and engineered fill with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted engineered backfill as directed by the Architect.
  - 4. Proof roll existing subgrades in areas of fill prior to placement of fill material.
  - 5. If the existing subgrade surface becomes unsuitable due to construction traffic, exposure to moisture or other conditions detrimental to soils before or after acceptable proof-rolling, contractor will disk, aerate, scarify the top 12 inches and re-compact to required degree of compaction at no cost to the owner. Proof roll to obtain approval prior to placement of fill.
- E. When excavations have reached subgrade elevations for footings, inspect the exposed bedrock for suitable bearing conditions.
- F. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- G. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### **3.10 UNAUTHORIZED EXCAVATION**

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Use fill materials approved by Architect.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

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### **3.11 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials, excavated satisfactory/unsatisfactory soil materials, topsoil and old fill material without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
  - 2. Stockpile soil materials in a location acceptable to the Architect.
  - 3. This area will need to be prepared to receive stock piled soil materials by striping vegetative cover and topsoil to prevent mixing soil materials.

### **3.12 BACKFILL**

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
  - 8. Removal of loose soil and other unsuitable materials.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.
- C. Backfill voids created from removal of existing structures (foundations, utilities etc) with approved engineered fill.

### **3.13 UTILITY TRENCH BACKFILL**

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

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- D. Backfill voids with satisfactory/engineered fill soil materials (same as soils to be installed) while installing and removing shoring and bracing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### **3.14 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under lawns and planted areas, use satisfactory soil material.
  - 2. Under walks and concrete/asphalt/gravel pavements, use engineered fill soil material.
  - 3. Under footing/foundations, and building pad use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.
- D. At the end of each day or prior to a forecasted rain event, all installed lifts shall be drum rolled smooth to prevent ponding of water and to facilitate water to run off. Surface water shall not be allowed to pond on the surface, in tire ruts or trench excavations.

### **3.15 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within plus or minus (+/-) 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
- B. Problems with compaction should be anticipated because the moisture content range necessary for satisfactory compaction should be narrow. The contractor will be required to maintain positive drainage away from the prepared subgrades to prevent degradation to the installed soils/exposed subgrades. Failure to properly dewater the site will result in subgrade failure. Repair to acceptable proof rolls of subgrades will be the responsibility of the contractor to repair at no cost to the Owner.



### **3.16 COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - 1. All engineered fill within the building pad shall be compacted to 98 percent.
  - 2. All engineered fill placed under asphalt/concrete pavements should be compacted to at least 98 percent.
  - 3. All aggregate base layers should be compacted to a minimum of 95 percent.
  - 4. Under lawn or unpaved areas, compact each layer of backfill or fill soil material to within a range between 85 and 90 percent. If soils compactions are higher than specified, the contractor will be responsible for disking, aerating or spading the soils to a depth of 8" to create a suitable subgrade growing condition for lawns and plants.
  - 5. For utility trenches, compact each layer of initial and final backfill soil material to similar compaction requirements of the soils/finished surface above the utility.
  - 6. All lifts are to be monitored and shall receive field density tests as the lifts are being placed in order to verify that compaction standards are met. Refer to Special Inspections herein.
- D. Soils shall be compacted to ensure the specified bearing capacities are met. Refer to Structural plans and specifications for additional requirements.

### **3.17 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
  - 2. Walks: Plus or minus 1 inch.
    - a. Where ADA (American with Disabilities Act) slope requirements are required, no area shall exceed 2 percent slope in any direction.

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3. Pavements: Plus or minus 1 inch.
  - a. Where ADA (American with Disabilities Act) slope requirements are required, no area shall exceed 2 percent slope in any direction.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.
  1. Refer to the Architectural/Structural Plans and specifications for additional requirements. Adhere to the more stringent requirements.

### 3.18 BASE COURSES

- A. Place base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place base course under pavements and walks as follows:
  1. After excavations have reached designed depths and Geotech Engineer has reviewed subgrades, proceed with work.
  2. Place base course material over subgrade under pavements.
  3. Shape /base course to required crown elevations and cross-slope grades.
  4. Place base course 6 inches or less in compacted thickness in a single layer.
  5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Extend the stone base course for the asphalt pavement a minimum of 6 inches beyond the asphalt base course in areas adjacent to lawn areas.

### 3.19 GEOTEXTILE FILTER FABRICS

- A. Install per manufacturer's written instructions.

### 3.20 SPECIAL INSPECTIONS

- A. Testing Agency: **Owner** will engage a qualified independent geotechnical engineering testing agency to perform Special Inspections testing.
- B. Special inspections are for the building pad area only.
- C. Refer to Structural Plans and the adopted building code special inspection requirements for the State of KY for additional information.

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- D. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- E. Testing agency shall test samples of all imported fill material for use under the building pad to ensure soils meet requirements herein.
- F. The installed engineered fill soils for the building pad should
- G. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 6938, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Building Pad Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 1000 sq. ft. or less of building pad. Building pad area will extend 5 feet beyond the face of the building.
    - a. Each lift under the building pad should be compacted and tested by nuclear density gauge methods prior to placing additional lifts.
    - b. Proof rolling as described in previous sections.
    - c. Dynamic Cone Penetration where required.
  - 2. Foundation Wall Footing Excavation: 1 test for each 50 feet or less of exposed excavated foundation trench length, within the defined building pad area to ensure the exposed soils are suitable for footings to bear on.
  - 3. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 50 feet or less of wall length, within the defined building pad area.
  - 4. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 50 feet or less of trench length, at locations within the defined building pad area.
- H. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

### 3.21 FIELD QUALITY CONTROL

- A. Testing Agency: **Contractor** will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 6938, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

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1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2500 sq. ft. or less of paved area.
    - a. Each engineered fill lift should be compacted and tested by nuclear density gauge methods prior to placing additional lifts. If proof rolling is a suitable alternative this method may be used.
  2. Proof roll where indicated in previous sections.
  3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 100 feet or less of trench length, at locations outside of the building pad area.
  4. Lawn Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 5,000 sq. ft. or less of lawn area.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained

### **3.22 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and re-compact.
  2. The site subgrades should be maintained by the contractor by grading out ruts or areas that will collect water. The site subgrades should not be allowed to pond surface water and should be dewatered as necessary.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

**END OF SECTION 31 20 00**

## **SECTION 31 31 16 - TERMITE CONTROL**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Soil treatment with termiticide at Wood Framed Building (Equipment Shed).

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of termite control product.
  - 1. Include the EPA-Registered Label for termiticide products.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For termite control products, from manufacturer.
- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
  - 1. Date and time of application.
  - 2. Moisture content of soil before application.
  - 3. Termiticide brand name and manufacturer.
  - 4. Quantity of undiluted termiticide used.
  - 5. Dilutions, methods, volumes used, and rates of application.
  - 6. Areas of application.
  - 7. Water source for application.
- D. Warranties: Sample of special warranties.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products from single source.

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## **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
- B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.
- C. Prevent soil treatment from entering the adjacent water drainage swales and pond. Do not allow termiticides to enter the stream protection area.

## **1.6 WARRANTY**

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 SOIL TREATMENT**

- A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
  - 1. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

- B. Proceed with application only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

### **3.3 APPLICATION, GENERAL**

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

### **3.4 APPLYING SOIL TREATMENT**

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
  - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  - 2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
  - 3. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

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- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

**END OF SECTION 31 31 16**



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## **SECTION 32 12 16 - ASPHALT PAVING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Hot-mix asphalt paving.
  - 2. Hot-mix asphalt patching.
  - 3. Paving Seam Geotextile Fabric (For use only were indicated).

#### **1.2 DEFINITIONS**

- A. KYTC: Kentucky Transportation Cabinet.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.
  - 2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
  - 3. Job-Mix Designs: For each job mix proposed for the Work.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.
- B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Paving Fabric material information, and manufacturer's standard information.
  - 1. If utilized on the project. See sections below for additional information.
- E. Field quality-control reports.
  - 1. For proof rolling of the prepared aggregate base course.

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## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the KYTC.
- B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the KYTC for asphalt paving work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
  - 2. If conflicting information between the KYTC standard specifications and this document are found, the more stringent of the 2 shall apply. Notify the Architect for clarification.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
  - 1. Prime Coat: Minimum surface temperature of 60 deg F.
  - 2. Tack Coat: Minimum surface temperature of 60 deg F.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Refer to KYTC standard specifications for additional information and requirements.
  - 1. Please note that testing of the installed asphalt paving thickness and compaction density is required.
- C. Notify Architect if prepared base stone or other conditions are not satisfactory and would adversely affect the asphalt at time of installation for resolution.
- D. Coordinate base bid work with ROW work. Notify Architect if conflicts are found between existing conditions in the ROW/proposed work and base bid work.

## PART 2 - PRODUCTS

### 2.1 BASE MATERIALS

- A. Aggregate Base Course: Refer to Division 31 Section 'Earth Moving' for requirements.

## **2.2 AGGREGATES – ASPHALT PAVING**

- A. General: Use materials and gradations that have performed satisfactorily in previous installations. Materials below shall be per KYTC referenced ASTM and AASHTO current standards.
- A. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- C. Mineral Filler: ASTM D 242/D 242M, rock or slag dust, hydraulic cement, or other inert material.

## **2.3 ASPHALT MATERIALS**

- A. General: Use materials that have performed satisfactorily in previous installations. Materials below shall be per KYTC referenced ASTM and AASHTO current standards.
- B. Asphalt Binder: PG 64-22, and shall meet the requirements for Class III mixtures per KYTC.
- A. Tack Coat: ASTM D 977 emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- B. Water: Potable.

## **2.4 AUXILIARY MATERIALS**

- A. Recycled Materials for Hot-Mix Asphalt Mixes (Optional): Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled materials approved by KYTC and from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Sand: ASTM D 1073, Grade No. 2 or No. 3.
- C. Joint Sealant: ASTM D 6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.
- D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
  - 1. Paving Fabric is not identified for use on the plans and details. Use paving fabric for any trench that is made in installed asphalt base course prior to installing asphalt surface course.

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2. Basis of design: Mirafi MPV 400 paving geotextile fabric as manufactured by Tencate. Or an approved product which is equal and or exceeds the basis of design, by one of the following companies:
  - a. Tensar International Corporation
  - b. Propex Geosynthetics
  - c. Approved equal meeting the minimum qualities of the basis of design.
3. For use on seams where installed base course has been cut.
4. Provide manufacturer's standard roll widths (not less than 24 inches).
5. Install per manufacturer's written requirements.
6. Provide quantities below for each individual job:
  - a. Provide enough linear feet to cover any cuts in the installed asphalt base course prior to installing the asphalt surface course.
  - b. Where directed by Architect to remediate cut asphalt paving.

## 2.5 MIXES

- A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent or more than 30 percent by weight.
  1. Surface Course Limit: Recycled content no more than 10 percent by weight.
  2. Optional. Not required to provide recycled content.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
  1. Provide mixes with a history of satisfactory performance in geographical area where Project is located and per the KYTC.
  2. Base Course: Refer to details for thickness – (KTC CL3 Base 0.75D PG64-22).
  3. Surface Course: 1-1/2 inches (KTC CL3 SURF 0.38D PG64-22).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll compacted aggregate base below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated aggregate base.
  1. Completely proof-roll in one direction, repeating proof-rolling in direction perpendicular to first direction or in opposite direction for narrow areas. Limit vehicle speed to 3 mph.

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2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed By Architect.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
  - D. Verify that storm drainage piping, utility lines and other items requiring a cut or installation below the asphalt surface / overlay course have been completed.
  - E. Verify that pavement underdrains are installed (where noted on the plans) prior to proceeding. These underdrains are important to remove subsurface water from the stone base to help keep the subgrade soils from becoming saturated.

### **3.2 PATCHING NEW ASPHALT BASE**

- A. This applies to trenching new asphalt base course only – cutting finished asphalt surface course will not be allowed.
  1. Before proceeding with cutting the asphalt base course – notify the Architect for approval.
- B. Asphalt Pavement: Saw cut perimeter of patch / trench cut to create a uniform edge and excavate existing pavement section to sound base. Do not undermine existing pavements to remain. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd..
  1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Prior to placing asphalt pavement, provide the minimum aggregate stone subbase and base as shown in the asphalt paving details.
- E. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- F. Provide a paving geotextile over the cut areas to prevent any cracks in the surface course. Extend fabric a minimum of 12” beyond all sides of the cut line.

### **3.3 PAVING GEOTEXTILE INSTALLATION**

- A. For use where indicated above in 3.2.

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- B. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd..
- C. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints a minimum of 6 inches and transverse joints a minimum of 6 inches.
- D. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.
- E. Apply fabric as follows:
  - 1. Minimum of 12" wide strip along saw cut joints in the new asphalt pavement base course.

### **3.4 SURFACE PREPARATION**

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### **3.5 PLACING HOT-MIX ASPHALT**

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt base course in single lift, or in two equal lifts.
  - 2. Place hot-mix asphalt surface course in single lift.
  - 3. Spread mix at a minimum temperature of 250 deg F.
  - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

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1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
  2. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.6 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
1. Clean contact surfaces and apply tack coat to joints.
  2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
  3. Offset transverse joints, in successive courses, a minimum of 24 inches.
  4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints per KYTC standards.
  5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.7 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
1. Average Density: 92 percent of reference laboratory density according to ASTM D 2041, but not less than 90 percent or greater than 94 percent. The average of the cores shall be between 92-94 percent. No individual core value will be less than 90 percent or greater than 96 percent.

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- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### **3.8 INSTALLATION TOLERANCES**

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch.
  - 2. Surface Course: Plus 1/4 inch, minus 1/8 inch.
  - 3. Pavements shall be flush with adjacent existing pavements to remain to ensure proper surface water drainage.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 1/4 inch.
  - 2. Surface Course: 1/8 inch.
  - 3. Areas subject to ADA (American with Disabilities Act) requirements, tolerances shall be such that these areas do not exceed the maximum cross slope in any direction of 2 percent or 1"V in 50'H.

### **3.9 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
  - 1. Testing Agency shall send reports to Contractor, Owner and Architect. If any deficiencies are noted, notify the Architect immediately for resolution.
- B. Proof roll the compacted aggregate stone base course prior to placing asphalt as outlined in previous sections of this specification.



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- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549/D 3549M or as determined by Owner's Testing Agency.
- D. In-Place Density: Testing agency will take samples of compacted pavement according to ASTM D 2041 or as determined by Owner's Testing Agency.
  - 1. In-place density of compacted pavement will be determined as noted below:
    - a. Field density of in-place compacted pavement shall be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726/D 2726M.
    - b. Test each 1,000 sq yds or less of installed pavement or 1 test for each small section of installed pavements.
    - c. Test both asphalt base and surface course.
    - d. If Testing Agency determines core samples need to be taken, coordinate with Architect prior to performing.
    - e. Testing Agency may recommend a different test to determine density – with approval by the Architect.
- E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.
  - 1. Coordinate with Architect prior to repairs.

### **3.10 WASTE HANDLING**

- A. Except for materials indicated or that can be recycled, remove all excavated material from the Project Site and legally dispose in an EPA-approved landfill.

**END OF SECTION 32 12 16**

## **SECTION 32 17 13 - PARKING BUMPERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes wheel stops.

#### **1.2 ACTION SUBMITTALS**

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

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Concrete wheel stops are not acceptable for use on this project.

#### **2.2 PARKING BUMPERS**

- A. Resilient Wheel Stops: Solid, integrally colored, 96 percent postconsumer or commingled postconsumer and preconsumer recycled rubber; UV stabilized; 4 inches high by 6 inches wide by 72 inches long. Provide chamfered corners and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
  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. Checkers Industrial Safety Products, Inc.
    - b. GNR Technologies.
    - c. Plastic Safety Systems, Inc.
    - d. Scientific Developments, Inc.
    - e. Technoflex.
    - f. Traffic Logix.
  2. Color: Black.
  3. Embedded Markings: Molded-in, white reflective markings, permanently inset in exposed surface.
    - a. Use blue reflective markings for accessible parking spaces.

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4. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, 15-inch minimum length.
5. Adhesive: As recommended by wheel-stop manufacturer for adhesion to pavement.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer. Recess head of hardware beneath top of wheel stop.

**END OF SECTION 32 17 13**

## **SECTION 32 17 23 - PAVEMENT MARKINGS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes painted markings applied to asphalt pavement.

#### **1.2 ACTION SUBMITTALS**

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

#### **1.3 QUALITY ASSURANCE**

- A. Use a single source and brand of paint throughout job.

#### **1.4 FIELD CONDITIONS**

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature as recommended by pavement marking manufacturer.

### **PART 2 - PRODUCTS**

#### **2.1 PAVEMENT-MARKING PAINT**

- A. Pavement-Marking Paint: MPI #97, latex traffic-marking paint with a drying time of less than 45 minutes.
  - 1. Color: 4 inch white for all lines except as noted below.
    - a. Color: 4 inch blue for all lines, hatching and international symbols for accessible parking spaces.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

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- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### **3.2 PAVEMENT MARKING**

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for a minimum number of days as required by the paint manufacturer before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

### **3.3 PROTECTING AND CLEANING**

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION 32 17 23**

## **SECTION 32 92 00 - TURF AND GRASSES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Seeding.
  - 2. Turf renovation.

#### **1.2 DEFINITIONS**

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- C. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- D. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- E. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- B. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

#### **1.4 QUALITY ASSURANCE**

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

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## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

## **1.6 PROJECT CONDITIONS**

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
- B. Seed:
  - 1. Spring Planting: March 1 – May 15.
  - 2. Fall Planting: September 1 – October 10.
  - 3. If the anticipated project schedule falls outside the time frame for seeding. Coordinate with Architect and Owner about seeding after substantial completion.
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

## **1.7 MAINTENANCE SERVICE**

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
  - 1. Seeded Turf: 60 days from date of planting completion.
    - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

## **PART 2 - PRODUCTS**

### **2.1 SEED**

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: Seed of grass species as follows, with not less than 98 percent germination, not less than 99 percent pure seed, and not more than 0.5 percent weed seed:
  - 1. Full Sun and Partial Shade: 90 percent blend of three different species of Turf Type Tall Fescue grass – suitable for use in lawn applications with 10% Kentucky Bluegrass.
  - 2. If seeding occurs during the late fall months (after the fall season planting dates), add an additional perennial ryegrass to the specified blend at a rate of 4 pounds per 1,000 sq ft.

### **2.2 INORGANIC SOIL AMENDMENTS**

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  - 1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
  - 2. Provide lime in form of ground dolomitic limestone.
  - 3. Provide quantities as recommended by manufacturer for use on seeded lawns.

### **2.3 FERTILIZERS**

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
  - 2. Spread at rates as recommended by manufacturer for use on seeded lawns.

### **2.4 PLANTING SOILS**

- A. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil



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with the recommended quantities of soil amendments and fertilizers per the soil testing agency.

- B. Spread planting soils to depths as indicated on the drawings.

## **2.5 PESTICIDES**

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

## **2.6 MULCHES**

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

## **2.7 WATER**

- A. Water provided by the owner will be available on site for the contractors use to meet the needs of this section.
  - 1. There are exterior hose bibs for use to water lawns.
- B. The contractor shall furnish all required hoses, equipment, attachments and accessories to incorporate the water into the Work to complete the Work of the Contract.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

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3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

### **3.2 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### **3.3 TURF AREA PREPARATION**

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
    - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    - b. Mix lime with dry soil before mixing fertilizer.
  2. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    - a. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, yet are affected by construction activities, prepare surface soil as follows:
1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.

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2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.
    - a. Apply fertilizer directly to surface soil before loosening.
  3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
  4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
1. Apply topsoil as required to bring grades back to original elevations.
- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.4 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
1. Do not use wet seed or seed that is moldy or otherwise damaged.
  2. Do not seed against existing trees.
- B. Sow seed at a total rate of 6 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
  2. Straw that is loose and blows freely around on the site will need to be replaced with new straw to keep the seeded areas protected.
- E. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations.
- F. Sow seed prior to placing erosion control blankets or mats.

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### **3.5 TURF RENOVATION**

- A. Renovate existing turf.
- B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
  - 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
  - 2. Install new planting soil as required.
- C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- E. Mow, dethatch, core aerate, and rake existing turf.
- F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- I. Apply sod as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

### **3.6 TURF MAINTENANCE**

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
  - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
  - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  - 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

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- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
  - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  - 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
- D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

### **3.7 SATISFACTORY TURF**

- A. Turf installations shall meet the following criteria as determined by Architect:
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

### **3.8 CLEANUP AND PROTECTION**

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove nondegradable erosion-control measures after grass establishment period.

**END OF SECTION 32 92 00**

## **SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
1. HDPE Drainage Piping.
  2. Stormwater Inlets.
  3. Grates.
  4. Perforated Pipes and Mitered Drain Covers.
  5. Downspout Boots.

#### **1.2 DEFINITIONS**

- A. HDPE: High Density Polyethylene plastic.
- B. RCP: Reinforced Concrete Pipe
- C. KYTC: Kentucky Transportation Cabinet.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Gravity-Flow, Nonpressure, Drainage-Piping Soil Type N-12. Pipe joints shall be watertight, unless otherwise indicated.
1. All piping shall be solid wall unless otherwise noted on the plans.
  2. Refer to Division 33, Section 'Subdrainage' for perforated piping requirements.

#### **1.4 SUBMITTALS**

- A. Product Data: For the following:
1. Special pipe fittings.
  2. Stormwater Inlets.
  3. Grates for Inlets
  4. Piping.
  5. Concrete Structures.
  6. Downspout Boots.
- B. Shop Drawings: For the following:

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1. Stormwater Inlets/Manholes: Include plans, rim/invert elevations (**match plan specified elevations – If submittals do not match plan elevations, they will be returned**), sections, details, frames, covers, and grates.
2. Trench Drains and grates.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic stormwater inlets, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes and precast structures according to manufacturer's written rigging instructions.
- D. Handle stormwater inlets according to manufacturer's written rigging instructions.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:
  1. Advanced Drainage Systems "ADS".
  2. Hancor.
  3. Prinsco.
  4. KYTC Approved Pre-Cast Manufacturer.

### **2.2 PIPING MATERIALS**

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.
- B. Joints, fittings and related pieces etc. shall be standard units as manufactured for the designed system.
- C. All pipes are to be solid, dual-wall, smooth waterway without perforations.
  1. Provide perforated pipes where indicated on the plans (foundation drain).

### **2.3 HDPE PIPE AND FITTINGS (SOLID WALL)**

- A. Corrugated HDPE Drainage Pipe and Fittings NPS 6 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

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1. Watertight Couplings: HDPE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
  2. Pipe shall be dual walled.
- B. Corrugated HDPE Pipe and Fittings NPS 8 to NPS 60: AASHTO M 294M, Type S, with smooth waterway for coupling joints.
1. Watertight Couplings: HDPE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
  2. Pipe shall be dual walled.

## 2.4 CONCRETE PIPE AND FITTINGS

- A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).
1. Bell-and-spigot ends and sealant joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant.
  2. Class III pipe.

## 2.5 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated HDPE Pipe and Fittings:
1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
  2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
  3. Couplings: Manufacturer's standard, band type.
- B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

## 2.6 STORMWATER INLETS

- A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth and size indicated, with provision for sealant joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
  2. Riser Sections: 4-inch minimum thickness, diameter to match inlet and grate size, and lengths to provide depth indicated.
  3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
  4. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.



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5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
  6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match indicated size of the frames and grates. These are to be used to raise the grate to provide a minimum of 8 to 12 inches of DGA cover over the concrete structure.
  7. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.
- B. Grates: Cast iron grates meeting dimensions, opening pattern, free area, and other attributes approved for use in traffic, sized to fit inlet.
1. Grates sized to fit the inlets as specified on the plans. Grates shall be rated for heavy duty traffic.

## 2.7 PIPE OUTLETS

- A. Headwalls:
1. Headwall: Construction shall be in accordance with drawings. Provide impact blocks on each headwall: minimum of 3.
  2. Stone Rip-Rap: Meeting State DOT specifications, and unless noted otherwise on drawings, shall have a median stone size of 6 inches. All rip-rap shall be installed over a medium weight non-woven geotextile fabric.
  3. Refer to plans for headwall type.

## 2.8 FLAT PANEL DRAINS – OPTIONAL FOR USE AS FOUNDATION DRAIN.

- A. Basis of Design: Multi-Flow 1" by 6" flat panel drains as manufactured by Multi-Flow.
1. Available manufacturers:
    - a. ADS – Advanedge.
    - b. Multi-Flow.
  2. The panel shall be a three dimensional rigid HDPE core surrounded by and bonded to a non-woven, needle punched 4 oz. geotextile fabric.
  3. Furnish panel drain system's standard fittings as required to connect to the storm drainage system.

## 2.9 CLEANOUTS

- A. PVC Cleanouts (use in lawn areas): PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

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1. Available Manufacturers:
  - a. Advanced Drainage Systems (ADS).
  - b. Prinsco.
  - c. Zurn Industries, Inc.

B. Provide concrete collar as shown on the plan and details.

## **2.10 DOWNSPOUT BOOTS**

A. Downspout Boots:

1. Cast iron downspout boots shall be N-Series as manufactured by J.R. Hoe and Sons or an approved equal meeting the requirements below.
  - a. Boot shall be a maximum of 16 inches tall. Refer to details for additional information.
  - b. Size to match downspout. Reducing/increasing the downspout size to fit the boot will not be acceptable.
  - c. Refer to Architectural plans for exact quantity and location of the downspouts.
    - 1) Only provide for the downspouts that are in lawn areas.
  - d. Do not provide the brass cleanout. As majority of the boot is buried.
2. Downspout boots are to be shipped to the job site with a factory applied light gray primer.
  - a. Paint the downspout boots with 2 coats of finish prior to installation. Architect to provide color.
  - b. Coordinate with the Architect if masonry protrusions, precast units or any other building element prevents the downspout boots from being set flush with the face
  - c. Paint the backside of the downspout boot prior to installing.

## **2.11 MITERED DRAIN COVER**

- A. Mitered Drain Cover – Provide 4 inch mitered drain pipe covers as manufactured by Mitered Drain Inc. 707-620-0606 or an approved equal at locations indicated on plans for day lighted subdrainage pipes. Install per manufacturer's written recommendations.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."
- B. Follow details, specifications and manufacturer's written instructions.

#### **3.2 PIPING INSTALLATION**

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install stormwater inlets and or manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into proposed sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure drainage piping according to the following:
  - 1. Install piping pitched down in direction of flow, at minimum slope of 1/2 percent, unless otherwise indicated.
  - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
  - 3. Install piping with 24-inch minimum cover, unless otherwise indicated.
  - 4. Install piping below frost line.
  - 5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

#### **3.3 PIPE JOINT CONSTRUCTION**

- A. Follow piping manufacturer's written instructions for joint construction.
- B. Join gravity-flow, nonpressure drainage piping according to the following:

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1. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
2. Join dissimilar pipe materials with nonpressure-type flexible couplings.

### **3.4 STORMWATER INLET AND OUTLET INSTALLATION**

- A. Construct drains to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.
- C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- D. Install boots as shown on the details. Provide shims and or blocking to set the boot away from the face of the concrete foundation wall. This will allow the bell of the boot to clear the building's metal wall panels system.

### **3.5 IDENTIFICATION**

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  1. Use warning tape over ferrous piping.
  2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### **3.6 FIELD QUALITY CONTROL**

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
- B. Test new piping systems for leaks and defects.
- C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### **3.7 CLEANING**

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.
- B. Remove debris from catch basins, manholes, pipes and headwalls after flushing storm system.

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**END OF SECTION 33 41 00**

# KYTC MAINTENANCE FACILITY CASEY COUNTY - LIBERTY, KENTUCKY

FOR THE  
**COMMONWEALTH OF KENTUCKY**  
ANDY BESHEAR, GOVERNOR

**FINANCE AND ADMINISTRATION CABINET**  
DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES  
DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION  
FRANKFORT, KENTUCKY  
HOLLY M. JOHNSON, SECRETARY

**KENTUCKY TRANSPORTATION CABINET**  
JIM GRAY, SECRETARY

ACCOUNT NO.609-C9NW-Z001-A10

12/16/2020



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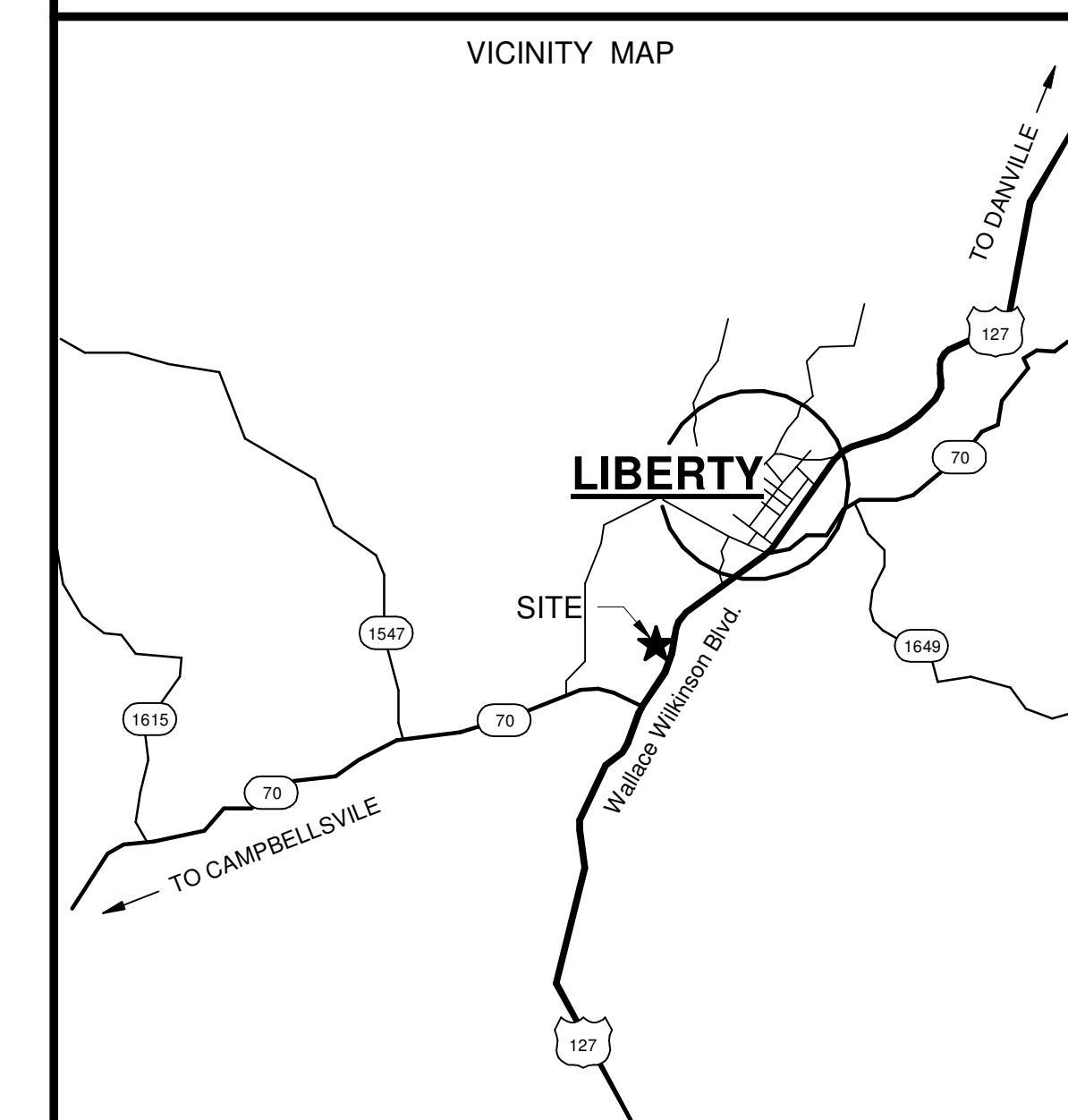
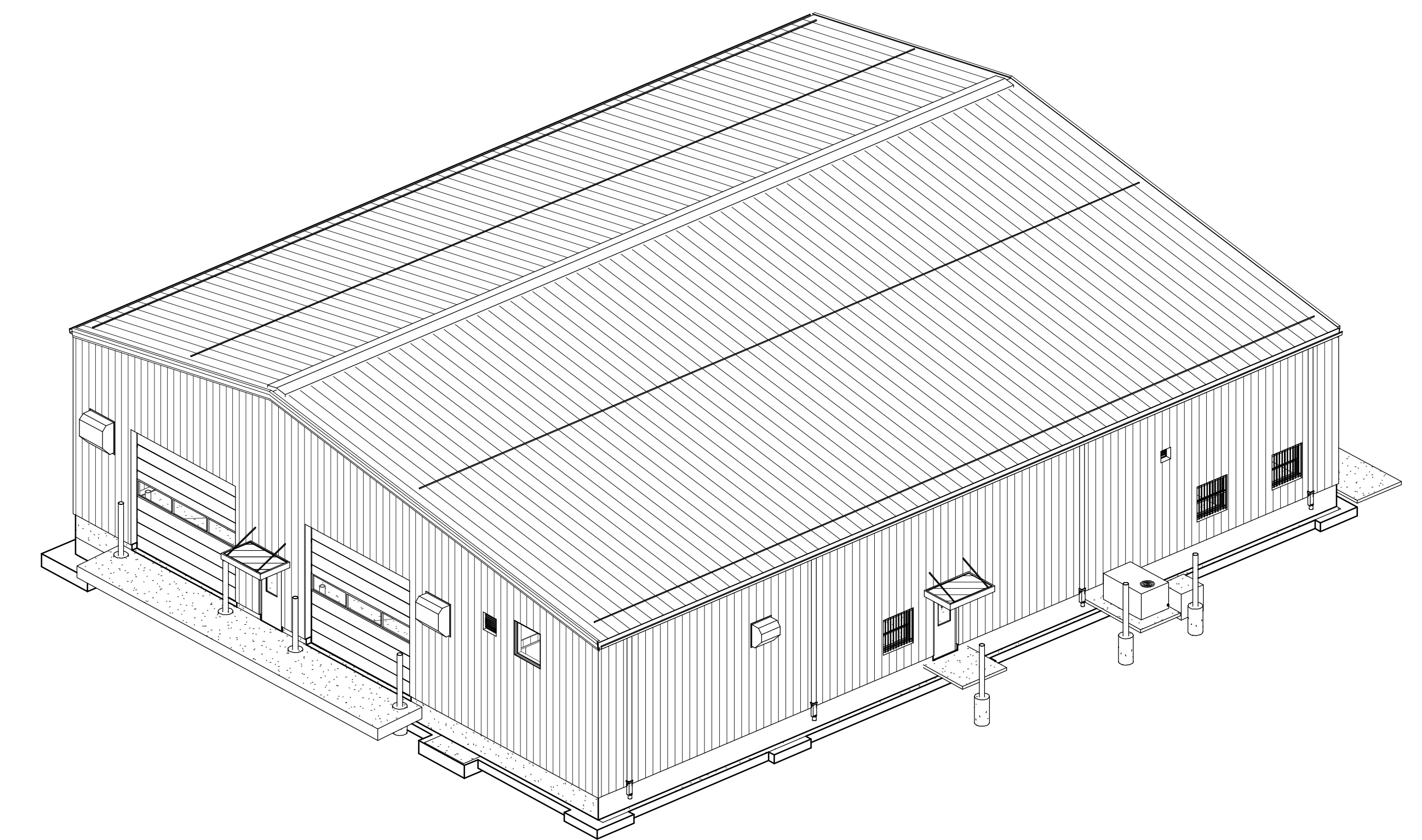
2224 Young Drive Lexington, KY 40505 Phone: 859-543-0933 Fax: 859-543-0733



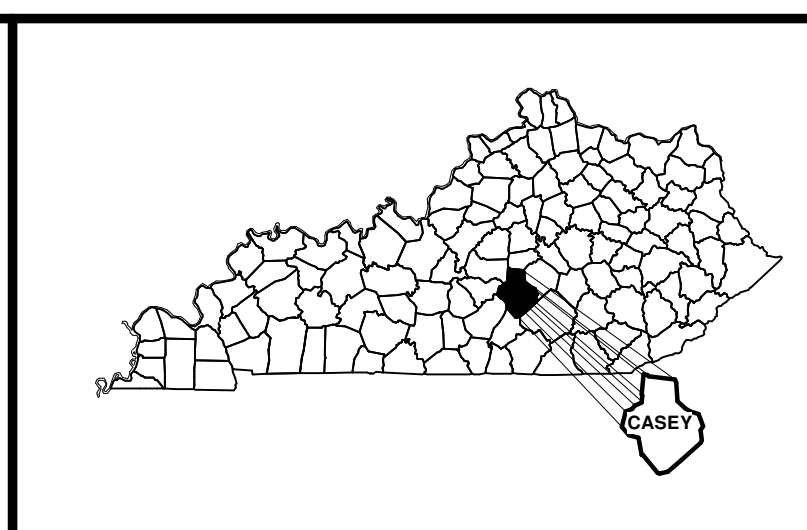
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3264 Lochness Drive  
Lexington, Kentucky 40517  
(859) 271-3246

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CASEY COUNTY  
MAINTENANCE FACILITY  
1090 S. WALLACE WILKINSON BLVD.  
LIBERTY, KY. 42539



DRAWING INFORMATION		KYTC MAINTENANCE FACILITY COUNTY - LIBERTY, KENTUCKY		CASEY
A & E FILE NO.	2011	TITLE SHEET		DRAWING NO.
DRAWING DATE	12/16/20	ACCOUNT NO.		G000
DRAWN BY	NICK	609-C9NW-Z001-A10		DECA LOG #
CHECKED BY	LSJ	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		A1C-8629
PHASE	C	RTA DATE		DATE
		12/16/2020		12/23/20
28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859-273-3700 / FAX 859-271-6602		APPROVED FOR PROGRAM CONCEPT ONLY		DATE:
DIVISION OF ENGINEERING		APPROVED FOR PROGRAM CONCEPT ONLY		DATE:



MATERIAL PATTERNS IN DETAIL / SECTION	
<b>MISCELLANEOUS</b>	
S.A.T. CEILING	
SOLID SURFACE COUNTERTOP	
TACKABLE SURFACE	
TERRAZZO	
WEEP PROTECTION	
<b>EARTH</b>	
CRUSHED STONE / D.G.A.	
EARTH	
SELF COMPACTING FILL	
SOLID ROCK	
<b>WOOD</b>	
WOOD ENDGRAIN	
PLYWOOD	
WOOD BLOCKING	
<b>INSULATION / WALL BOARD</b>	
CONCRETE BACKER BOARD	
E.I.F.S.	
GYPSUM BOARD	
RIGID INSULATION	
BATT INSULATION	
<b>METAL</b>	
ALUMINUM	
STEEL	

MATERIAL PATTERNS IN PLAN	
ASPHALT	
BRICK	
C.M.U.	
C.M.U. - FIRE WALL	
CONCRETE - PAVING	
CONCRETE - SIDEWALK	
DEMOLITION	
E.I.F.S.	
GLAZED TILE	
GYPSUM BOARD	
GYPSUM BOARD / STUD WALL	
ASPHALT - TOP COAT	
CONCRETE FLOOR SLAB	
SOD	
TOILET PARTITION	

WALL TYPES	
	BRICK
	CONCRETE UNIT MASONRY
	CAVITY WALL
	METAL STUD AND GYPSUM
	CONCRETE

ABBREVIATIONS	
A.F.F.	ABOVE FINISH FLOOR
ARCH.	ARCHITECT OR ARCHITECTURAL
AVG.	AVERAGE
B.C.	BASE CABINET
B.L.D.G.	BUILDING
BM	BENCHMARK
B.M.	BENCHMARK
BRG.	BEARING
BRD.	BOARD
BSMT.	BASEMENT
C.C.	CENTER TO CENTER
C.I.	CAST IRON
C.I.B.	CAST IRON BOOT
C.J.	CONSTRUCTION JOINT
C.L.	CENTER LINE
C.L.	CENTER LINE
CL.	CLEAR
COL.	COLUMN
CONC.	CONCRETE
C.M.U.	CONCRETE MASONRY UNIT
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
CONTR.	CONTRACTOR
D.B.	DRAWER BASE
DEMCO.	DEMOLITION
DET.	DETAIL
DIA.	DIAMETER
DIM.	DIMENSION
DR.	DOOR
D.S.	DOWNSPOUT
DWG.	DRAWING
E.A.	EACH
E.I.F.S.	EXTERIOR INSULATED FINISH SYSTEM
E.J.	EXPANSION JOINT
ELEC.	ELECTRIC OR ELECTRICAL
ELEV.	ELEVATION
E.W.C.	ELECTRIC WATER COOLER
EQ.	EQUAL
ENG.	ENGINEER
EXISTG.	EXISTING
EXT.	EXTERIOR
FAB.	FABRICATED
F.E.	FIRE EXTINGUISHER
F.F.	FINISHED FLOOR
FT. OR .	FEET
FIN.	FINISH
FLR.	FLOOR
FLUOR.	FLUORESCENT
F.P.	FIREPROOF
FURN.	FURNISH
F.V.	FIELD VERIFY
GA.	Gauge
GEN.	GENERAL
GYP.	GYPSUM
HDW.	HARDWARE
HDWD.	HARDWOOD
H.	HEIGHT
HT.	HEIGHT
HOT.	HEIGHT
H.C.	HOLLOW CORE
HORIZ.	HORIZONTAL
I.D.	INSIDE DIAMETER
I.N. OR .	INCH
INSUL.	INSULATION
INT.	INTERIOR
J.B.E.	JOIST BEARING ELEVATION
K.J.	KEYED JOINT
LAV.	LAVATORY
LTG.	LIGHTING
LN.	LINEAR
L.	LENGTH
M.B.	MARKER BOARD
MFR.	MANUFACTURER
MFD.	MANUFACTURED
M.O.	MASONRY OPENING
MATL.	MATERIAL
MAX.	MAXIMUM
MECH.	MECHANICAL
MIN.	MINIMUM
MISC.	MISCELLANEOUS
MUL.	MULLION
NOM.	NOMINAL
N.I.C.	NOT IN CONTRACT
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
OPG.	OPENING
OPP.	OPPOSITE
PL. OR .	PLATE
P.LAM.	PLASTIC LAMINATE
PLY.	PLYWOOD
P.T.M.	PART TO MATCH
QTY.	QUANTITY
R.	RADIUS
R.C.P.	REINFORCED CONCRETE PIPE
REF.	REFERENCE
REIN.	REINFORCING
REQD.	REQUIRED
REV.	REVISED OR REVISION
RM.	ROOM
R.O.	ROUGH OPENING
S.A.T.	SUSPENDED ACOUSTICAL TILE
S.B.	SINK BASE
SCH.	SCHEDULE
SECT.	SECTION
S.F.	SQUARE FEET
S.G.T.	STRUCTURAL GLAZED TILE
SHT.	SHEET
SIM.	SIMILAR
S.I.I.	STEEL JOIST INDUSTRY
SPEC'S.	SPECIFICATIONS
SO. FT.	SQUARE FEET
S.S.	STAINLESS STEEL
STD.	STANDARD
STL.	STEEL
STR.	STRUCTURAL
SUSP.	SUSPENDED
SYS.	SYSTEM
T.B.	TACK BOARD
T.J.	TOOLED JOINT
T.O.F.	TOP OF FOOTING
T.O.G.	TOP OF GRATE
T.O.M.	TOP OF MASONRY
TEMP.	TEMPORARY
T&G.	TONGUE AND GROOVE
TRD.	TREAD
T.S.	TACK STRIP
T.W.U.	TEACHER'S WARDROBE UNIT
TYP.	TYPICAL
UNF.	UNFINISHED
V.T.R.	VENT THROUGH ROOF
VERT.	VERTICAL
V.C.T.	VINYL COMPOSITION TILE
W.	WIDTH OR WIDE
W.	WITH
W.C.	WALL CABINET
WD.	WOOD
W/O.	WITHOUT
WP.	WATERPROOF
WP.	WEATHERPROOF

ARCHITECTURAL SYMBOLS	
SHEET NOTE	
DEMOLITION NOTE	
WINDOW TYPE DESIGNATION	
DOOR NUMBER	
ACCESSORY TYPE DESIGNATION	
ELEVATION BENCHMARK	
BORING LOCATION	
CONTROL JOINT	
EXPANSION JOINT	
ROOM DESIGNATION	
OCCUPANT LOAD	
DETAIL REFERENCE	
SECTION REFERENCE	
ELEVATION REFERENCE	
REVISION	
CENTER LINE	
SPOT ELEVATION	
VIEW REFERENCE (MATCHLINE)	

FOR USE BY DEPARTMENT OF HOUSING, BUILDINGS AND CONSTRUCTION ONLY.

**BUILDING CODE - 2018 KENTUCKY BUILDING CODE**

**BUILDING DESIGN INFORMATION**

OCCUPANCY CLASSIFICATION	MIXED USE, NON SEPARATED BUSINESS / STORAGE
BUILDING AREA	
BUSINESS USE (GROUP B)	1,445 S.F.
STORAGE USE (GROUP S-1)	6,555 S.F.
TOTAL FIRST FLOOR AREA	8,000 S.F.
CONSTRUCTION TYPE	IIB

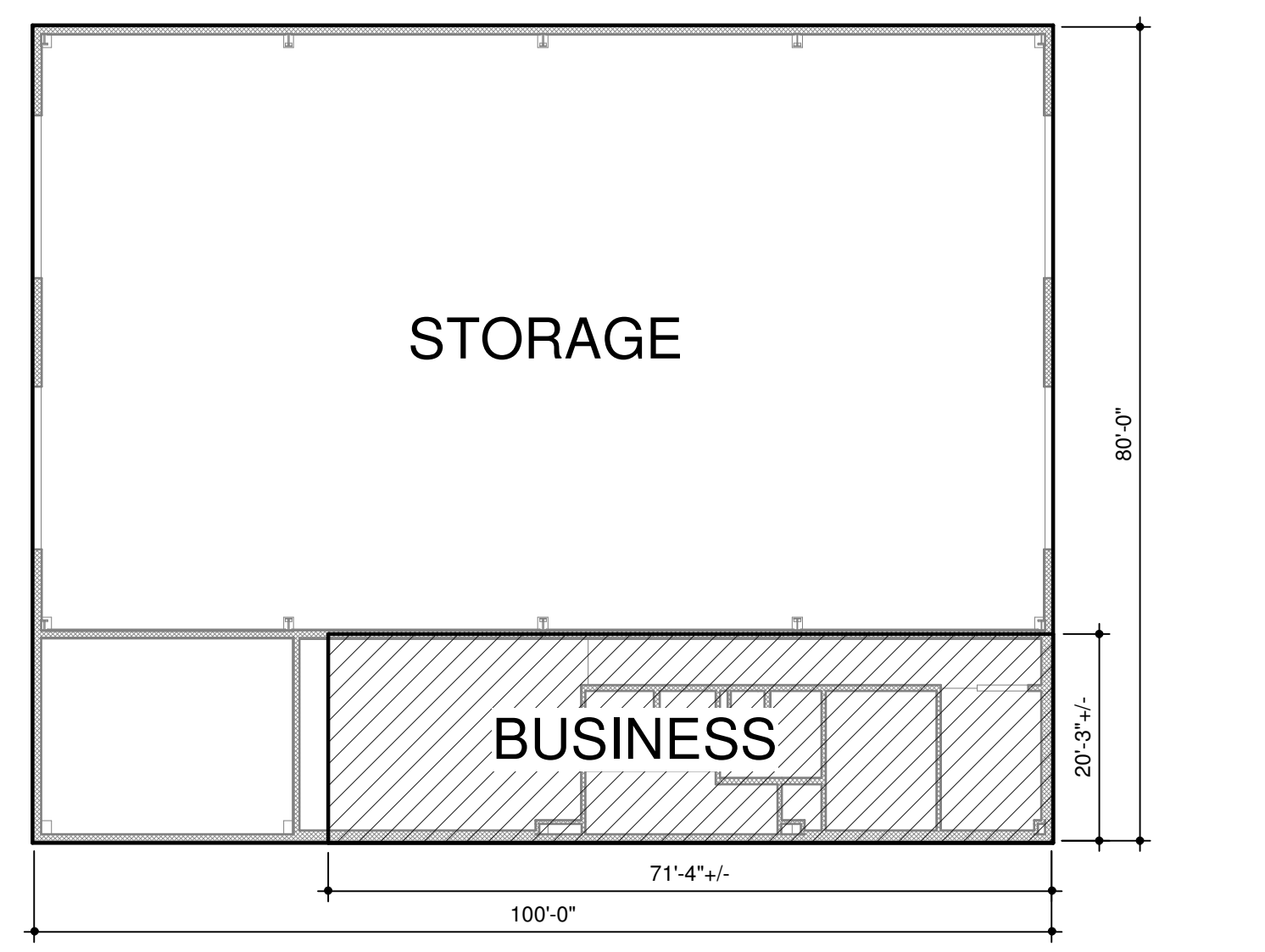
SEE STRUCTURAL SHEETS FOR DESIGN LOADS (FLOOR, ROOF AND WIND), EARTHQUAKE DESIGN DATA AND DESIGN STRESSES.

**ALLOWABLE HEIGHT AND AREA CALCULATIONS**

GENERAL HEIGHT AND AREA	AREA 1
OCCUPANCY CLASSIFICATION	MIXED USE B & S-1
ACTUAL FLOOR AREA (LARGEST FLOOR)	8,000 S.F.
ACTUAL BUILDING HEIGHT	27 FT
ALLOWABLE BUILDING HEIGHT	55 FT
ALLOWABLE NUMBER OF STORIES	2
SPRINKLER SYSTEM INSTALLED	NO
SPRINKLER SYSTEM TYPE	N/A

**AREA MODIFICATIONS**

TOTAL PERIMETER	P	360 FT
TOTAL OPEN PERIMETER	F	360 FT
WIDTH OF OPEN SPACE (WEIGHTED AVERAGE)	W	30 FT
AREA INCREASE DUE TO FRONTAGE	I <sub>f</sub>	75%
AREA INCREASE DUE TO SPRINKLER	I <sub>s</sub>	0%
MINIMUM CONSTRUCTION TYPE		IIB
TABULAR AREA (FROM TABLE 506.2) B, TYPE 2B - 23,000 S-1, TYPE 2B - 17,500	A <sub>t</sub>	17,500 SF
ALLOWABLE AREA PER STORY	A <sub>a</sub>	30,625 SF
ACTUAL AREA (LARGEST STORY)		8,000 SF
IS MAXIMUM ALLOWABLE AREA EXCEEDED?		NO



**USE CLASSIFICATION PLAN**  
SCALE: 1/16" = 1'-0"

DRAWING INFORMATION		LEGENDS, SYMBOLS AND BUILDING DATA		DRAWING NO.
A & E FILE NO.	2011	ACCOUNT NO.	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	G001
DRAWING DATE	12/16/20	PHASE	C	AS-BUILT DATE
DRAWN BY	NICK	RTA DATE	12/16/2020	DECA LOG #
CHECKED BY	LSJ			A1C-8630
RTA DATE	12/16/2020			
28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859.273.3700 / FAX 859.271.6605				
REVISION HISTORY OF THIS DRAWING		REVISION HISTORY OF THIS DRAWING		
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE	
1		5		
2		6		
3		7		
4		8		



"MATCH LINE" - SEE SHEET 2 -

- \*NOTES:**
1. ALL STRUCTURES SHOWN ARE EXISTING AT THE TIME OF SURVEY.
  2. NO DEED FOR RIGHT OF WAY RECOVERED THIS SURVEY.
  3. NO CEMETERY WAS VISIBLE ON TRACT BEING SURVEYED.
  4. UTILITIES SHOWN ARE APPROXIMATE. BASED UPON INFORMATION SUPPLIED BY KYDOT STAFF AND OBSERVATION AT TIME OF SURVEY FOR TOPOGRAPHY AND BOUNDARY.

**LAND SURVEYORS CERTIFICATE**

I HEREBY CERTIFY THAT THIS BOUNDARY SURVEY AND PLAT WERE MADE UNDER MY SUPERVISION AND THAT THE ANGULAR AND LINEAR MEASUREMENTS OF THE BOUNDARY LINES AS WITNESSED BY MONUMENTS SHOWN HEREON ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. THIS SURVEY AND PLAT MEET OR EXCEEDS THE MINIMUM STANDARDS OF GOVERNING AUTHORITIES.

**FLOOD HAZARD STATEMENT**

THIS PROPERTY IS NOT LOCATED IN THE 100 YEAR FLOOD HAZARD AREA AS SHOWN ON FIRM MAP No. 21045C0237D TO THE BEST OF MY KNOWLEDGE AND BELIEF. FIRM MAP DATED 07-07-2009.

**REFERENCE BEARING**

THE REFERENCE BEARING FOR THIS SURVEY WAS TAKEN FROM A GPS BASE LINE-SETUP ON AUGUST 13, 2020. THE BEARING OF THIS LINE IS S80°07'36"E (SHOWN HEREON BETWEEN CP#203 & TBM "A") SINGLE ZONE - KY STATE PLANE COORDINATE - NAD 1983.

**STATEMENT ON PRECISION & MEASUREMENTS**

AN RTK-GPS UNIT WAS USED TO DETERMINE GRID NORTH, COMPLETE PARTS OF THE TRAVERSE AND TO RECOVER BOUNDARY MONUMENTS FOR THIS SURVEY. A SOKKIA GRV3 (DUAL FREQUENCY) RECEIVER UTILIZING REAL TIME VRS CORRECTIONS FROM THE KYDOT CORS NETWORK WAS USED. THE NAD 83 - HORIZONTAL KENTUCKY SINGLE ZONE (1600), WGS 84 ELLIPSOID WITH GEOID MODEL G2012BUT (1) WAS USED ON THIS SURVEY. RELATIVE POSITIONAL ACCURACY FOR THIS SURVEY MEETS OR EXCEEDS THE (+/-) 0.10' + 200 PPM REQUIRED FOR THE RURAL SURVEY CLASSIFICATION. ALL BEARINGS & DISTANCES SHOWN HEREON ARE MEASURED VALUES OBTAINED THIS SURVEY THRU THE USE OF A TOTAL STATION & DESCRIBED GPS UNIT. TRAVERSE WAS NOT ADJUSTED.

**EXCEPTIONS TO SURVEY**

THIS SURVEY IS SUBJECT TO ALL RIGHTS OF WAY, EASEMENTS, CONVEYANCES AND RESTRICTIONS THAT A TITLE EXAMINATION WOULD REVEAL. NO TITLE REPORT WAS PROVIDED TO THE SURVEYOR FOR THIS SURVEY. IT IS CLIENTS RESPONSIBILITY TO DISCOVER & REPORT RECORDED AND UNRECORDED MATTERS THAT AFFECT THIS SURVEY.

**TOPOGRAPHIC SURVEY**

CONDITIONS SHOWN REPRESENT THE SITE ON SEPTEMBER 9, 2020. CONTRACTOR RESPONSIBLE TO CHECK GRADES DURING "SITE VISIT". NO GUARANTEE SHALL BE MADE FOR ANY DISCREPANCIES THAT MAY HAVE TAKEN PLACE BETWEEN TIME OF TOPO & TIME OF CONSTRUCTION.

**SURVEY CLASSIFICATION**

THIS SURVEY AND PLAT MEETS OR EXCEEDS THE TECHNICAL STANDARDS FOR A CLASS "B" SURVEY FOR RURAL LAND IN ACCORDANCE WITH 201 KAR 18.150.

**MONUMENTS**

ALL PROPERTY CORNERS HAVE BEEN CALCULATED AND REFERENCED AS INDICATED THIS SURVEY AND DESCRIBED HEREON:

- 1/2" REBAR (FOUND) - CAP STAMPED "BROWN-3746"
- CALCULATED BOUNDARY CORNER
- 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3757" BEING S80°58'08"W @ 40.69' FROM TRUE CORNER.
- 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3757" BEING N45°15'45"W @ 38.55' FROM TRUE CORNER.
- 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3757" BEING N66°46'08"E @ 39.96' FROM TRUE CORNER.
- 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3757" BEING S24°02'02"E @ 50.62' FROM TRUE CORNER.

**KYDOT TITLE SOURCE**

BEING PARCEL #1 AS DESCRIBED IN DEED BOOK 79, PAGE 482 AS RECORDED IN THE OFFICE OF THE CLERK IN CASEY COUNTY, KENTUCKY. DATED APRIL 3, 1969.

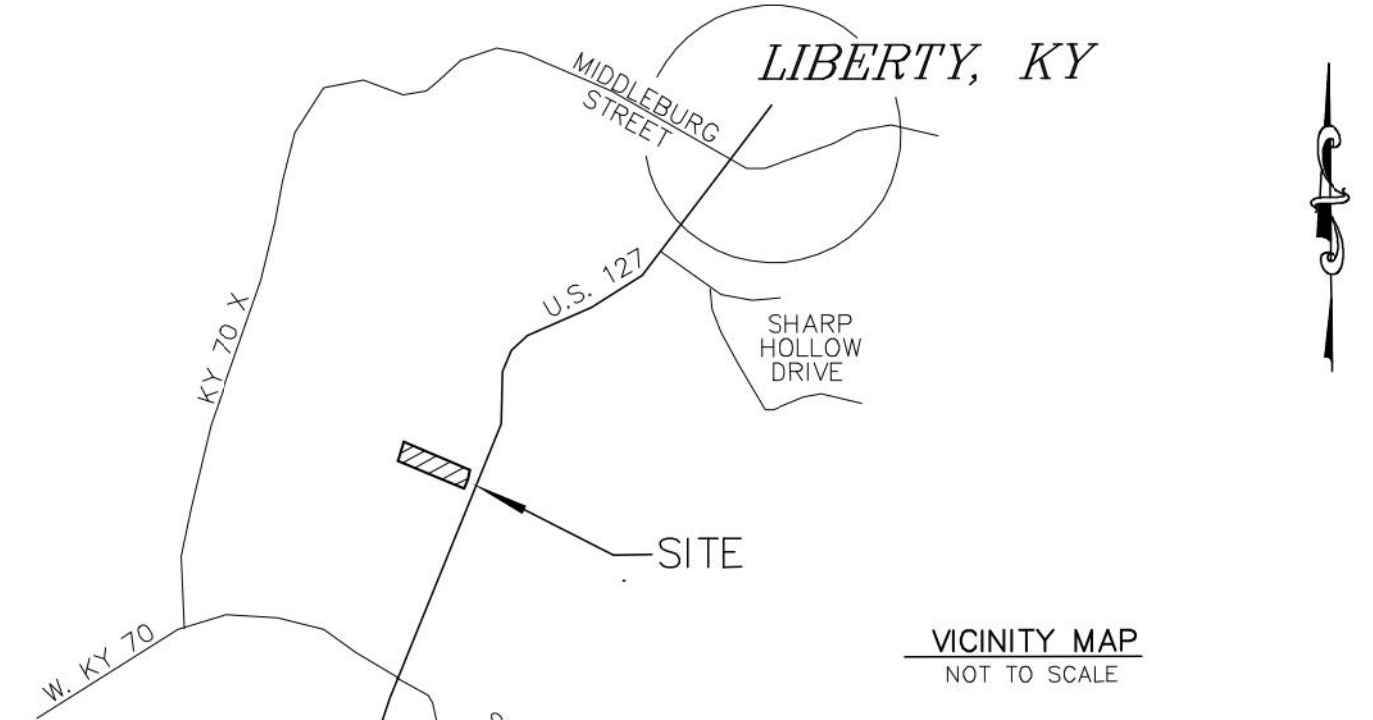
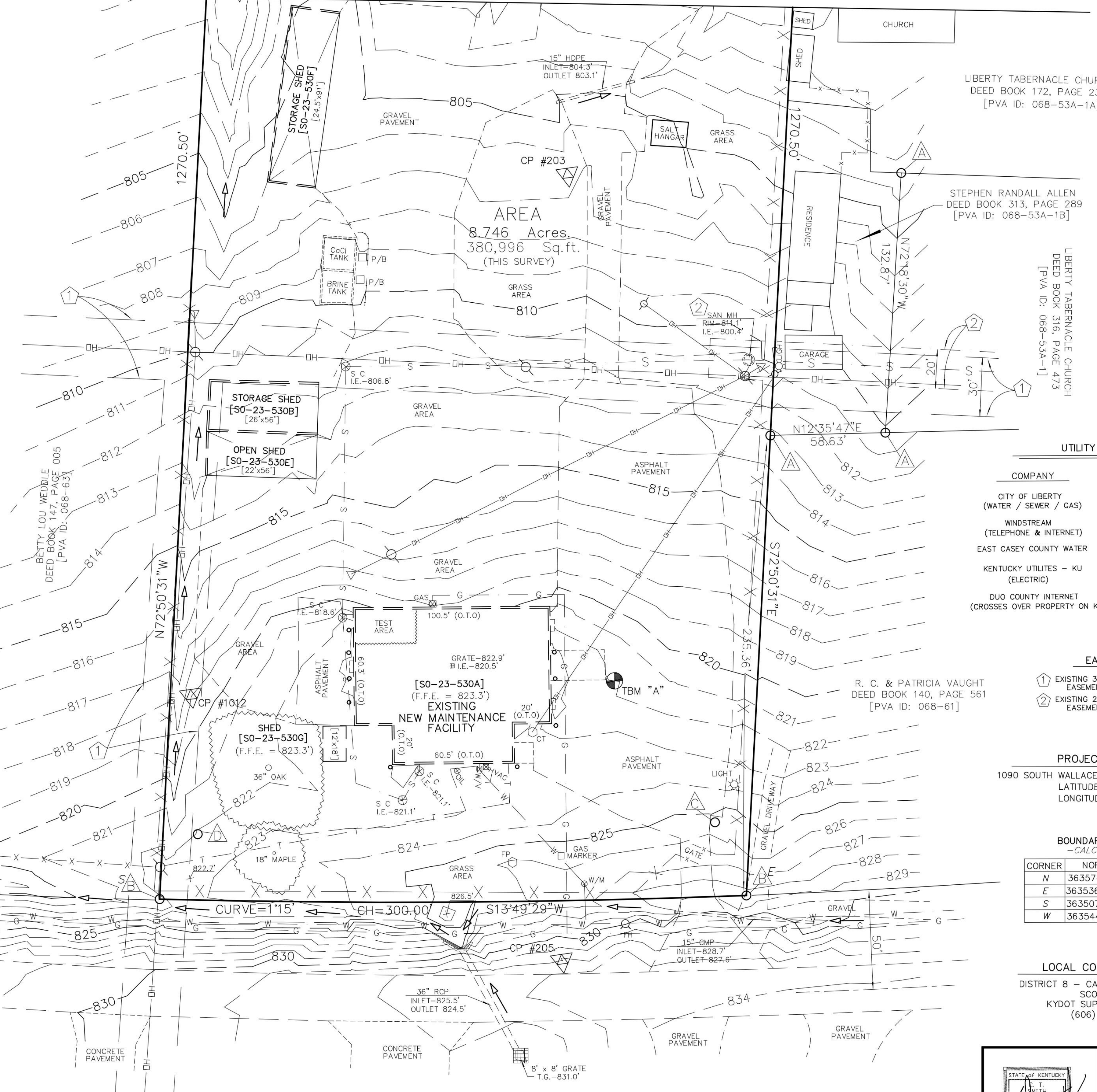
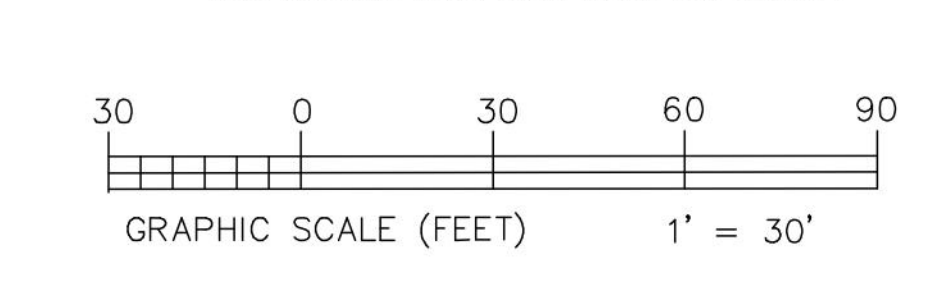


**BEFORE YOU DIG**

ALL UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE. PRIOR TO ANY EXCAVATION THE CONTRACTOR SHALL CONTACT THE UTILITY PROTECTION CENTER FOR THE ACCURATE LOCATION OF THE UNDERGROUND UTILITIES. THE CONTRACTOR IS REQUIRED TO GIVE AT LEAST 48 HOURS PRIOR NOTICE OF EXCAVATION WORK. THE UNDERGROUND PROTECTION CENTER CAN BE REACHED BY CALLING 1-800-752-6607 OR 811.

**TEMPORARY BENCHMARK (TBM "A")**

"X" CUT IN NORTH EAST CORNER OF CONCRETE APRON. (SEE CONTROL POINT DATA TABLE FOR DETAILS)



**CONTROL POINT DATA TABLE**

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
TBM "A"	3635323.640	5154969.050	822.07'	NORTH EAST CORNER OF APRON
CP #200	3635473.110	5153972.890	789.25'	1/2" REBAR (SET) - RED CAP
CP #201	3635295.560	5154327.110	794.74'	1/2" REBAR (SET) - RED CAP
CP #203	3635367.860	5154714.210	806.30'	1/2" REBAR (SET) - RED CAP
CP #205	3635267.150	5155102.400	832.15'	1/2" REBAR (SET) - RED CAP
CP #1012	3635116.200	5154924.880	818.85'	1/2" REBAR (SET) - RED CAP
	3635360.010	5155053.340		1/2" REBAR (SET) - ORANGE CAP
	3635102.220	5154994.460		1/2" REBAR (SET) - ORANGE CAP
	3635465.660	5153844.610		1/2" REBAR (SET) - ORANGE CAP
	3635694.970	5153900.190		1/2" REBAR (SET) - ORANGE CAP

**UTILITY COMPANIES**

COMPANY	NUMBER
CITY OF LIBERTY (WATER / SEWER / GAS)	606-787-9973 606-787-6691
WINDSTREAM (TELEPHONE & INTERNET)	800-347-1991
EAST CASEY COUNTY WATER	606-787-9961
KENTUCKY UTILITIES - KU (ELECTRIC)	800-981-0600
DUO COUNTY INTERNET (CROSSES OVER PROPERTY ON KU)	270-343-3131

- EASEMENTS**
- 1. EXISTING 30' KENTUCKY UTILITIES EASEMENT (PER K.U.)
  - 2. EXISTING 20' SANITARY SEWER EASEMENT D.B. 247, PG. 770

**PROJECT LOCATION**

1090 SOUTH WALLACE WILKINSON BOULEVARD  
LATITUDE: 37°18'18"  
LONGITUDE: -84°56'47"

**BOUNDARY CORNERS - CALCULATED-**

CORNER	NORTH	EAST
N	3635741.206	5153879.572
E	3635366.397	5155093.528
S	3635075.088	5155021.842
W	3635449.896	5153807.886

**LOCAL CONTACT PERSON**

DISTRICT 8 - CASEY COUNTY - LIBERTY  
SCOTT PRICE  
KYDOT SUPERINTENDENT II  
(606) 875-2361

**LEGEND**

- CP #400 BOUNDARY (DEED/PLAT CALLS & DISTANCES)
- TBM CONTROL POINTS (SEE TABLE)
- TEMPORARY BENCHMARK
- EXISTING CONTOUR
- EXISTING UTILITY POLE
- EXISTING OVERHEAD UTILITIES LINE
- EXISTING WATER VALVE
- EXISTING WATER METER
- EXISTING CHAIN LINK SECURITY FENCE
- EXISTING SPOT ELEVATION
- EXISTING SEWER MANHOLE
- EXISTING FIRE HYDRANT
- EXISTING TELECOM. PEDESTAL
- EXISTING POLE ANCHOR
- EXISTING WATER LINE
- BROKEN LINES (NOT TO SCALE)
- EXISTING SANITARY SEWER
- EXISTING SEWER CLEAN OUT
- EXISTING STONE RIP-RAP
- EXISTING FLAG POLE
- EXISTING LIGHT POLE
- EXISTING CA CL PUMP BASE & DISPENSER
- EXISTING STEEL W BEAM GUARDRAIL
- EXISTING CENTER LINE (AS CONSTRUCTED)
- EXISTING GAS LINE
- EXISTING NATURAL GAS VALVE/METER
- CENTER LINE (AS CONSTRUCTED)
- EXISTING OIL WATER SEPARATOR
- EXISTING UNDERGROUND TELECOM. CABLE
- EXISTING COMMUNICATIONS ANTENNA TOWER
- EXISTING FLOW OF RUNOFF
- APPROXIMATE DRIP LINE OF EX. TREES

~ U.S. 127 ~  
 { A.K.A. WALLACE WILKINSON BOULEVARD  
 & F.K.A. GREEN RIVER TURNPIKE }  
 100' RIGHT OF WAY @ SITE  
 -KYDOT PROJECT# S-142 (5) - PLANS DATED 1954-

	DRAWING INFORMATION A&E FILE NO. DRAWING DATE DRAWN BY: c.t.s. CHECKED BY: M.A.T. PHASE RTA DATE	<b>TRANSPORTATION CABINET</b> DIVISION OF FACILITIES SUPPORT <b>CASEY COUNTY MAINTENANCE FACILITY</b> PLAN SHEET	DRAWING NO. AS BUILT DATE
	SHEET 1 OF 2	ACCOUNT NO. 609-CRW COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY <b>Advanced</b> Engineering and Surveying, LLC 319 TUCKER STATION ROAD LOUISVILLE, KENTUCKY 40243 (502) 244-3878	DECA LOG # <b>A1C-8631</b>
HISTORY & REVISION TO THIS DRAWING		DESCRIPTION OF REVISIONS DATE DESCRIPTION OF REVISIONS DATE	
1. PVA, COURT HOUSE, & SITE VISIT 7/30/20		5. SUBMITTED FOR AGENCY REVIEW 9/16/20	
2. DEEDS & CONTROL ESTABLISHED 8/31/20		6. REV. UTILITIES, TREES, & FLOW LINES 9/19/20	
3. FIELD WORK BOUNDARY & TOPO 9/8 & 9/9		7.	
4. MET WITH KYDOT CONCERN UTILITIES 9/15/20		8.	



**TRANSPORTATION CABINET**  
DIVISION OF FACILITIES SUPPORT  
CASEY COUNTY MAINTENANCE FACILITY

**PLAN SHEET**

ACCOUNT NO. 609-C9NW  
COMMONWEALTH OF KENTUCKY  
FINANCE AND ADMINISTRATION CABINET  
DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES  
DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION  
FRANKFORT, KENTUCKY

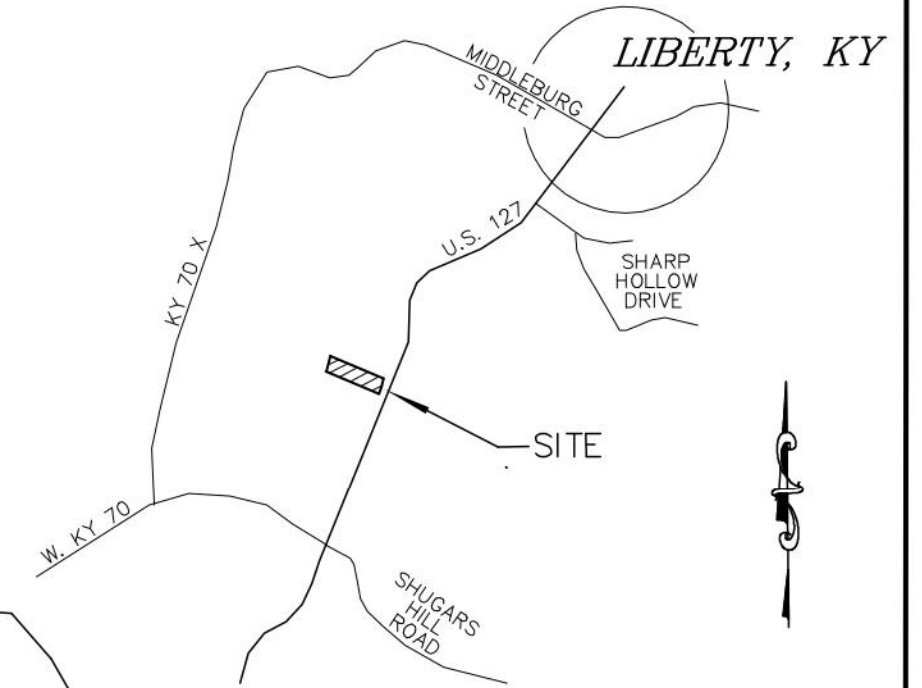
**Advanced**  
Engineering and Surveying, LLC  
319 TUCKER STATION ROAD  
LOUISVILLE, KENTUCKY 40243  
(502) 244-3870

AS BUILT DATE  
DECA LOG #  
**A1C-8632**

DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE
1. PVA, COURT HOUSE, & SITE VISIT	7/30/20	5. SUBMITTED FOR AGENCY REVIEW	9/16/20
2. DEEDS & CONTROL ESTABLISHED	8/31/20	6. REV. UTILITIES, TREES, & FLOW LINES	9/19/20
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4. MET WITH KYDOT CONCERN UTILITIES	9/15/20	8.	

**BOUNDARY CORNERS**  
-CALCULATED-

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E	3635366.397	5155093.528
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"X" CUT IN NORTH EAST CORNER OF CONCRETE APRON.  
(SEE CONTROL POINT DATA TABLE FOR DETAILS)

- NOTES:**
- ALL STRUCTURES SHOWN ARE EXISTING AT THE TIME OF SURVEY.
  - NO DEED FOR RIGHT OF WAY RECOVERED THIS SURVEY.
  - NO CEMETERY WAS VISIBLE ON TRACT BEING SURVEYED.
  - UTILITIES SHOWN ARE APPROXIMATE. BASED UPON INFORMATION SUPPLIED BY KYDOT STAFF AND OBSERVATION AT TIME OF SURVEY FOR TOPOGRAPHY AND BOUNDARY.

**LAND SURVEYORS CERTIFICATE**  
I HEREBY CERTIFY THAT THIS BOUNDARY SURVEY AND PLAT WERE MADE UNDER MY SUPERVISION AND THAT THE ANGULAR AND LINEAR MEASUREMENTS OF THE BOUNDARY LINES AS WITNESSED BY MONUMENTS SHOWN HEREON ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. THIS SURVEY AND PLAT MEET OR EXCEEDS THE MINIMUM STANDARDS OF GOVERNING AUTHORITIES.

**FLOOD HAZARD STATEMENT**  
THIS PROPERTY IS NOT LOCATED IN THE 100 YEAR FLOOD HAZARD AREA AS SHOWN ON FIRM MAP No. 21045C0237D TO THE BEST OF MY KNOWLEDGE AND BELIEF. FIRM MAP DATED 07-07-2009.

**REFERENCE BEARING**  
THE REFERENCE BEARING FOR THIS SURVEY WAS TAKEN FROM A GPS BASE LINE-SETUP ON AUGUST 13, 2020. THE BEARING OF THIS LINE IS S80°07'36"E (SHOWN HEREON BETWEEN CP#203 & TBM "A") SINGLE ZONE - KY STATE PLANE COORDINATE - NAD 1983.

**STATEMENT ON PRECISION & MEASUREMENTS**  
AN RTK-GPS UNIT WAS USED TO DETERMINE GRID NORTH, COMPLETE PARTS OF THE TRAVERSE AND TO RECOVER BOUNDARY MONUMENTS FOR THIS SURVEY. A SOKKIA GRX3 (DUAL FREQUENCY) RECEIVER UTILIZING REAL TIME VRCS CORRECTIONS FROM THE KYDOT CORS NETWORK WAS USED. THE NAD 83 - HORIZONTAL, KENTUCKY SINGLE ZONE (1600), WGS 84 ELLIPSOID WITH GEOID MODEL G2012BUT7 (1) WAS USED ON THIS SURVEY. RELATIVE POSITIONAL ACCURACY FOR THIS SURVEY MEETS OR EXCEEDS THE (+/-) 0.10' ± 200 PPM REQUIRED FOR THE RURAL SURVEY CLASSIFICATION. ALL BEARINGS & DISTANCES SHOWN HEREON ARE MEASURED VALUES OBTAINED THIS SURVEY THRU THE USE OF A TOTAL STATION & DESCRIBED GPS UNIT. TRIANGULAR WAS NOT ADJUSTED.

**TOPOGRAPHIC SURVEY**  
CONDITIONS SHOWN REPRESENT THE SITE ON SEPTEMBER 9, 2020. CONTRACTOR RESPONSIBLE TO CHECK GRADES DURING "SITE VISIT". NO GUARANTEE SHALL BE MADE FOR ANY DISCREPANCIES THAT MAY HAVE TAKEN PLACE BETWEEN TIME OF TOPO & TIME OF CONSTRUCTION.

**UTILITY COMPANIES**

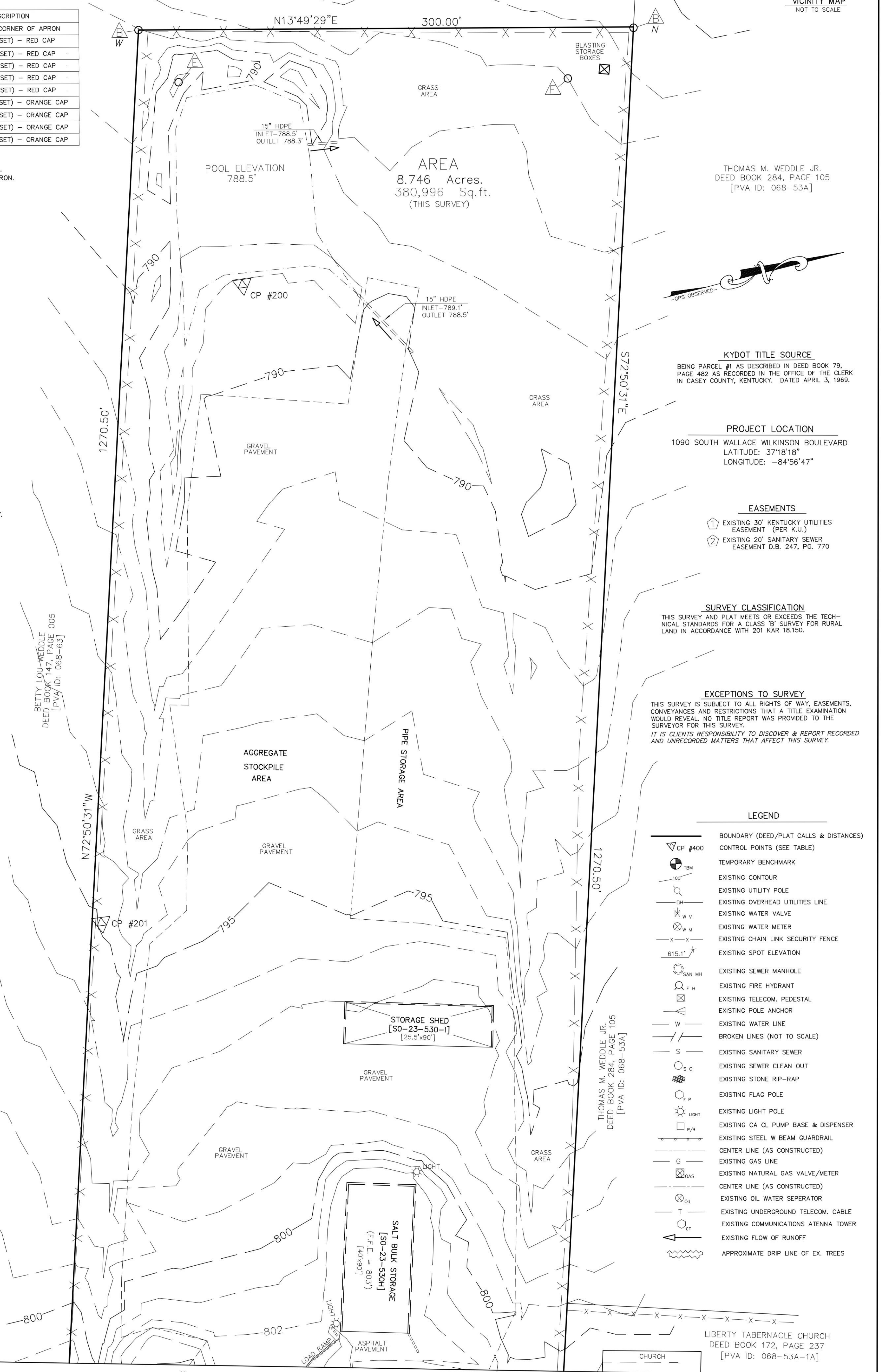
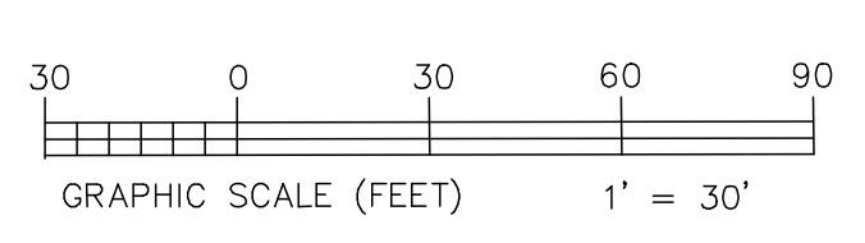
COMPANY	NUMBER
CITY OF LIBERTY (WATER / SEWER / GAS)	606-787-9973 606-787-6691
WINDSTREAM (TELEPHONE & INTERNET)	800-347-1991
EAST CASEY COUNTY WATER	606-787-9961
KENTUCKY UTILITIES - KU (ELECTRIC)	800-981-0600
DUO COUNTY INTERNET (CROSSES OVER PROPERTY ON KU)	270-343-3131

- MONUMENTS**  
ALL PROPERTY CORNERS HAVE BEEN CALCULATED AND REFERENCED AS INDICATED THIS SURVEY AND DESCRIBED HEREON:
- 1/2" REBAR (FOUND) - CAP STAMPED "BROWN-3746"
  - CALCULATED BOUNDARY CORNER
  - 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3757" BEING S80°58'08"W @ 40.60' FROM TRUE CORNER.
  - 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3767" BEING N45°15'45"W @ 38.55' FROM TRUE CORNER.
  - 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3757" BEING N66°46'08"E @ 39.96' FROM TRUE CORNER.
  - 1/2" REBAR (SET) - CAP STAMPED "REFERENCE-3757" BEING S24°02'02"E @ 50.62' FROM TRUE CORNER.

**BEFORE YOU DIG**  
ALL UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE. PRIOR TO ANY EXCAVATION THE CONTRACTOR SHALL CONTACT THE UTILITY PROTECTION CENTER FOR THE ACCURATE LOCATION OF THE UNDERGROUND UTILITIES. THE CONTRACTOR IS REQUIRED TO GIVE AT LEAST 48 HOURS PRIOR NOTICE OF EXCAVATION WORK. THE UNDERGROUND PROTECTION CENTER CAN BE REACHED BY CALLING 1-800-752-6007 OR 811.



**LOCAL CONTACT PERSON**  
DISTRICT 8 - CASEY COUNTY - LIBERTY  
SCOTT PRICE  
KYDOT SUPERINTENDENT II  
(606) 875-2361



**KYDOT TITLE SOURCE**  
BEING PARCEL #1 AS DESCRIBED IN DEED BOOK 79, PAGE 482 AS RECORDED IN THE OFFICE OF THE CLERK IN CASEY COUNTY, KENTUCKY, DATED APRIL 3, 1969.

**PROJECT LOCATION**  
1090 SOUTH WALLACE WILKINSON BOULEVARD  
LATITUDE: 37°18'18"  
LONGITUDE: -84°56'47"

- EASEMENTS**
- EXISTING 30' KENTUCKY UTILITIES EASEMENT (PER K.U.)
  - EXISTING 20' SANITARY SEWER EASEMENT D.B. 247, PG. 770

**SURVEY CLASSIFICATION**  
THIS SURVEY AND PLAT MEETS OR EXCEEDS THE TECHNICAL STANDARDS FOR A CLASS 'B' SURVEY FOR RURAL LAND IN ACCORDANCE WITH 201 KAR 18.150.

**EXCEPTIONS TO SURVEY**  
THIS SURVEY IS SUBJECT TO ALL RIGHTS OF WAY, EASEMENTS, CONVEYANCES AND RESTRICTIONS THAT A TITLE EXAMINATION WOULD REVEAL. NO TITLE REPORT WAS PROVIDED TO THE SURVEYOR FOR THIS SURVEY. IT IS CLIENT'S RESPONSIBILITY TO DISCOVER & REPORT RECORDED AND UNRECORDED MATTERS THAT AFFECT THIS SURVEY.

- LEGEND**
- BOUNDARY (DEED/PLAT CALLS & DISTANCES)
  - CONTROL POINTS (SEE TABLE)
  - TEMPORARY BENCHMARK
  - EXISTING CONTOUR
  - EXISTING UTILITY POLE
  - EXISTING OVERHEAD UTILITIES LINE
  - EXISTING WATER VALVE
  - EXISTING WATER METER
  - EXISTING CHAIN LINK SECURITY FENCE
  - EXISTING SPOT ELEVATION
  - EXISTING SEWER MANHOLE
  - EXISTING FIRE HYDRANT
  - EXISTING TELECOM. PEDESTAL
  - EXISTING POLE ANCHOR
  - EXISTING WATER LINE
  - BROKEN LINES (NOT TO SCALE)
  - EXISTING SANITARY SEWER
  - EXISTING SEWER CLEAN OUT
  - EXISTING STONE RIP-RAP
  - EXISTING FLAG POLE
  - EXISTING LIGHT POLE
  - EXISTING CA CL PUMP BASE & DISPENSER
  - CENTER LINE (AS CONSTRUCTED)
  - EXISTING GAS LINE
  - EXISTING NATURAL GAS VALVE/METER
  - CENTER LINE (AS CONSTRUCTED)
  - EXISTING OIL WATER SEPARATOR
  - EXISTING UNDERGROUND TELECOM. CABLE
  - EXISTING COMMUNICATIONS ANTENNA TOWER
  - EXISTING FLOW OF RUNOFF
  - APPROXIMATE DRIP LINE OF EX. TREES

"MATCH LINE" - SEE SHEET 2 -



- GENERAL NOTES:**
1. THE REQUIREMENTS OF ALL GENERAL NOTES ON THIS PAGE APPLY TO ALL 'C' SHEETS UNLESS OTHERWISE NOTED ON THE PLANS OR IN THE SPECIFICATIONS.
  2. THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS, PROPOSED DIMENSIONS IN THE FIELD PRIOR TO COMMENCING WORK. NOTIFY ARCHITECT IF ISSUES ARE FOUND.
  3. ANY DISCREPANCIES BETWEEN SITE DRAWINGS AND THE CORRESPONDING CIVIL, ARCHITECTURAL, STRUCTURAL AND MEP PLANS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT.
  4. DO NOT SCALE DRAWINGS.
  5. IF THE CONTRACTOR ENCOUNTERS HAZARDOUS MATERIALS ON SITE THAT HAVE NOT BEEN RENDERED HARMLESS, THE CONTRACTOR SHALL IMMEDIATELY STOP ALL WORK IN THE CONTAMINATED AREA AND REPORT THE CONDITION TO THE OWNER AND THE ARCHITECT.
  6. ALL EXISTING SITE FEATURES ARE SHOWN AS ACCURATELY AS POSSIBLE AND BELIEVED TO BE CORRECT. SHOULD THE CONTRACTOR FIND ANY DISCREPANCIES, THE ARCHITECT SHALL BE NOTIFIED IMMEDIATELY AND NECESSARY ADJUSTMENTS WILL BE MADE IN THE FIELD, PRIOR TO CONSTRUCTION.
  7. UNDERGROUND UTILITIES - THE AVAILABLE INFORMATION CONCERNING THEIR LOCATION HAS BEEN SHOWN ON THE DRAWINGS. WHILE IT IS BELIEVED THAT THE LOCATIONS SHOWN ARE REASONABLY CORRECT, NEITHER THE ARCHITECT NOR THE OWNER CAN GUARANTEE THE ACCURACY OF THIS INFORMATION.
  8. REFER TO ARCHITECTURAL/STRUCTURAL SHEETS FOR ALL WORK RELATED TO BUILDING.
  9. REFER TO UTILITY SHEETS FOR ALL WORK RELATED TO UTILITY DEMOLITION AND IMPROVEMENTS.
  10. THE CONTRACTOR SHALL MAINTAIN TRAFFIC CONTROL AND DIRECTIONAL SIGNAGE REQUIRED DURING CONSTRUCTION.
  11. THE CONTRACTOR IS RESPONSIBLE FOR JOB SITE SECURITY.
  12. CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED NOTICES TO AGENCIES HAVING JURISDICTION - PRIOR TO THE START OF WORK.
  13. PROJECT LIMITS SHOWN IS APPROXIMATE BOUNDARY OF THE EXTENTS OF WORK. SOME UTILITY WORK OCCURS OUTSIDE THESE LIMITS.
  14. GENERAL CONTRACTOR WILL BE RESPONSIBLE TO REVIEW, COORDINATE, AND LAYOUT ALL UTILITY LINES (STORM, WATER, FIRE PROTECTION, SANITARY, GAS, & ELECTRIC, ETC.) IN THE FIELD PRIOR TO INSTALLATION. SHOULD A CONFLICT BE FOUND, NOTIFY THE ARCHITECT BEFORE PROCEEDING WITH WORK. IF A CONFLICT IS FOUND DURING INSTALLATION AS A RESULT OF NOT COORDINATING UTILITY LINES, THE GENERAL CONTRACTOR WILL BE RESPONSIBLE FOR CORRECTING THE ISSUE AS DIRECTED BY THE ARCHITECT WITHOUT COMPENSATION.

- SEED NOTES:**
1. SEED ALL DISTURBED AREAS - REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

- ALTERNATE #1 NOTE:**
1. REFER TO SHEET C001 FOR ALTERNATE #1 SITE WORK.

**LAYOUT NOTES:**

THE CONTRACTOR SHALL LAYOUT WORK PRIOR TO START OF WORK. SHOULD THERE BE ANY INCONSISTENCIES OBSERVED DURING THE LAYOUT AND STAKING OF PROPOSED IMPROVEMENTS, ADVISE ARCHITECT IMMEDIATELY PRIOR TO PROCEEDING.

ALL DIMENSIONS ARE TO FACE OF CURB, FACE OF BUILDING, OR EDGE OF PAVEMENTS UNLESS OTHERWISE NOTED.



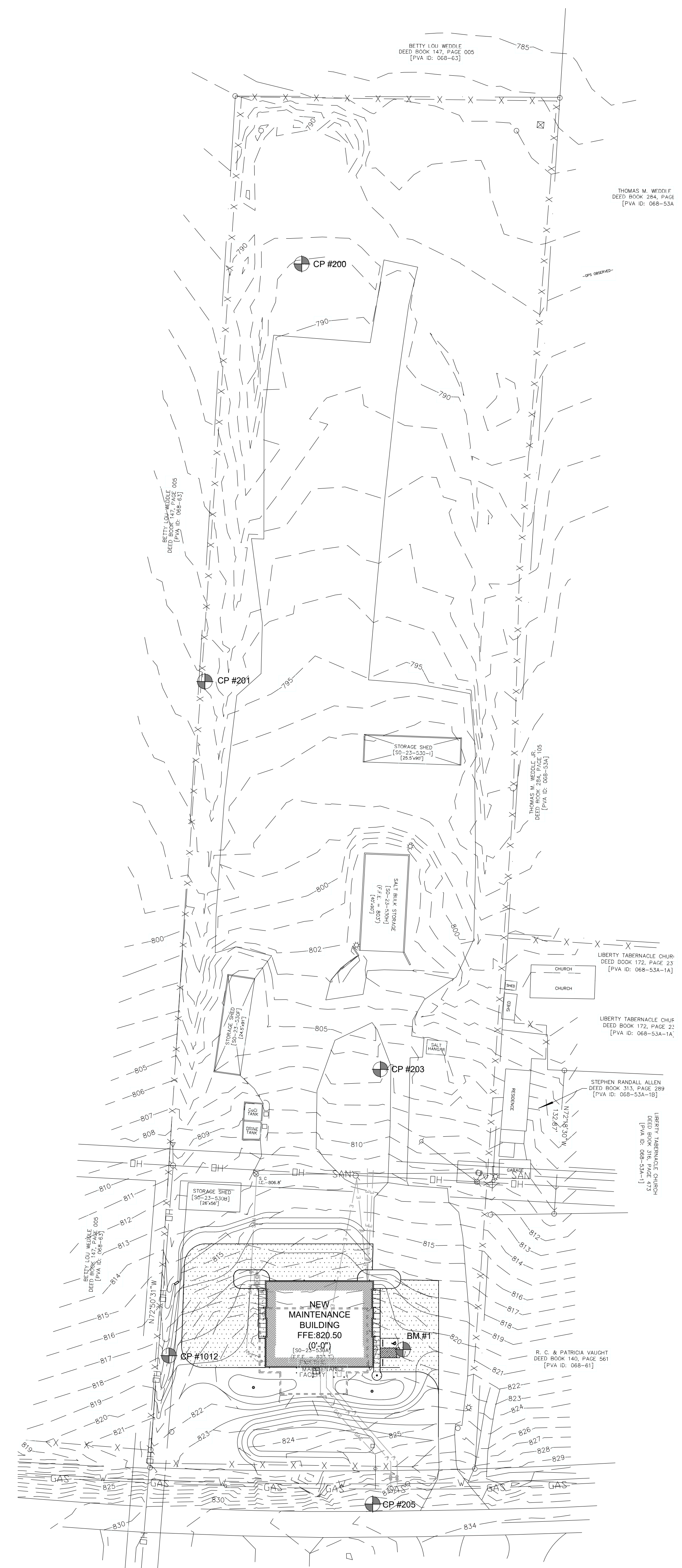
**BENCH MARK (BM)/CONTROL POINT (CP) SCHEDULE**

BM/CP #	SURVEY COORDINATES 'X', 'Y' & 'Z'	BM/CP LOCATION
BM #1	X: 5155595.71 Y: 3637831.37 Z: 181.35	NORTHEAST CORNER OF APRON
CP #200	X: 5154594.26 Y: 3637971.36 Z: 789.25	1/2" REBAR (SET) - RED CAP
CP #201	X: 5154948.20 Y: 3637793.73 Z: 794.74	1/2" REBAR (SET) - RED CAP
CP #203	X: 5155335.19 Y: 3637866.32 Z: 806.30	1/2" REBAR (SET) - RED CAP
CP #1012	X: 5155546.29 Y: 3637814.51 Z: 818.85	1/2" REBAR (SET) - RED CAP
CP #205	X: 5155723.95 Y: 3637765.18 Z: 832.15	1/2" REBAR (SET) - RED CAP

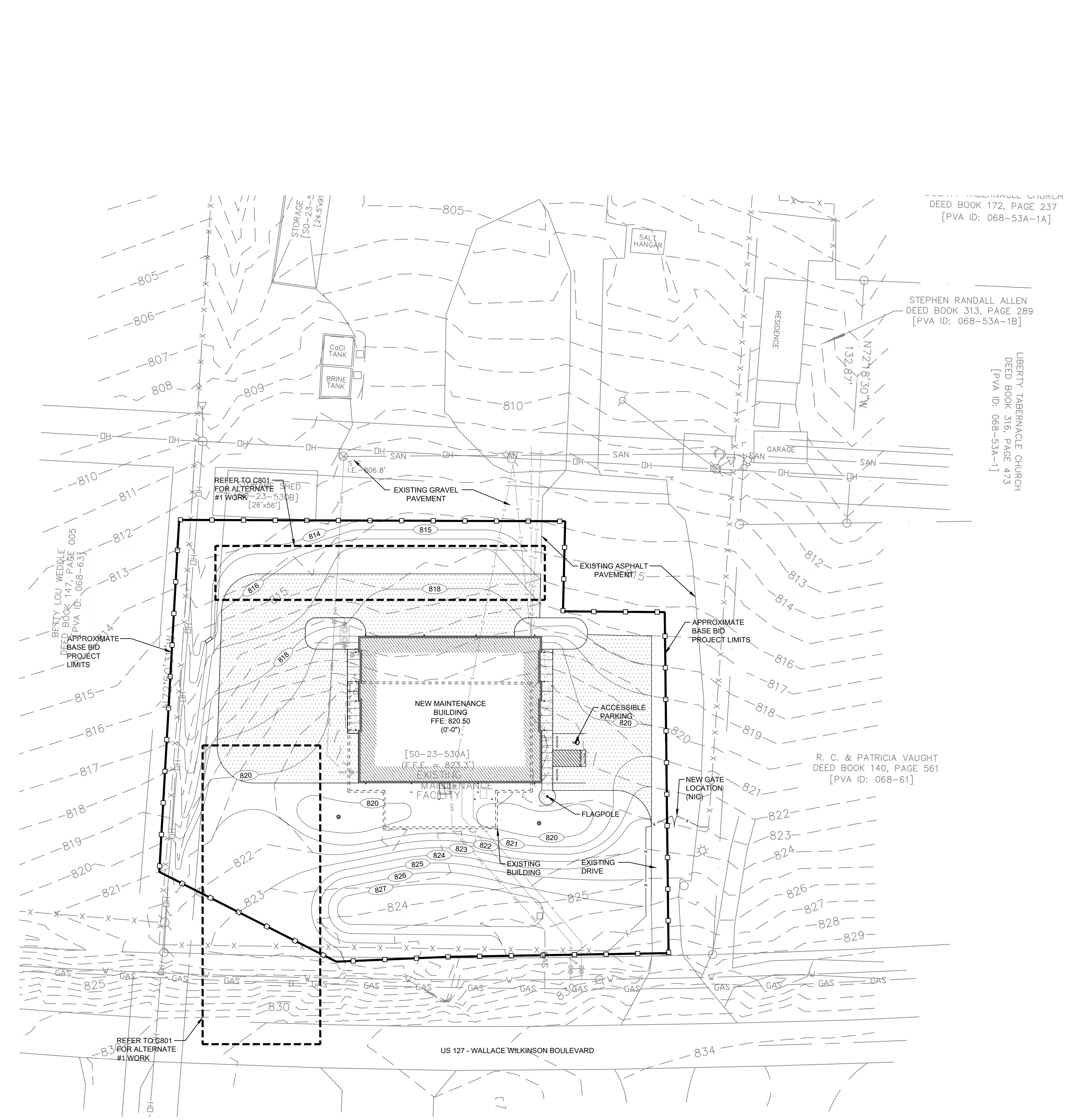
BENCHMARK (BM) AND CONTROL POINTS (CP) 'X' AND 'Y' COORDINATES IN THIS SET OF CONSTRUCTION DRAWINGS DIFFERS FROM THOSE SPECIFIED ON THE SURVEY DRAWING DUE TO A DISCRETION IN HOW THE SURVEY FILE WAS DRAFTED. THIS WILL NOT IMPACT LAYOUT.

**LEGEND:**

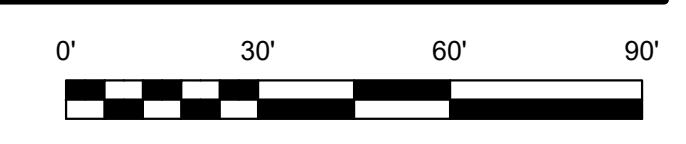
	NEW BUILDING		BENCHMARK/CONTROL POINT
	ASPHALT PAVEMENT		
	NEW CONCRETE WALKS/PAVEMENT		
	EXISTING CONTOURS		
	PROPOSED CONTOURS		
	PROJECT LIMITS		
	SLOPE DIRECTION		



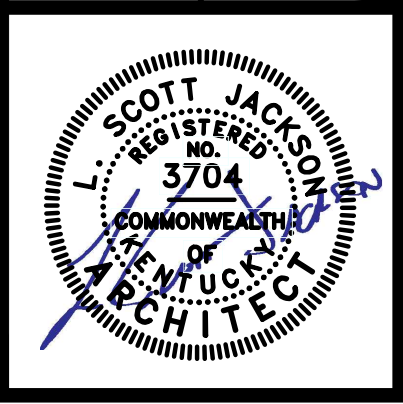
**SITE PLAN - BM AND CP LOCATIONS**  
SCALE: 1"=60'-0"



**MASTER SITE PLAN**  
SCALE: 1"=30'-0"



<b>DRAWING INFORMATION</b>		<b>KYTC MAINTENANCE FACILITY LIBERTY, KENTUCKY</b>	
A & E FILE NO.	2011	DRAWING NO. <b>C001</b>	
DRAWING DATE	12/16/20	ACCOUNT NO.	609-C8NW-2001-A10
DRAWN BY	BRB/RAL	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET	
CHECKED BY	LSJ	DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
PHASE	RTA	AS-BUILT DATE	
RTA DATE	12/16/20	AS-BUILT DATE	
		DECA LOG # <b>A1C-8633</b>	
<b>Clotfelter SAMOKAR</b> Architecture   Interiors   Landscapes   Planning			
228 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH: 859.273.3700 / FAX: 859.271.6605			
REVISION HISTORY OF THIS DRAWING			
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE
1		5	
2		6	
3		7	
4		8	





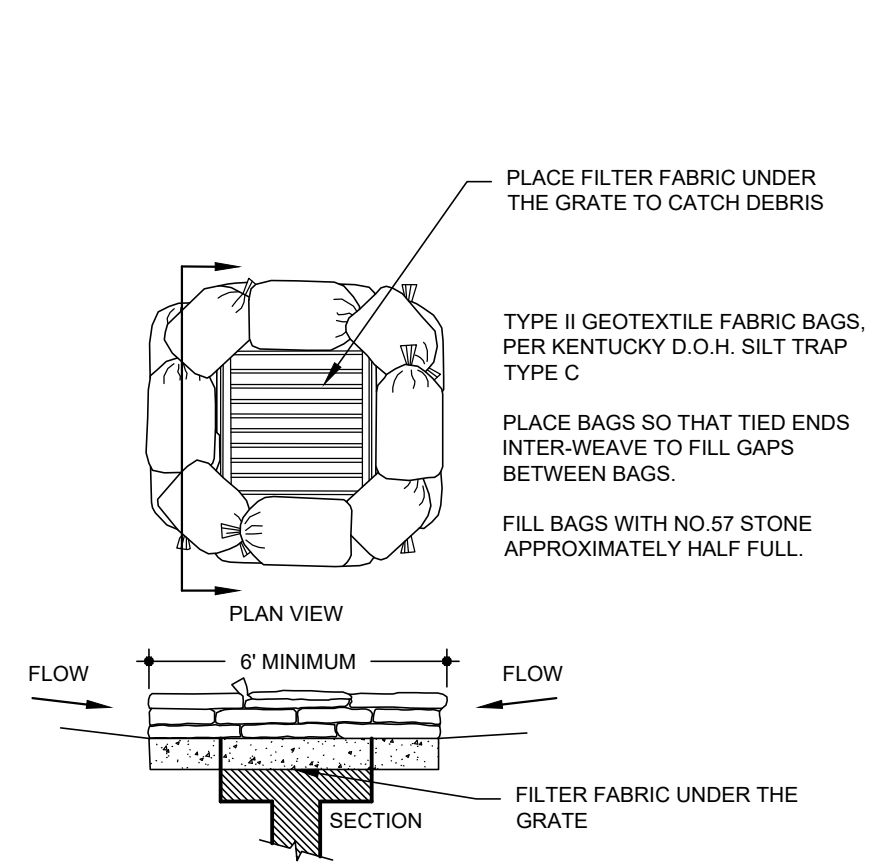
- GENERAL DEMOLITION NOTES:**
- IT IS THE CONTRACTORS RESPONSIBILITY TO NOTIFY THE ARCHITECT REGARDING ANY DISCREPANCIES OR ITEMS THAT ARE NOT SHOWN, THAT MUST BE REMOVED BEFORE START OF NEW WORK.
  - REFER TO UTILITY SITE SHEETS FOR ALL DEMOLITION WORK RELATED TO SITE UTILITIES.
  - COORDINATE SITE DEMOLITION WITH SITE IMPROVEMENT PLANS TO ENSURE SMOOTH TRANSITIONS BETWEEN EXISTING AND PROPOSED IMPROVEMENTS.
  - REMOVE ALL VEGETATION, ROOT MASSES AND ORGANIC DEBRIS WITHIN PROJECT LIMITS UNLESS IDENTIFIED TO REMAIN.
  - PROTECT ALL EXISTING VEGETATION OUTSIDE LIMITS OF WORK OR IDENTIFIED TO REMAIN.
  - REFER TO SPECIFICATIONS FOR ADDITIONAL SITE DEMOLITION REQUIREMENTS.
  - COORDINATE ALTERNATE DEMOLITION WORK WITH ALTERNATE SITE WORK AS SHOWN ON C801.

**BEST MANAGEMENT PRACTICE NOTE:**

THE CONTRACTOR SHALL IMPLEMENT THE DESIGNED PLAN (SHEET C002) AS REQUIRED TO ELIMINATE EROSION AND SEDIMENTATION FROM IMPACTING THE SITE AND SURROUNDING PROPERTIES AND WATERWAYS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL EROSION & SEDIMENT CONTROL DEVICES ARE INSTALLED AND MAINTAINED THROUGHOUT THE DURATION OF ALL CONSTRUCTION ACTIVITIES. ALL PUBLIC AND PRIVATE VEHICULAR PATHWAYS ARE TO BE KEPT FREE OF SILT AT ALL TIMES.

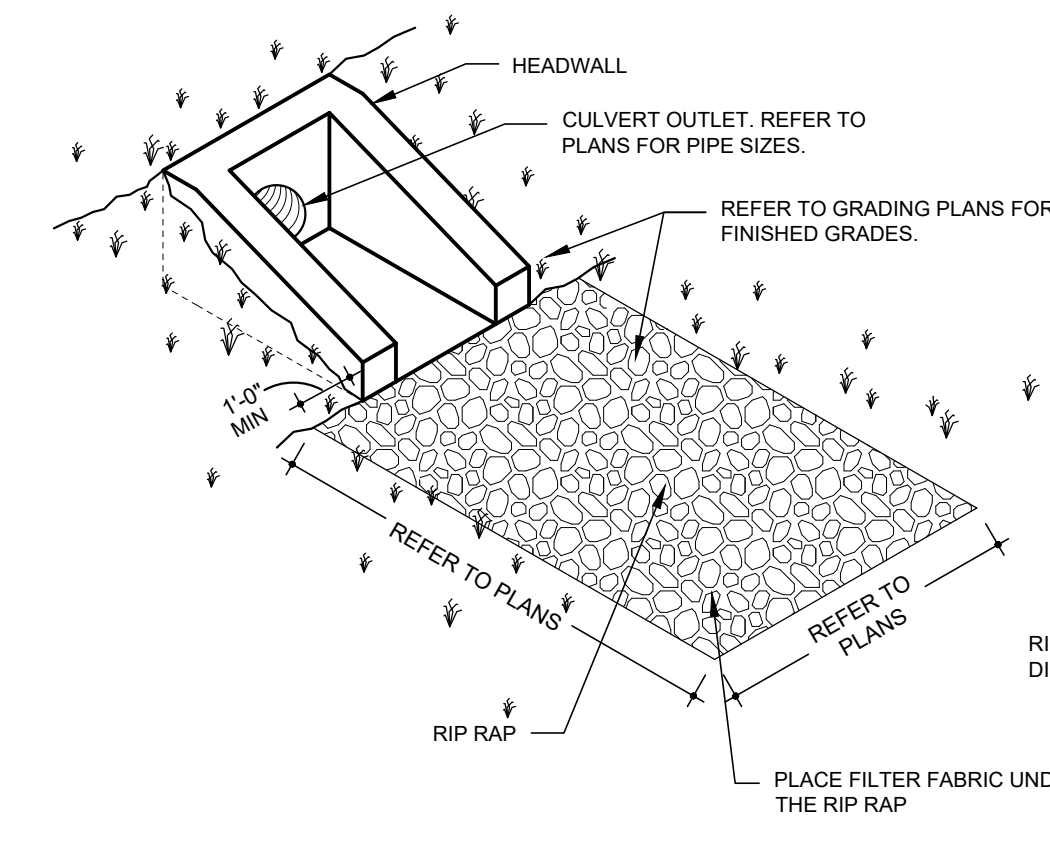
THE CONTRACTOR SHALL ADHERE TO THE STORM WATER POLLUTION PREVENTION PLAN THAT HAS BEEN DESIGNED FOR THIS PROJECT.

MODIFY EROSION CONTROL SYSTEM AS CONSTRUCTION PROCEEDS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PREPARE REVISED EROSION CONTROL PLANS AND SHALL DISPLAY THEM IN A PROMINENT ON-SITE LOCATION.



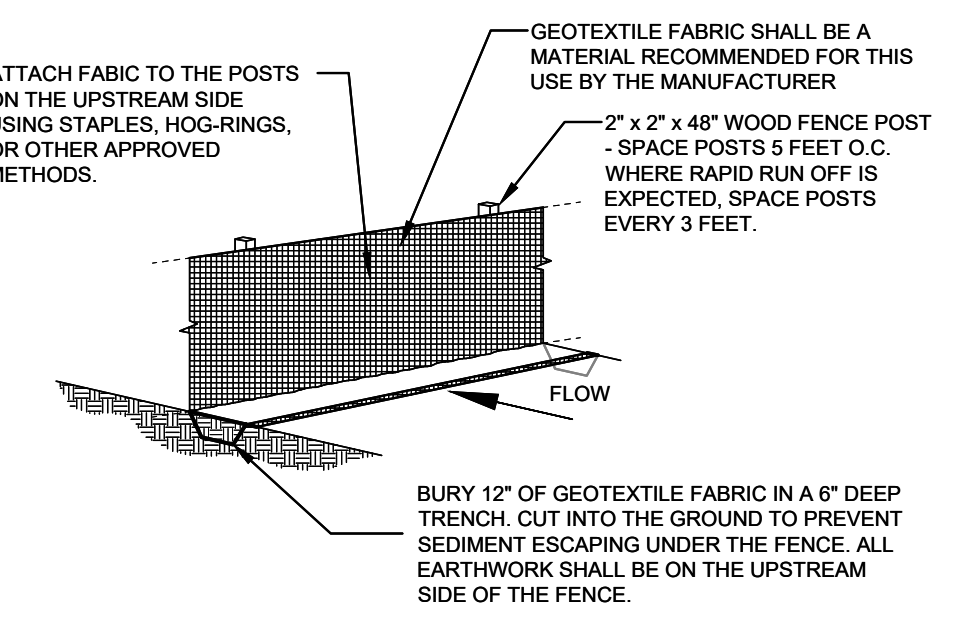
**SILT TRAP**  
SCALE: NOT TO SCALE

**A**  
C002



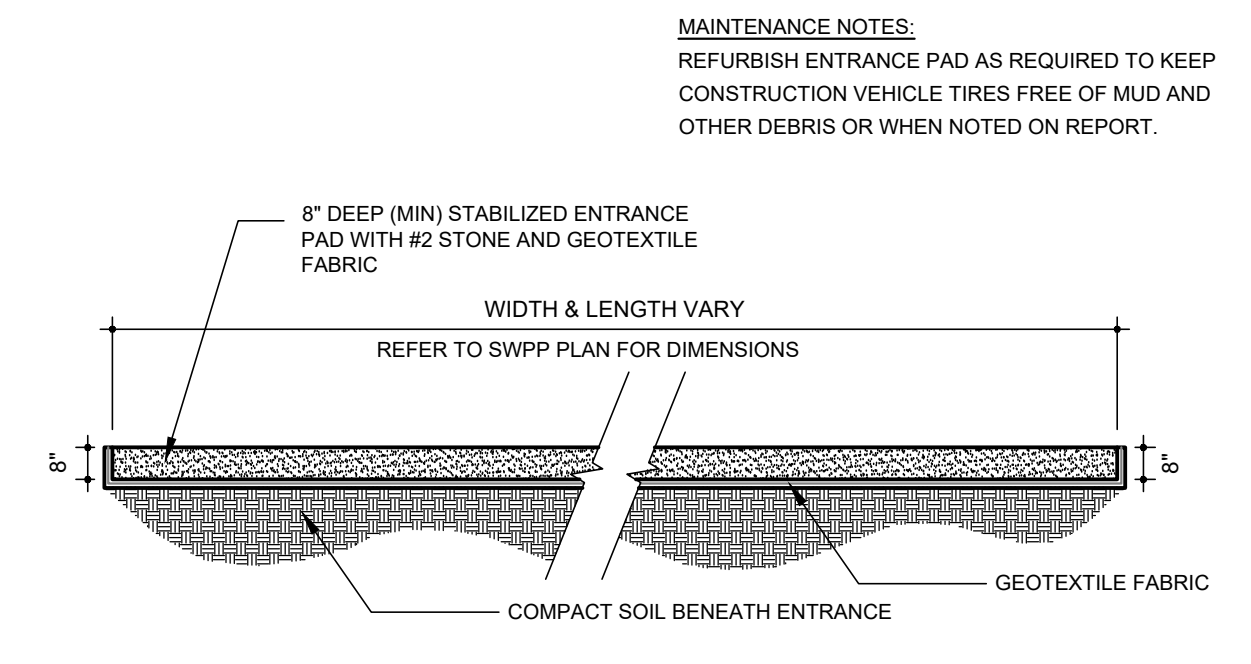
**CULVERT ROCK DISSIPATER**  
SCALE: NOT TO SCALE

**B**  
C002



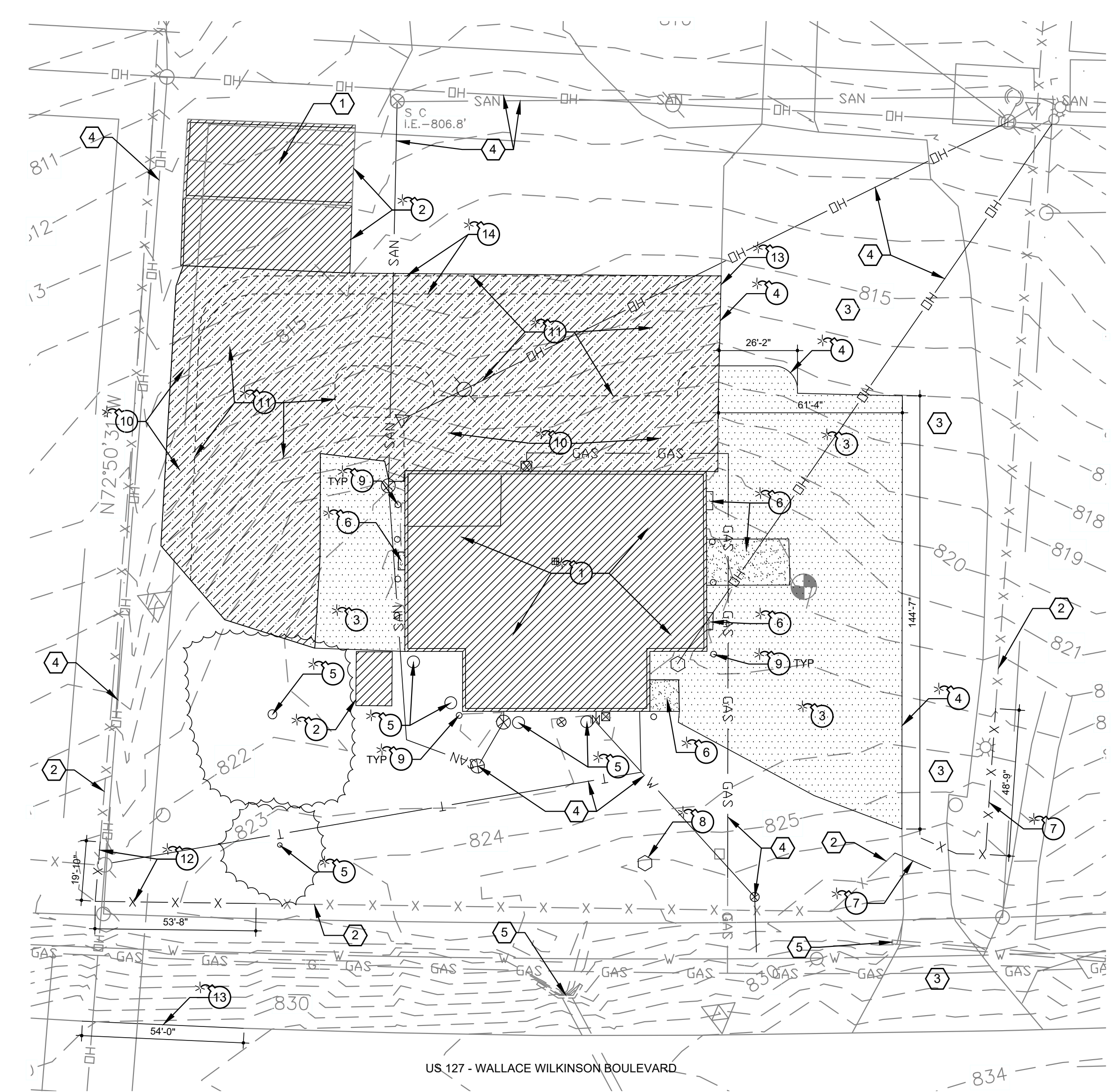
**SILT FENCE**  
NOT TO SCALE

**C**  
C002



**CONSTRUCTION ENTRANCE**  
NOT TO SCALE

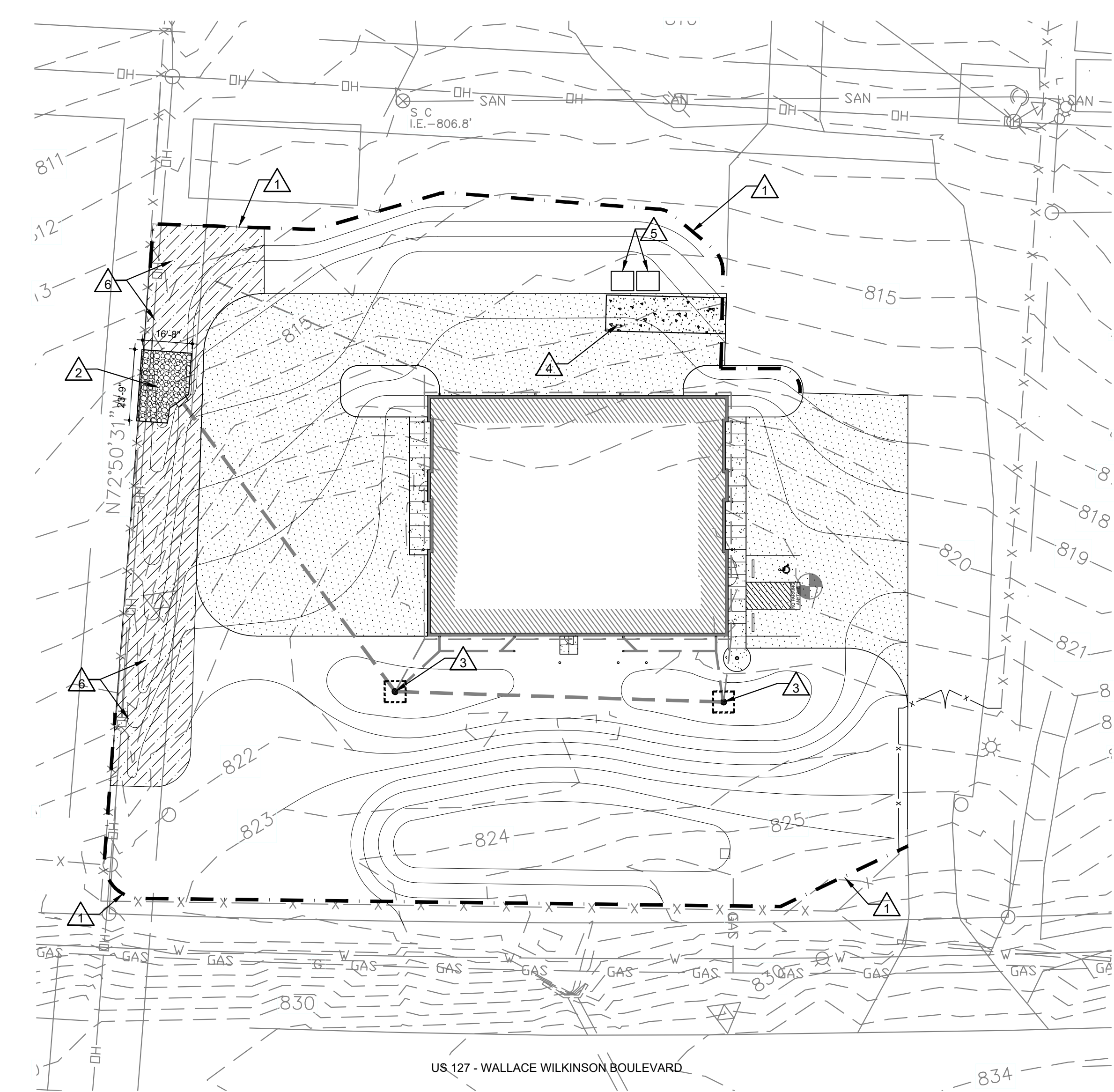
**D**  
C002



**SITE DEMOLITION PLAN**  
SCALE: 1"=30'-0"

- DEMOLITION SHEET NOTES:**
- EXISTING BUILDING TO BE DEMOLISHED BY KYTC PRIOR TO START OF THIS PROJECT.
  - OUT BUILDINGS TO BE DEMOLISHED BY KYTC PRIOR TO START OF THIS PROJECT.
  - SAWCUT AND REMOVE ASPHALT PAVEMENT AND BASE STONE - DO NOT UNDERMINE EXISTING PAVEMENT TO REMAIN.
  - SAWCUT EDGE OF EXISTING PAVEMENT TO CREATE A UNIFORM EDGE FOR NEW PAVEMENT TO ADJOINT TO.
  - REMOVE PLANTS/VEGETATION AND ASSOCIATED ROOT MASS.
  - REMOVE CONCRETE WALKS/PAVEMENTS AND BASE STONE.
  - REMOVE EXISTING CHAIN LINK FENCE, GATES AND FOUNDATIONS. BACKFILL VOIDS WITH COMPACTED ENGINEERED FILL.
  - REMOVE EXISTING FLAGPOLE AND FOUNDATION. BACKFILL VOID WITH SATISFACTORY SOILS.
  - REMOVE BOLLARDS.
  - REMOVE EXISTING GRAVEL PAVEMENT.
  - REMOVE EXISTING GRAVEL AND SUB-GRADE SOILS TO DEPTHS REQUIRED TO INSTALL ASPHALT PAVING AND NEW WORK.
  - ALTERNATE #1: REMOVE EXISTING CHAIN LINK FENCE, GATES AND FOUNDATIONS. BACKFILL VOIDS WITH COMPACTED ENGINEERED FILL.
  - ALTERNATE #1: SAWCUT EDGE OF EXISTING PAVEMENT TO CREATE A UNIFORM EDGE FOR NEW PAVEMENT TO ADJOINT TO.
  - ALTERNATE #1: REMOVE EXISTING GRAVEL AND SUB-GRADE SOILS TO DEPTHS REQUIRED TO INSTALL ASPHALT PAVING AND NEW WORK.

- EXISTING SHEET NOTES:**
- EXISTING CONCRETE SLAB TO REMAIN.
  - FENCE TO REMAIN.
  - EXISTING ASPHALT TO REMAIN.
  - EXISTING UTILITIES. REFER TO UTILITY SITE PLANS FOR ALL INFORMATION.
  - EXISTING STORM DRAINAGE STRUCTURE TO REMAIN.



**SITE BMP PLAN**  
SCALE: 1"=30'-0"

- BMP NOTES:**
- SILT FENCE PER DETAIL C/C002. PROVIDE SILT FENCE AROUND ALL STOCKPILED AREAS. DO NOT INSTALL SILT FENCE INSIDE THE DRIP LINE OF THE TREES.
  - RIP RAP, 6" TO 8" SIZE. PROVIDE A MINIMUM WIDE, 15' LONG AND 12" DEEP RIP RAP BED AND TO EXTENT SHOWN ON PLANS. INSTALL A 4 OZ. NON-WOVEN FILTER FABRIC BETWEEN SOIL AND ROCK. RIP RAP SHALL REMAIN. REFER TO DETAIL B/C002 FOR MORE INFORMATION.
  - INLET PROTECTION PER DETAIL A/C002. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
  - PROVIDE CONSTRUCTION ENTRANCE. MINIMUM 12' WIDE, 80' LONG AND 8" THICK OF #2 STONE OVER A WOVEN TYPE III FILTER FABRIC. REMOVE AS REQUIRED TO INSTALL NEW ASPHALT PAVING. REFER TO DETAIL D/C002 FOR ADDITIONAL INFORMATION.
  - CONCRETE WASH PIT AND FUEL STORAGE PER KY BMP STANDARDS. PLACE WHERE NEEDED ON SITE.
  - PROVIDE EROSION CONTROL BLANKETS. REFER TO SPECIFICATIONS FOR MORE INFORMATION.

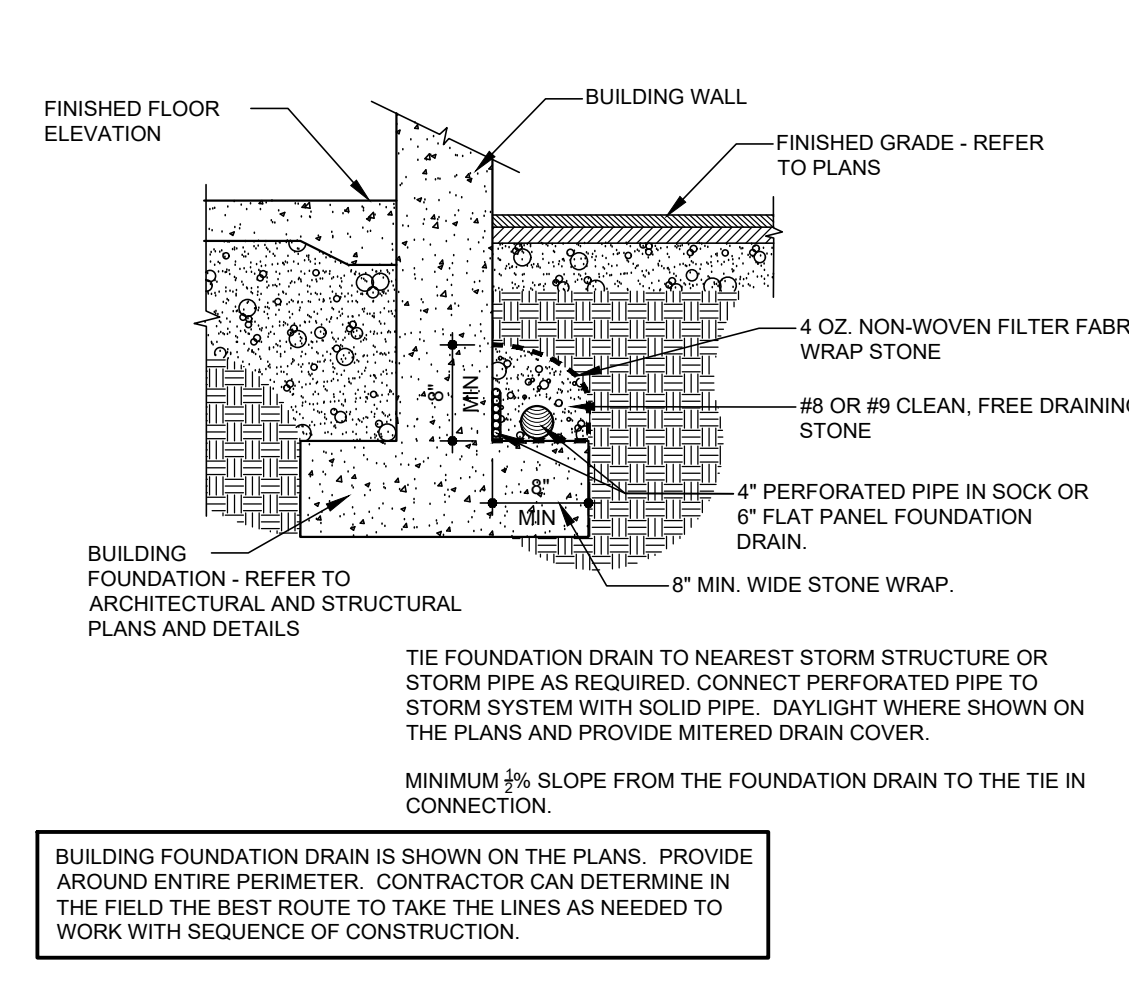
- ALTERNATE #1 BMP NOTES:**
- REFER TO SHEET C801 FOR ADDITIONAL BMP REQUIREMENTS REGARDING ALTERNATE #1 GRADING WORK.

**LEGEND:**

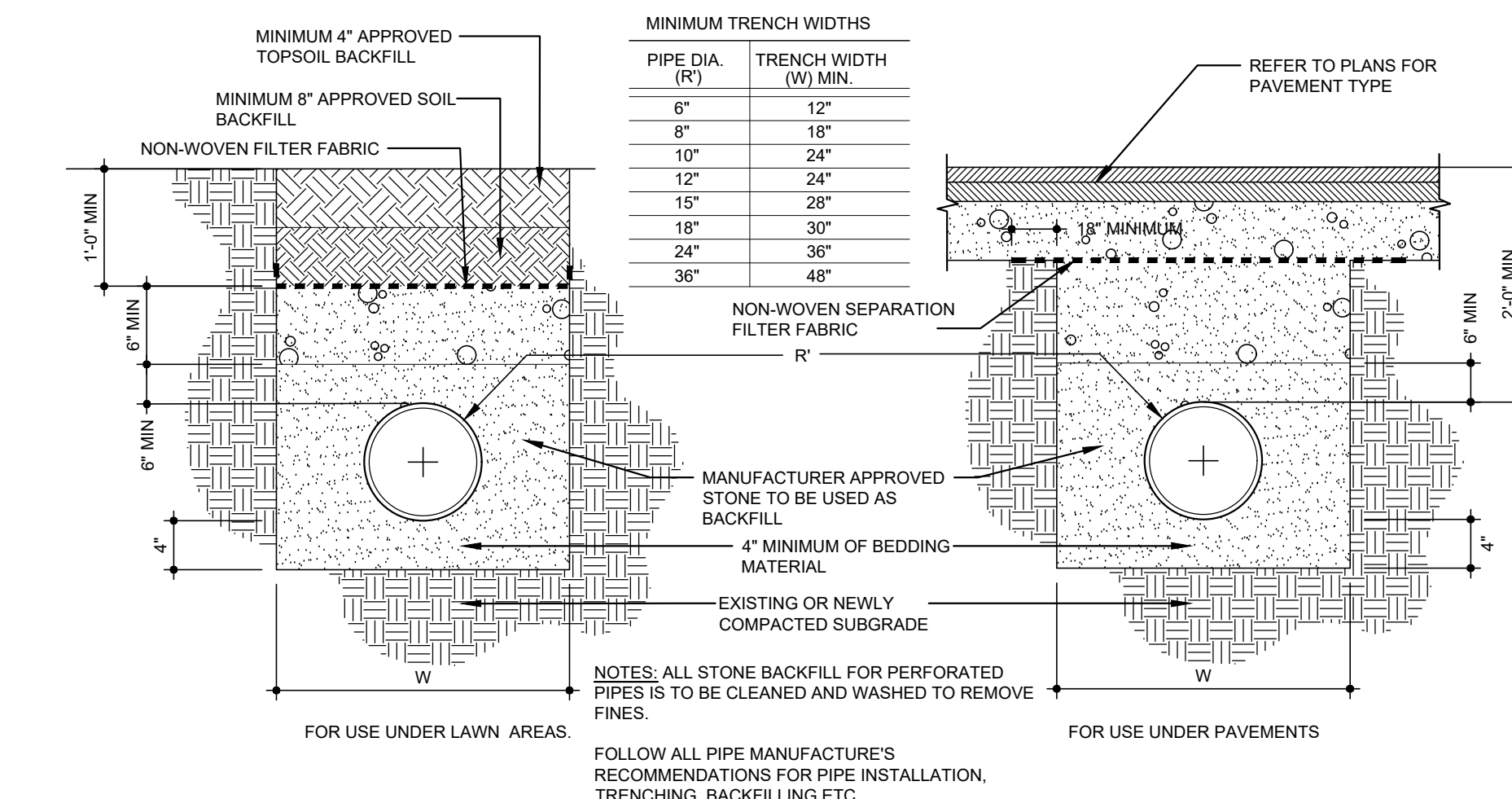
- DEMO BUILDING (1, 2)
- DEMO GRAVEL PAVEMENT (10, 11, 14)
- DEMO ASPHALT PAVEMENT (3)
- DEMO CONCRETE PAVEMENT (6)

<b>DRAWING INFORMATION</b>		<b>KYTC MAINTENANCE FACILITY LIBERTY, KENTUCKY</b>	
A & E FILE NO.	2011	<b>SITE DEMOLITION PLAN</b>	
DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-2001-A10
DRAWN BY	BRB/RAL	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET	
CHECKED BY	LSJ	DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES	
PHASE	RTA	DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION	
RTA DATE	12/16/20	FRANKFORT, KENTUCKY	
		<b>Clotfelter SAMOKAR</b>	
		Architecture   Interiors   Landscapes   Planning	
		228 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH: 859.273.3700 / FAX: 859.271.8605	
		AS-BUILT DATE	
		As-Built Date	
		DECA LOG #	
		A1C-8634	
<b>REVISION HISTORY OF THIS DRAWING</b>			
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE
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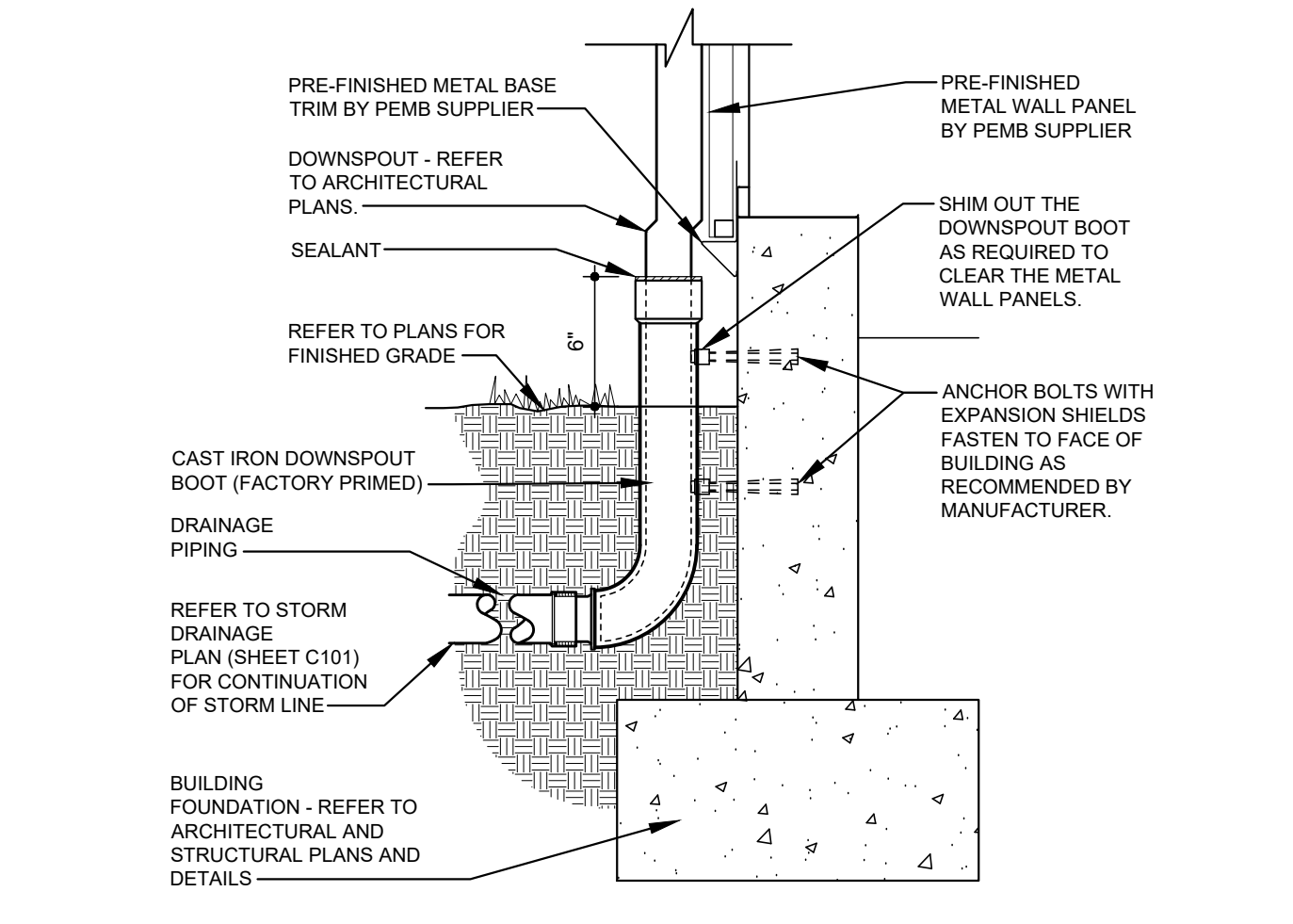




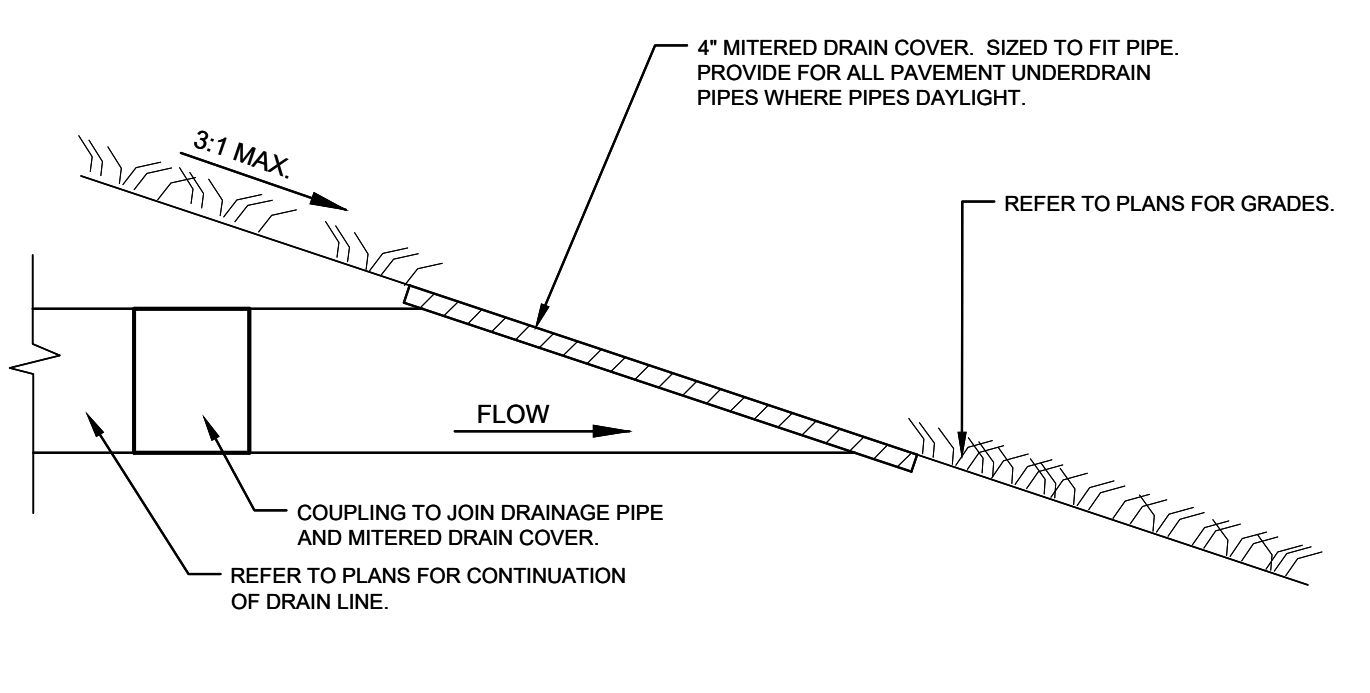
**FOUNDATION DRAIN**  
SCALE: NOT TO SCALE



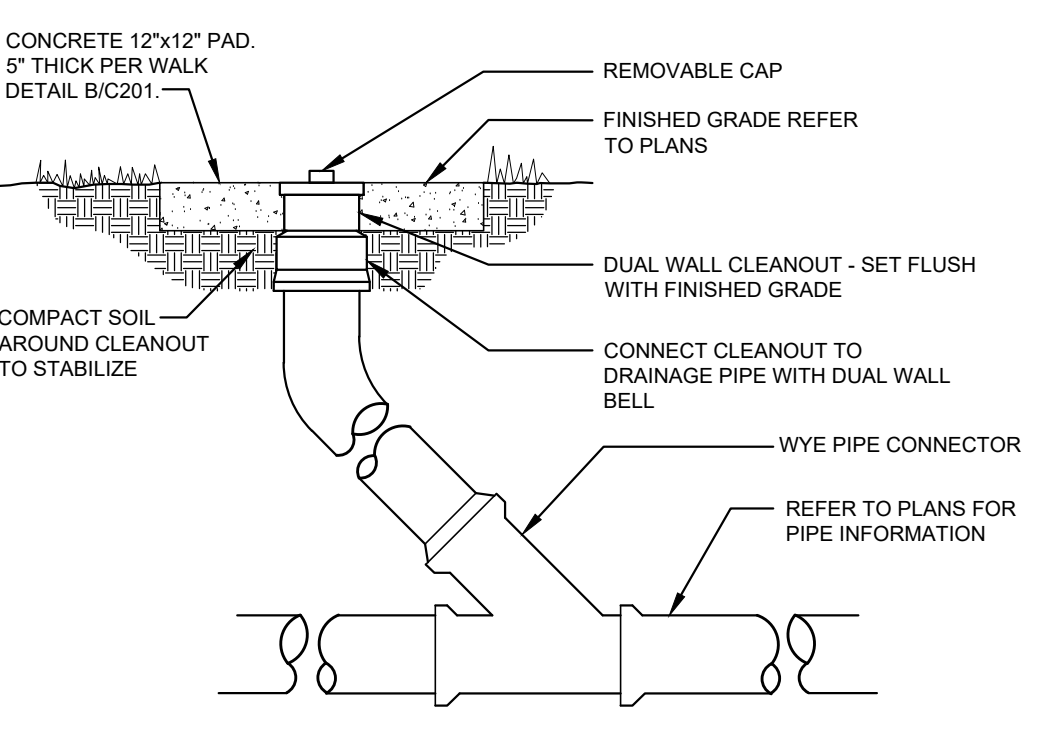
**TYPICAL STORM PIPE BEDDING AND BACKFILL**  
SCALE: NOT TO SCALE



**DOWNSPOUT BOOT**  
SCALE: NOT TO SCALE



**MITERED DRAIN COVER**  
SCALE: NOT TO SCALE



**CLEANOUT IN LAWN**  
SCALE: NOT TO SCALE

- GENERAL GRADING NOTES:**
- REFER TO SHEET C001 FOR ADDITIONAL GENERAL NOTES.
  - THE CONTRACTOR IS RESPONSIBLE FOR MODIFYING THE EROSION CONTROL SYSTEM AS CONSTRUCTION PROCEEDS. IT SHALL ALSO BE THE CONTRACTOR'S RESPONSIBILITY TO PREPARE REVISED EROSION CONTROL PLANS AND SHALL DISPLAY THEM IN A PROMINENT ON-SITE LOCATION. REFER TO SWPPP PLANS FOR ADDITIONAL INFORMATION.
  - ALL REQUIRED EROSION CONTROL MEASURES ARE TO BE INSTALLED BEFORE ANY SITE CLEARING OR EXCAVATION HAS BEGUN. EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL CONSTRUCTION IS COMPLETE, AND UNTIL THE LAWNPLANTINGS HAVE BEEN INSTALLED.
  - NO MUD SHALL BE TRACKED ONTO PUBLIC ROADS OR ADJACENT SCHOOL ROADS.
  - PROTECT ALL STORM SEWER INLETS, DRAINAGE SWALES AND OFFSITE DISCHARGE POINTS FROM ACCUMULATION OF SILT, MUD AND OTHER DEBRIS THROUGHOUT CONSTRUCTION.
  - THE CONTRACTOR IS RESPONSIBLE TO VERIFY THAT ALL AREAS WILL DRAIN. NOTIFY THE ARCHITECT SHOULD ANY AREA NOT DRAIN, FOR RESOLUTION.
  - PRIOR TO REMOVAL OF TOPSOIL, STRIP ALL VEGETATION (INCLUDING ROOTS) WITHIN PROJECT LIMITS AND REMOVE FROM SITE.
  - STRIP AND STOCKPILE ALL TOPSOIL WITHIN THE PROJECT LIMITS. UTILIZE STOCKPILED TOPSOIL TO BACKFILL LAWN AND PLANTING AREAS.
  - ALL SWALES SHALL HAVE A MINIMUM SLOPE OF 1.5% UNLESS NOTED.
  - MAXIMUM CROSS SLOPE FOR CONCRETE WALKS CANNOT EXCEED 2% OR 1" IN 50'.
  - MAXIMUM SLOPE FOR ANY LAWN AREA SHALL NOT EXCEED 1% IN 50'.
  - COORDINATE STORM PIPE INSTALLATION WITH WATER, ELECTRIC, SANITARY, AND OTHER UTILITY INSTALLATION.
  - REFER TO DETAIL A/C101 FOR FOUNDATION DRAIN. INSTALL FOUNDATION DRAIN AROUND PERIMETER OF ENTIRE BUILDING. CONNECT TO NEAREST STORM STRUCTURE / PIPE OR DAYLIGHT WHERE SHOWN (WITH SOLID WALL PIPE). MAINTAIN A MINIMUM SLOPE OF 1/2 PERCENT FOR CONNECTION LINES.

- SHEET NOTES:**
- MEET AND MATCH ELEVATION OF EXISTING IMPROVEMENTS AT POINT OF TIE IN. THE CONTRACTOR IS RESPONSIBLE TO VERIFY THAT IMPROVEMENTS WILL BLEND SMOOTHLY INTO EXISTING FEATURES. NOTIFY ARCHITECT IMMEDIATELY OF ANY DISCREPANCIES.
  - UNIFORM GRADE BETWEEN PROPOSED CONTOUR AND EXISTING CONTOUR GRADES TO REMAIN. EVENLY SMOOTH OUT GRADES TO AVOID ABRUPT CHANGES IN GRADE. WATER SHALL FLOW UNINTERRUPTED FROM NEWLY GRADED AREAS TO EXISTING UNCHANGED AREAS AND VISE VERSA.
  - 24" CONCRETE DRAIN BASIN. PROVIDE 18" SQUARE GRATE. PROVIDE A TRAFFIC RATED METAL GRATE. ENSURE GRATE CAN BE REMOVED AFTER CONCRETE IS PLACED.
  - HDPE STORM DRAINAGE PIPE. REFER TO DETAIL B/C101 FOR ADDITIONAL INFORMATION. PIPE SIZES AND SLOPES ARE SHOWN ON THE PLANS.
  - NOT USED.
  - 4" SOLID WALL STORM DRAINAGE PIPE. CONNECT TO THE FOUNDATION DRAIN. CONNECT PIPE TO NEAREST INLET AS SHOWN OR DAYLIGHT AND PROVIDE MITERED DRAIN COVER PER DETAIL D/C101.
  - NOT USED.
  - HEADWALL PER KYTC STANDARD DRAWING RDH-005-02. PROVIDE 3 IMPACT BLOCKS.
  - INSTALL 6" OF TOPSOIL OVER ALL DISTURBED LAWN AREAS.
  - MAXIMUM SLOPE ON ACCESSIBLE PARKING SPACES CAN NOT EXCEED 1V:50H OR 2.0% PER ADA REQUIREMENTS. REFER TO C201 FOR STRIPING EXTENTS.
  - MAXIMUM SLOPE (OF EITHER NEW FILL OR CUT) SHALL NOT EXCEED 1V IN 50H.
  - DOWNSPOUT CONNECTION TO STORM SYSTEM PER DETAIL C/C101.
  - CLEANOUT PER DETAIL E/C101.
  - FINISHED GRADES ARE SHOWN FOR THE GRAVEL AREAS. PROVIDE IN YOUR BID WORK TO DESIGNED SUBGRADE ELEVATION (-12") FOR THE KYTC INSTALLED DGA PAVEMENT. COORDINATE WITH KYTC AT THE TIME OF WORK TO INSTALL FINISHED GRADING AT THE EDGES OF THE PAVEMENTS.
  - COORDINATE UTILITIES AND STORM DRAINAGE INSTALLATION.
  - ROOF LEADER LINES SHALL BE 8" HDPE OR PVC STORM LINES.

- EXISTING CONDITIONS NOTES (NIC):**
- EXISTING BUILDING FOOTINGS WILL BE REMOVED BY OWNER PRIOR TO START OF CONSTRUCTION. ASSUME THAT AN OPEN TRENCH APPROXIMATELY 4' WIDE AND 3' DEEP WILL BE PRESENT AT THE SITE WHEN CONSTRUCTION BEGINS.
  - EXISTING CONTAMINATED SOILS WILL BE REMOVED BY OWNER PRIOR TO THE START OF CONSTRUCTION. TO ENSURE THAT ALL EROSION AND SEDIMENT CONTROL DEVICES ARE INSTALLED AND MAINTAINED THROUGHOUT THE DURATION OF ALL CONSTRUCTION ACTIVITIES. ALL PUBLIC AND PRIVATE VEHICULAR PATHWAYS ARE TO BE KEPT FREE OF SILT AT ALL TIMES.

- GENERAL EARTH MOVING NOTE:**
- REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION REGARDING EARTH MOVING REQUIREMENTS.

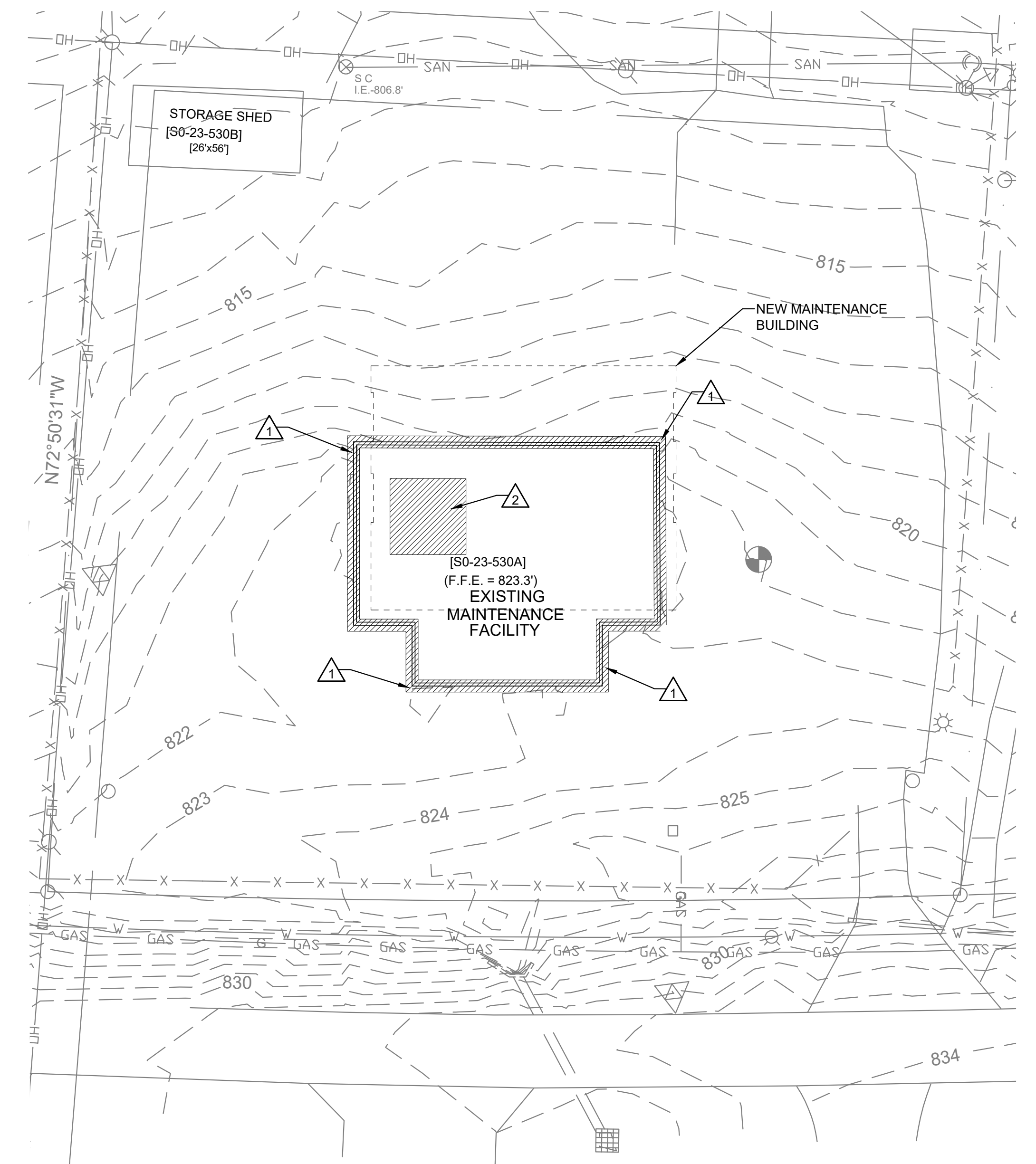
- SEED NOTES:**
- SEED ALL DISTURBED AREAS - REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
  - VOIDS WILL BE LEFT OVER FROM REMOVAL OF THE EXISTING BUILDING FOOTINGS. REFER TO EARTH MOVING SPECIFICATIONS FOR ADDITIONAL INFORMATION.

- BEST MANAGEMENT PRACTICE NOTE:**
- THE CONTRACTOR SHALL IMPLEMENT THE DESIGNED PLAN (C002) AS REQUIRED TO ELIMINATE EROSION AND SEDIMENTATION FROM IMPACTING THE SITE AND SURROUNDING PROPERTIES AND WATERWAYS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL EROSION AND SEDIMENT CONTROL DEVICES ARE INSTALLED AND MAINTAINED THROUGHOUT THE DURATION OF ALL CONSTRUCTION ACTIVITIES. ALL PUBLIC AND PRIVATE VEHICULAR PATHWAYS ARE TO BE KEPT FREE OF SILT AT ALL TIMES.
- THE CONTRACTOR SHALL ADHERE TO THE STORM WATER POLLUTION PREVENTION PLAN THAT HAS BEEN DESIGNED FOR THIS PROJECT.

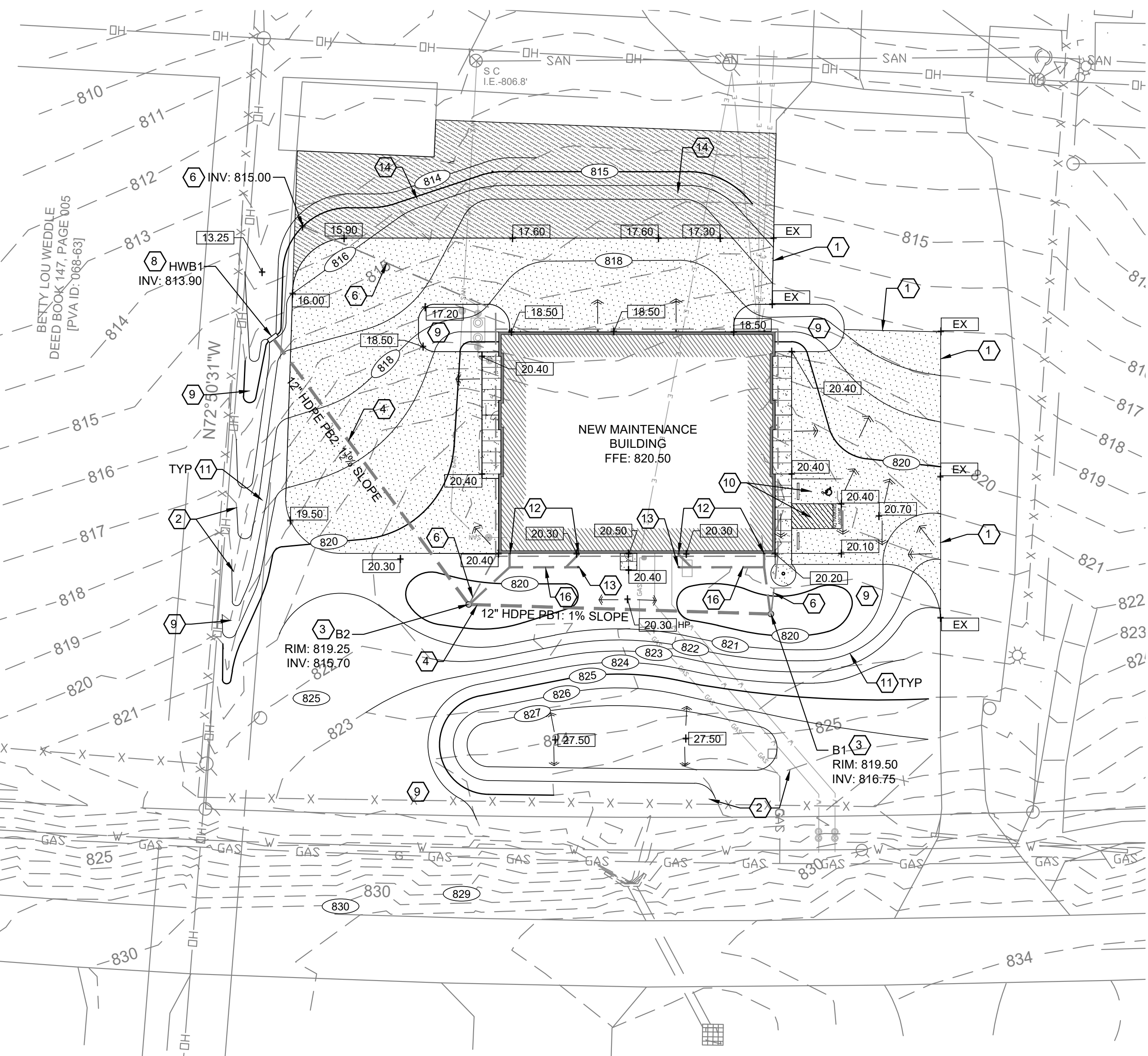
- GRAVEL PAVEMENT NOTE:**
- DGA GRAVEL PAVEMENT IS INSTALLED BY KYTC. COORDINATE WITH KYTC AT TIME OF INSTALL AND FINISH GRADING. FINISHED GRADES ADJACENT TO THE GRAVEL SHALL BE FLUSH.

**LEGEND:**

	NEW BUILDING		EXISTING CONTOURS
	GRAVEL PAVEMENT		PROPOSED CONTOURS
	ASPHALT PAVEMENT		SLOPE DIRECTION
	CONCRETE WALK/PAVEMENT		STORM DRAINAGE STRUCTURES
	EXISTING SPOT ELEVATIONS		EXISTING HIGH POINT
	PROPOSED SPOT ELEVATIONS		



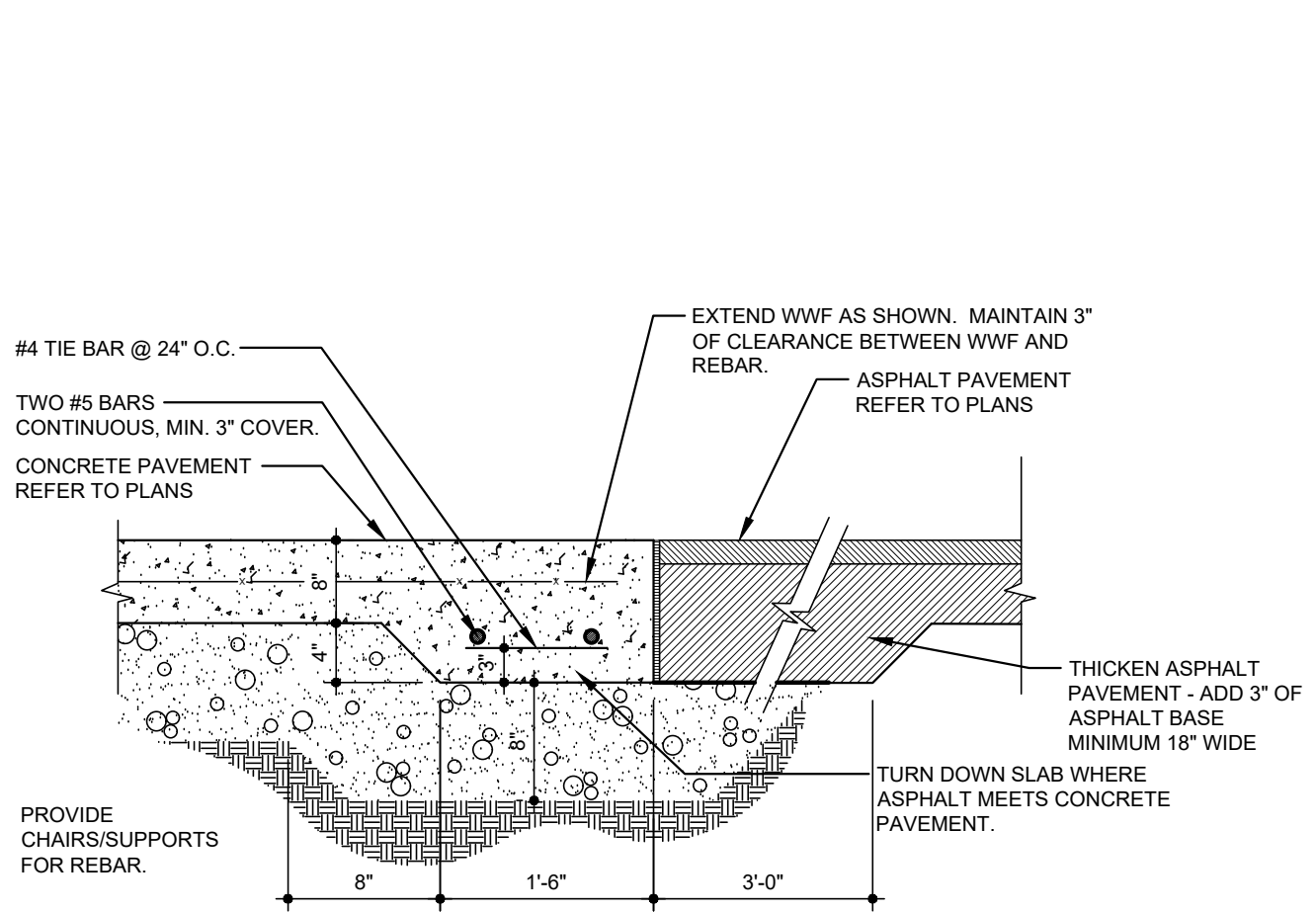
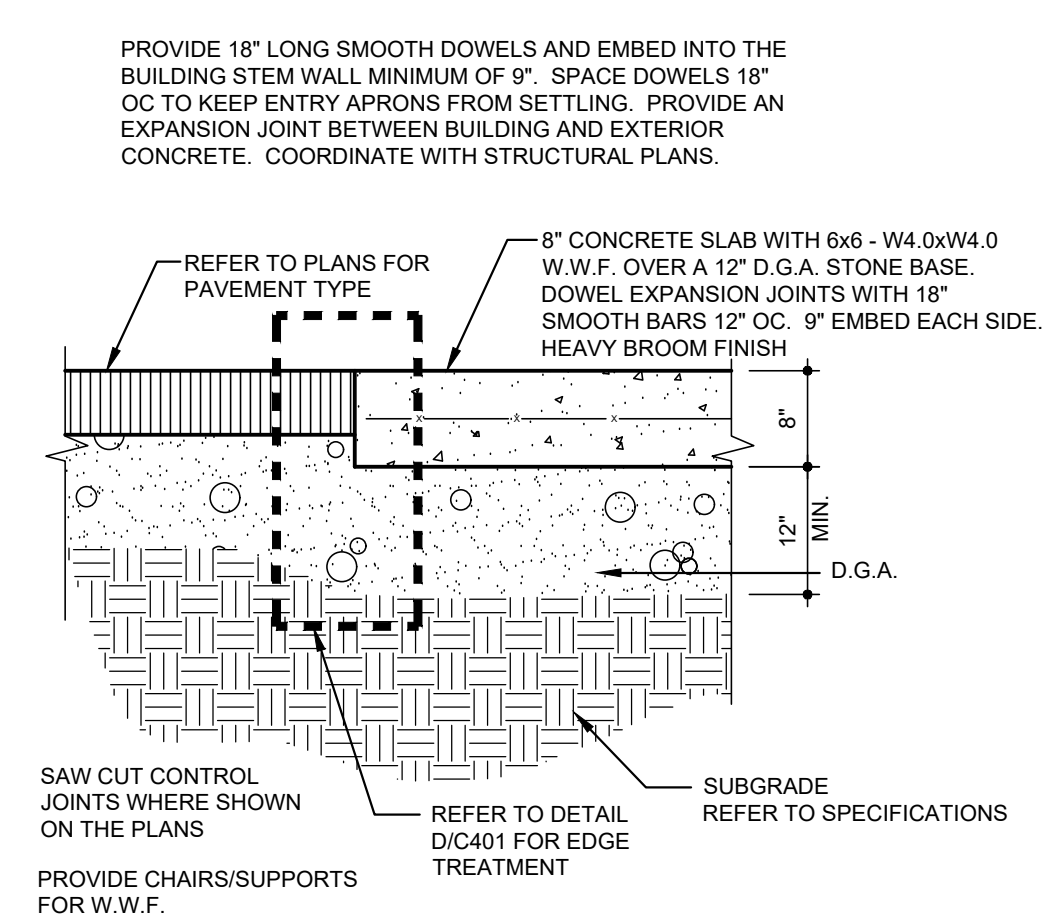
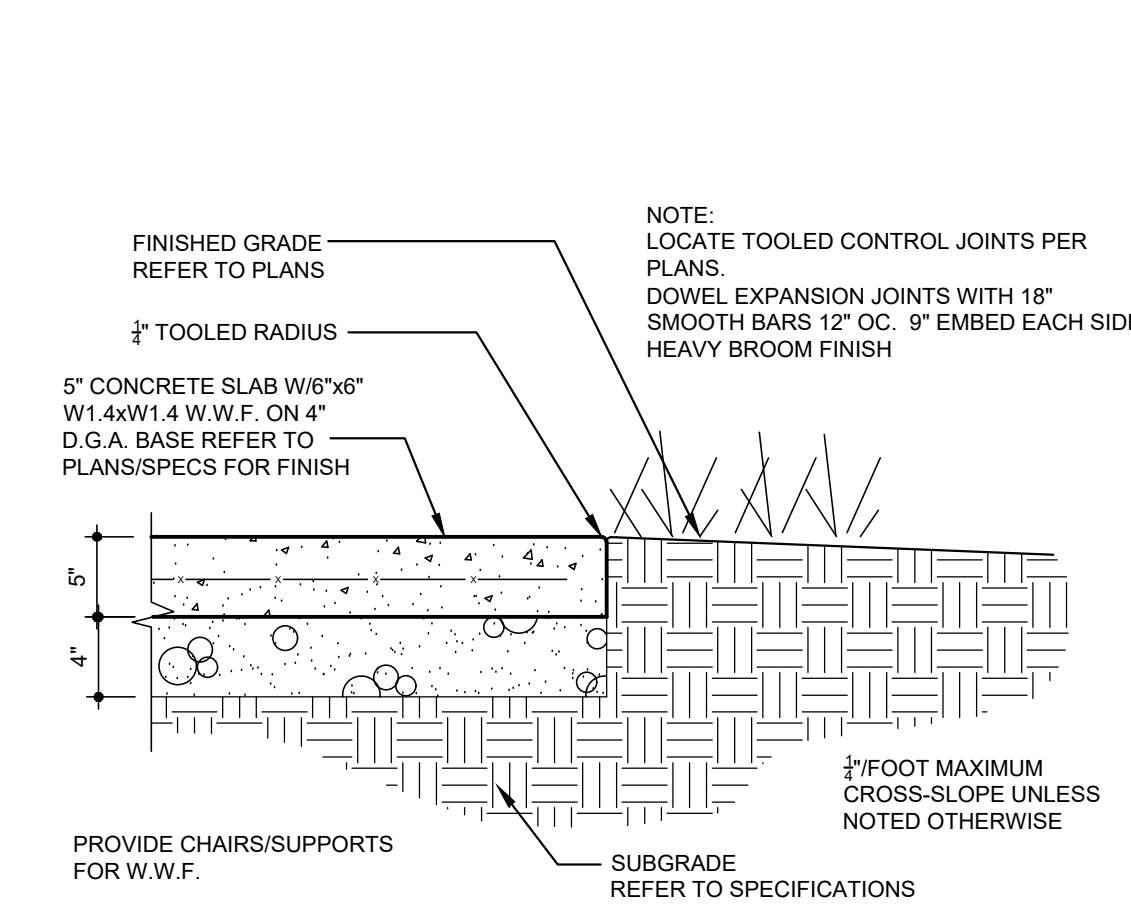
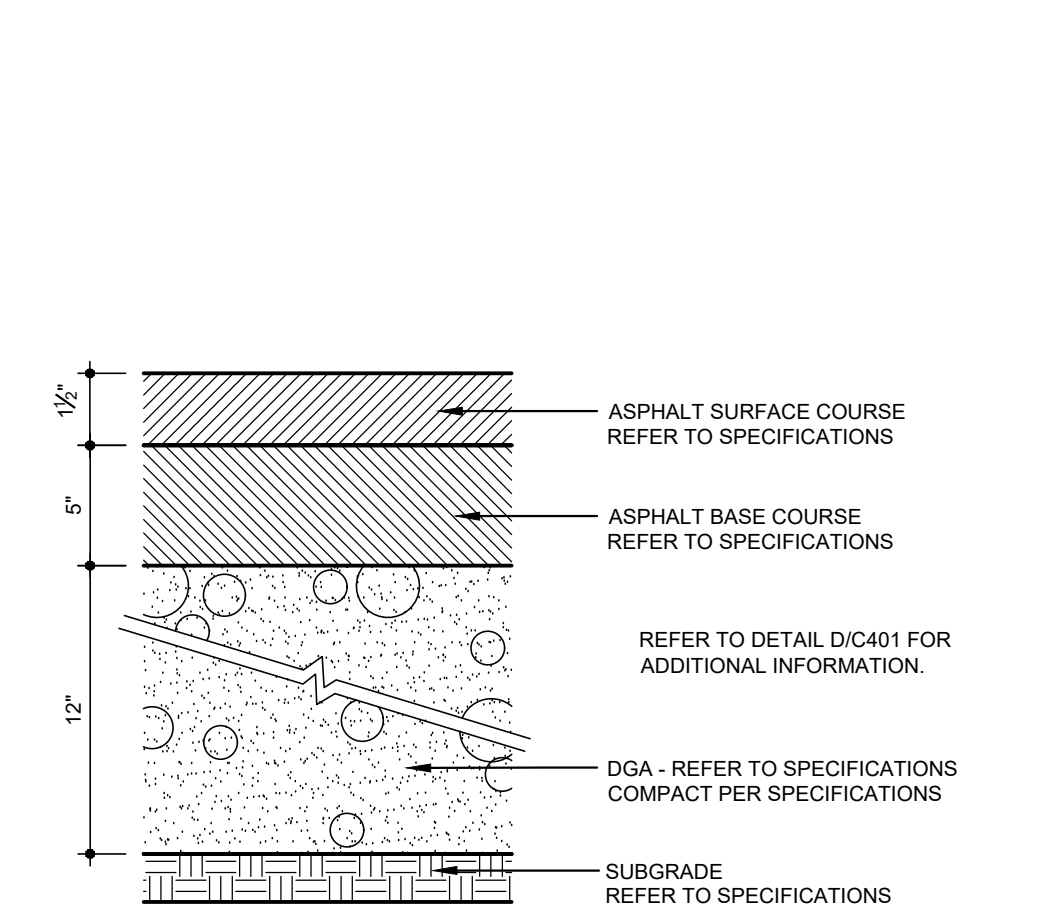
**EXISTING CONDITIONS PLAN**  
SCALE: 1"=30'-0"



**SITE GRADING PLAN AND EROSION CONTROL**  
SCALE: 1"=30'-0"

<b>DRAWING INFORMATION</b>		<b>KYTC MAINTENANCE FACILITY LIBERTY, KENTUCKY</b>	
A & E FILE NO.	2011	<b>SITE GRADING PLAN</b>	
DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-Z001-A10
DRAWN BY	BRB/RAL	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET	
CHECKED BY	LSJ	DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
PHASE	RTA	DRAWING NO.	C101
RTA DATE	12/16/20	AS-BUILT DATE	
		AS-BUILT DATE	
		DECA LOG #	
		A1C-8635	
		228 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH: 859.273.3700 / FAX: 859.271.8605	
		REVISION HISTORY OF THIS DRAWING	
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE
1		5	
2		6	
3		7	
4		8	



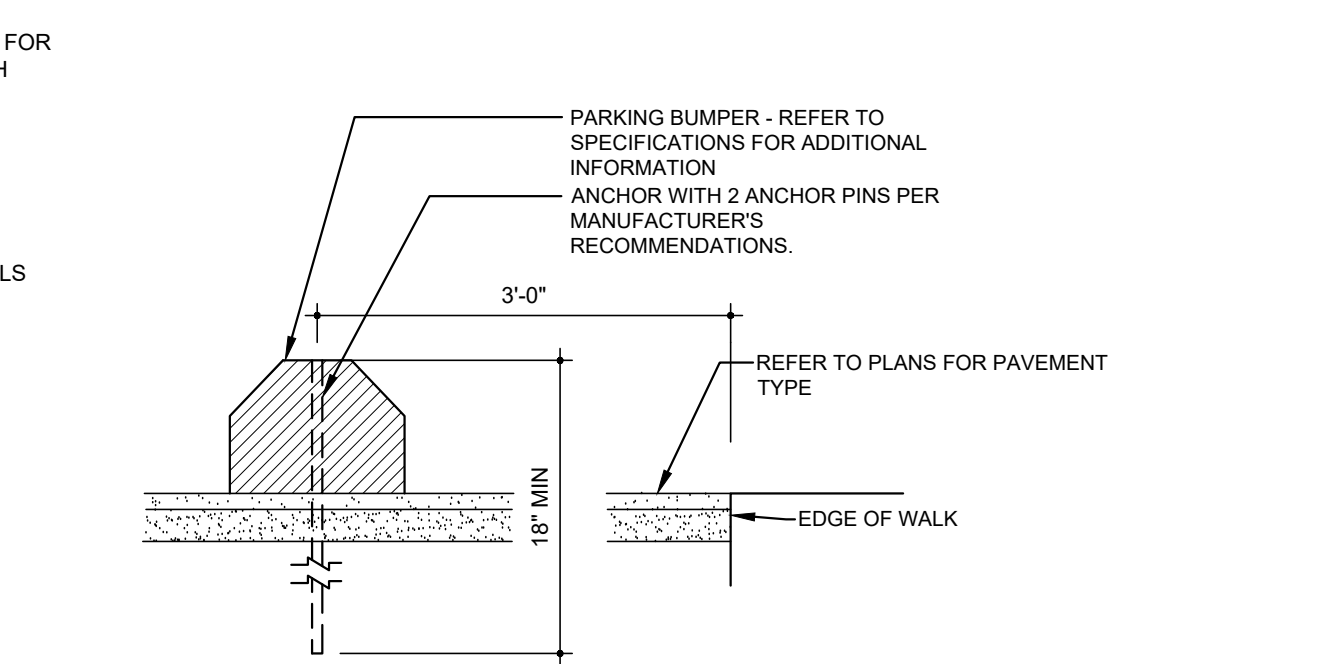
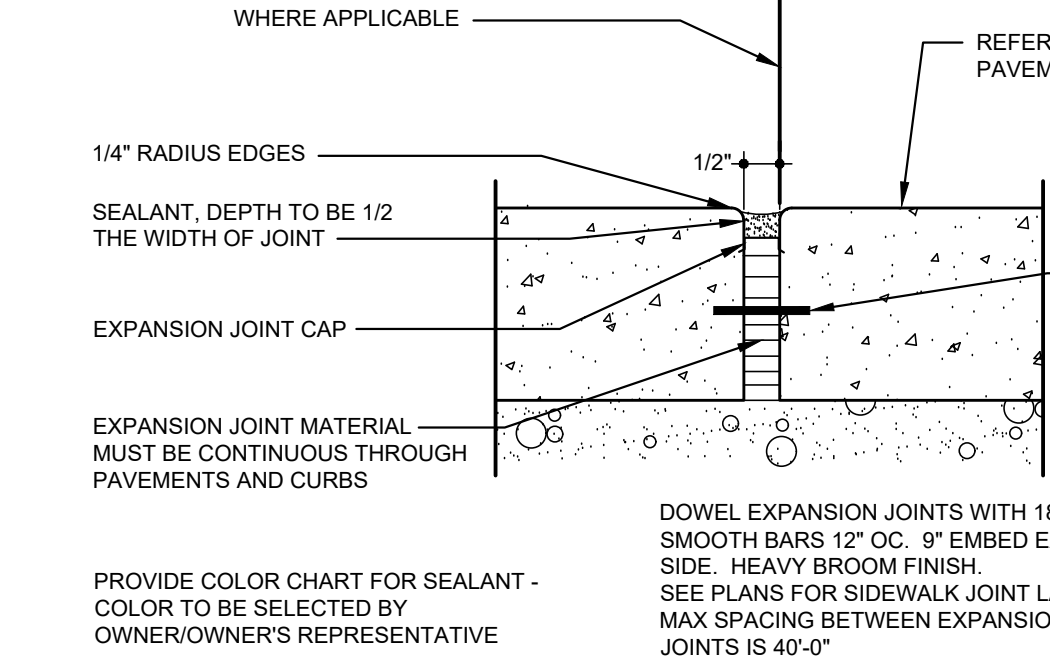
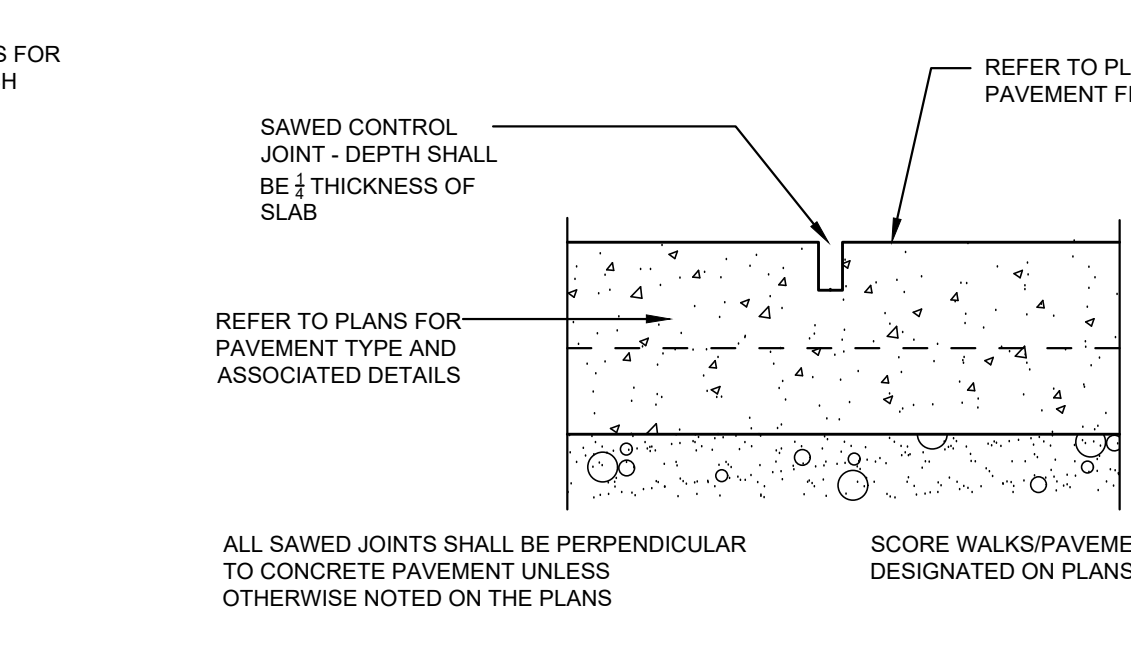
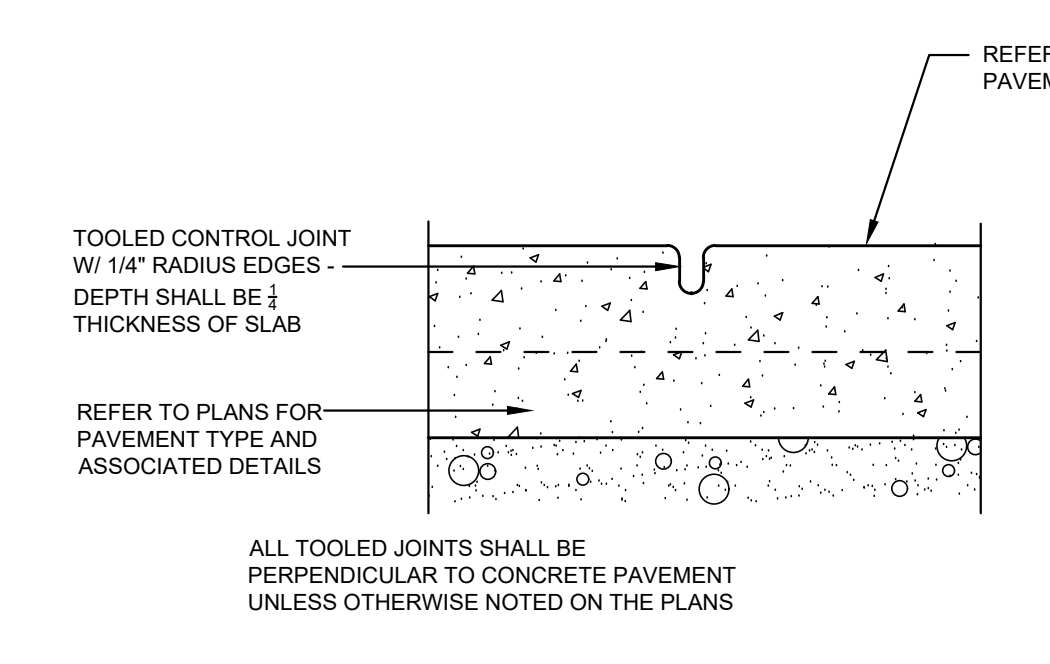


ASPHALT PAVEMENT  
SCALE: NOT TO SCALE

5" CONCRETE WALK  
SCALE: NOT TO SCALE

8" CONC PAVEMENT  
SCALE: NOT TO SCALE

ASPHALT/CONCRETE SECTION  
SCALE: NOT TO SCALE

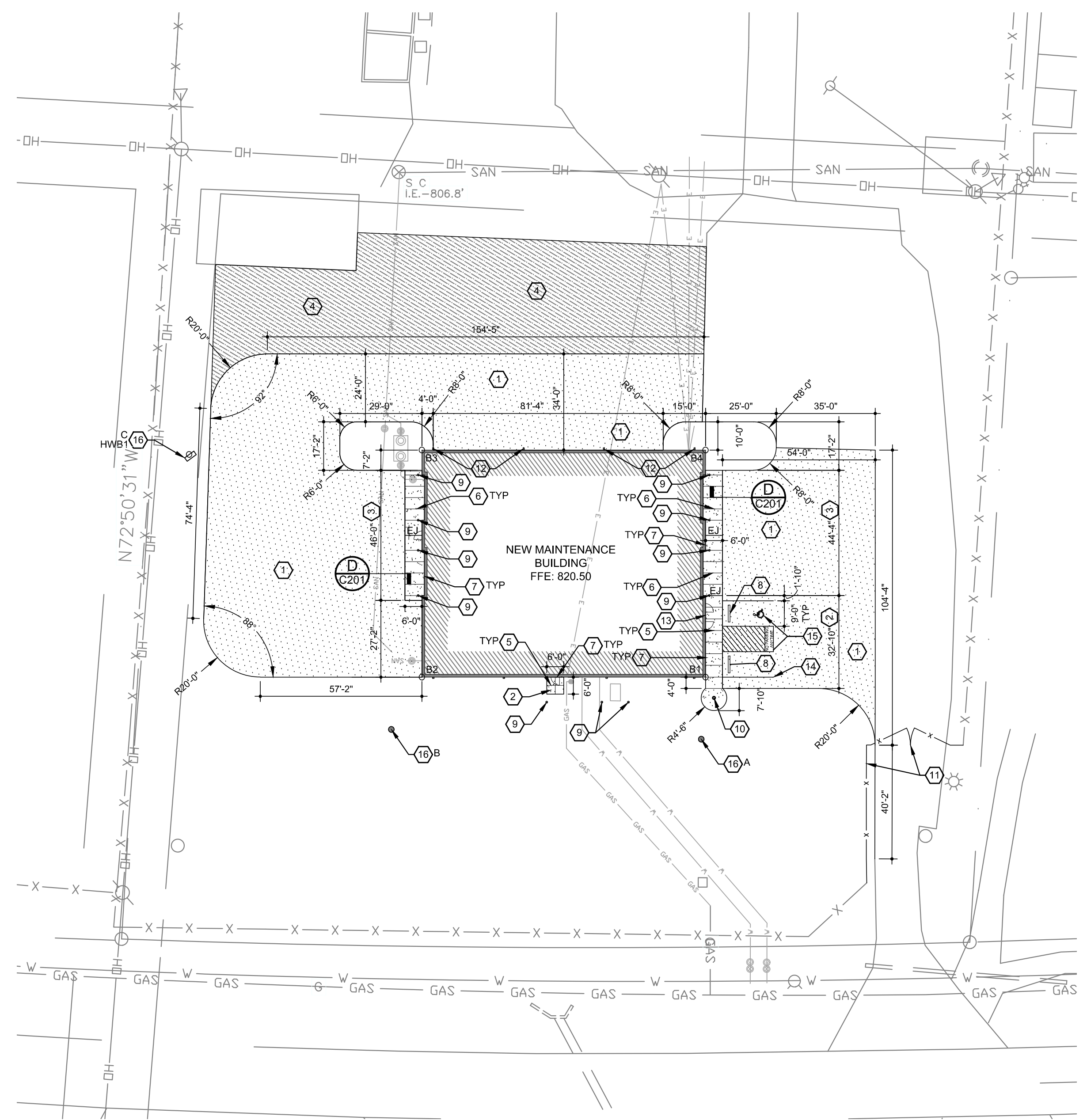


CONTROL JOINT - WALK  
SCALE: NOT TO SCALE

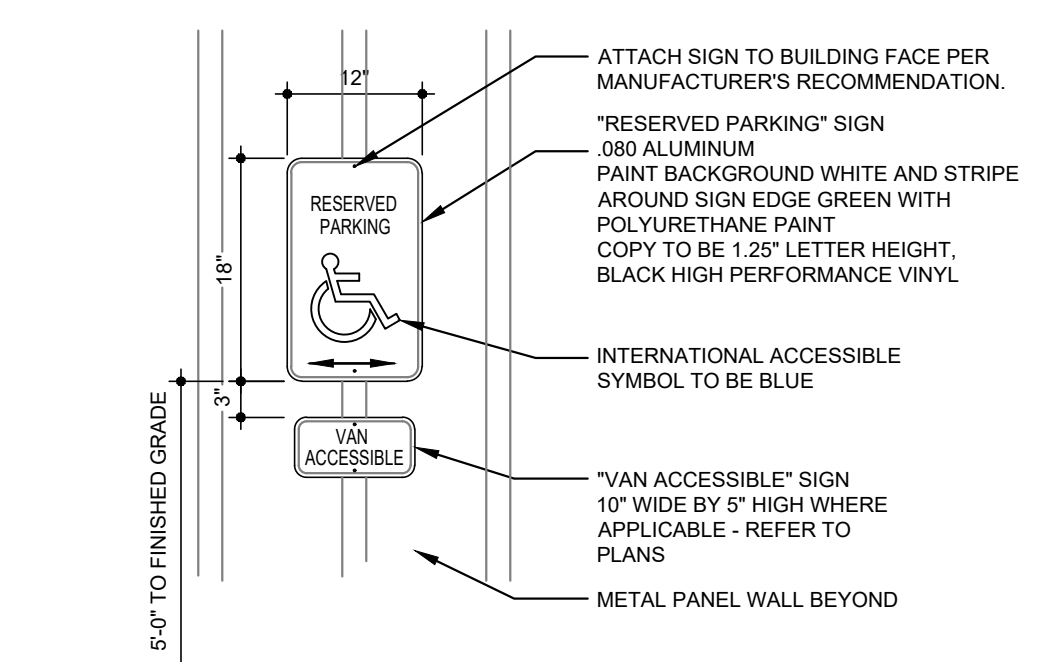
SAWED JOINT - PAVEMENT  
SCALE: NOT TO SCALE

EXPANSION JOINT  
SCALE: NOT TO SCALE

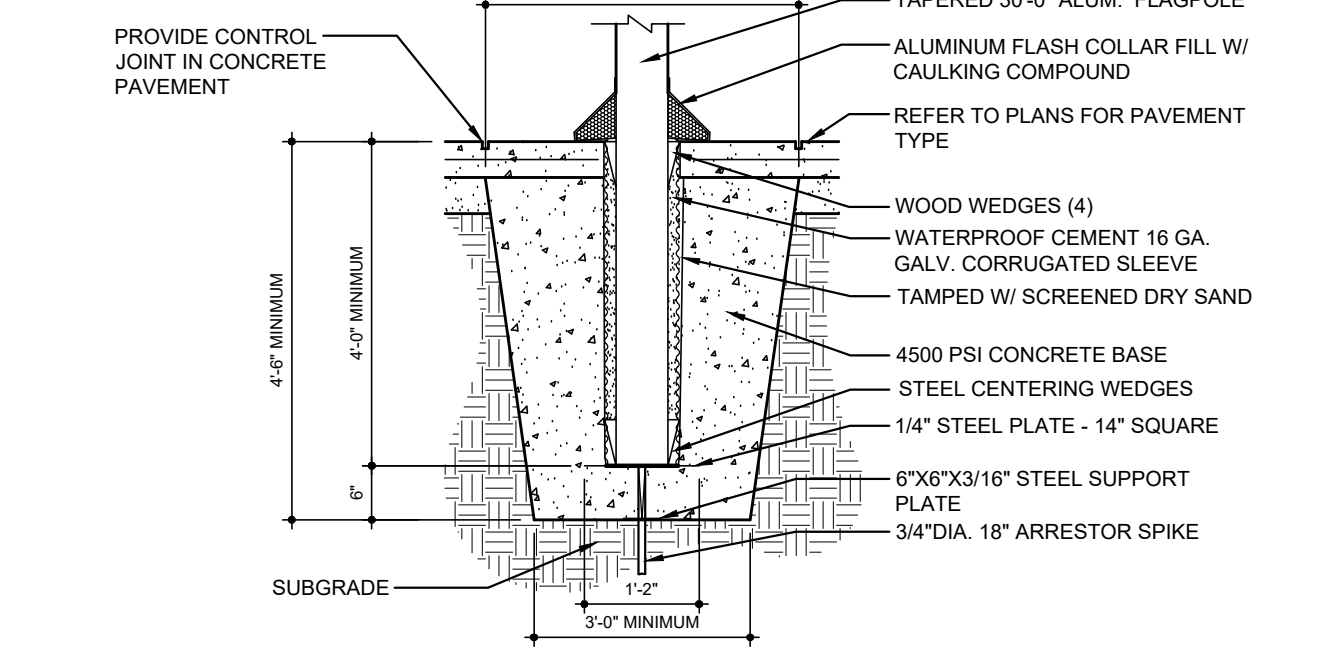
PARKING BUMPER  
SCALE: NOT TO SCALE



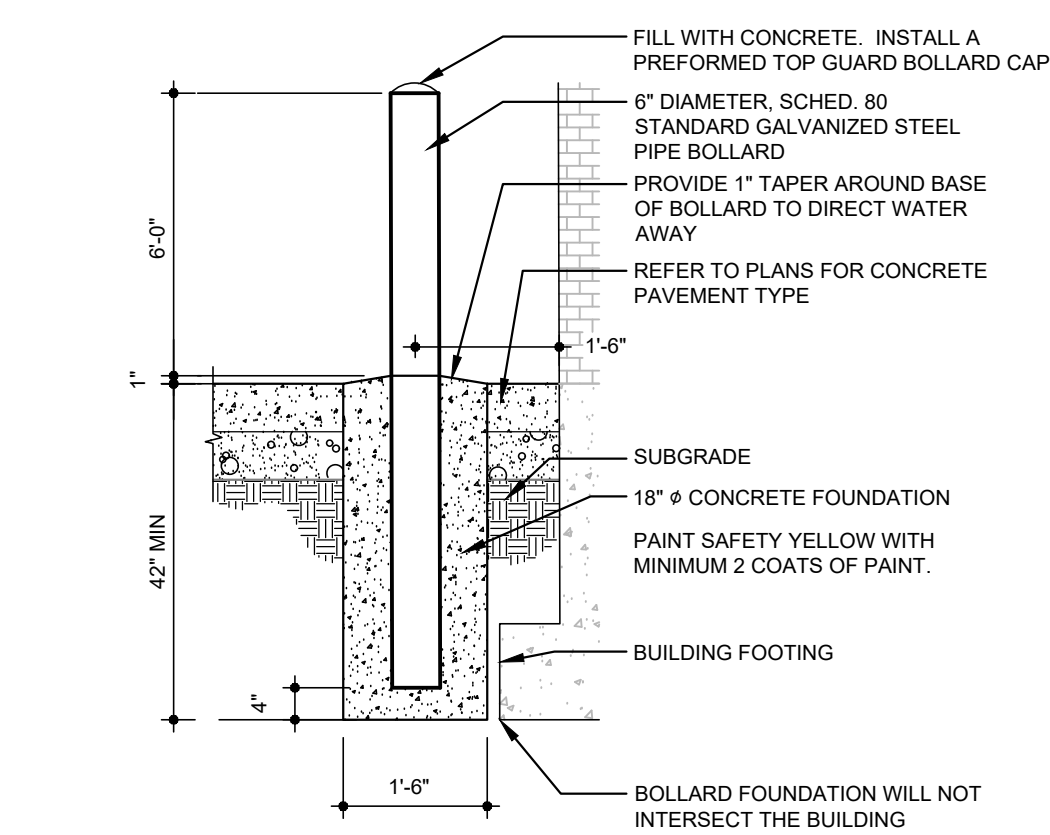
SITE IMPROVEMENT PLAN  
SCALE: 1"=30'-0"



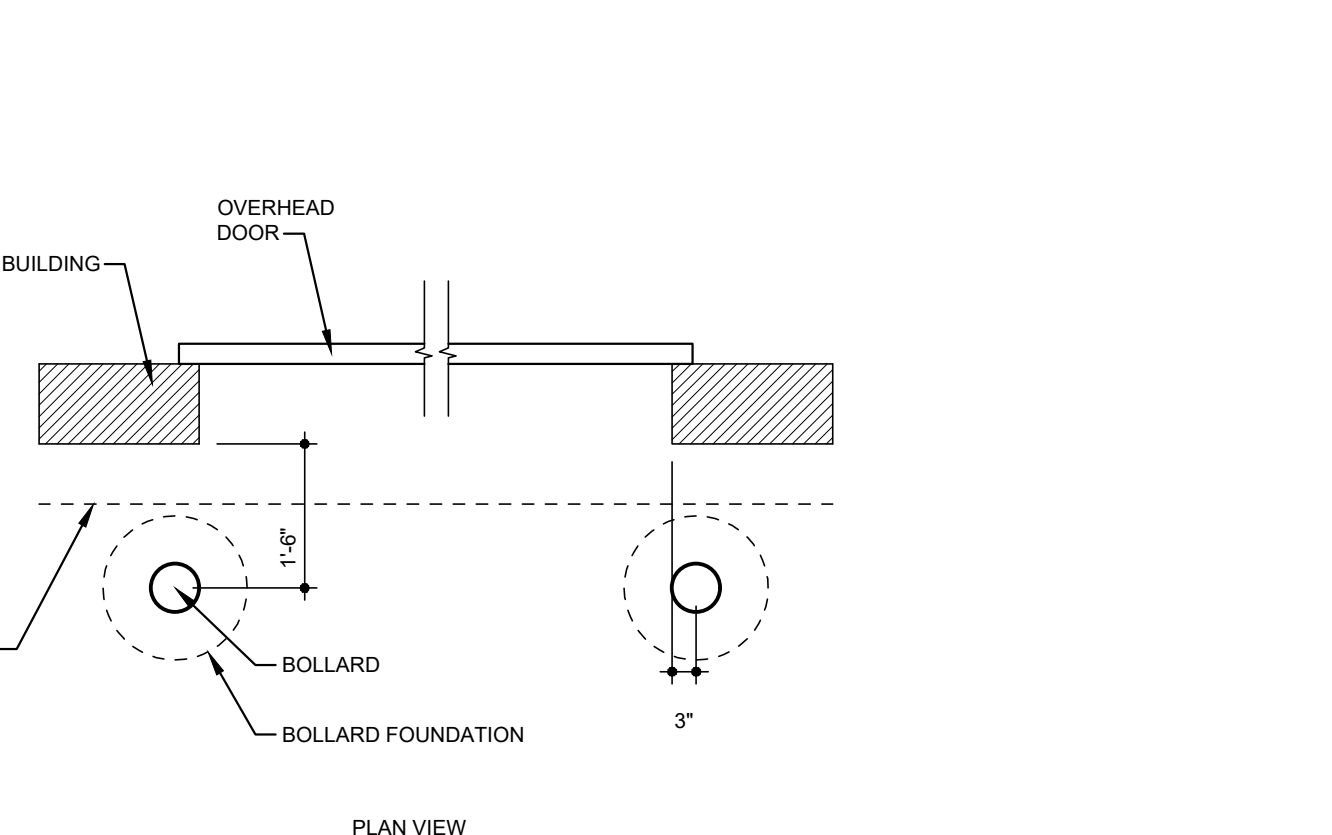
SITE SIGNAGE  
SCALE: NOT TO SCALE



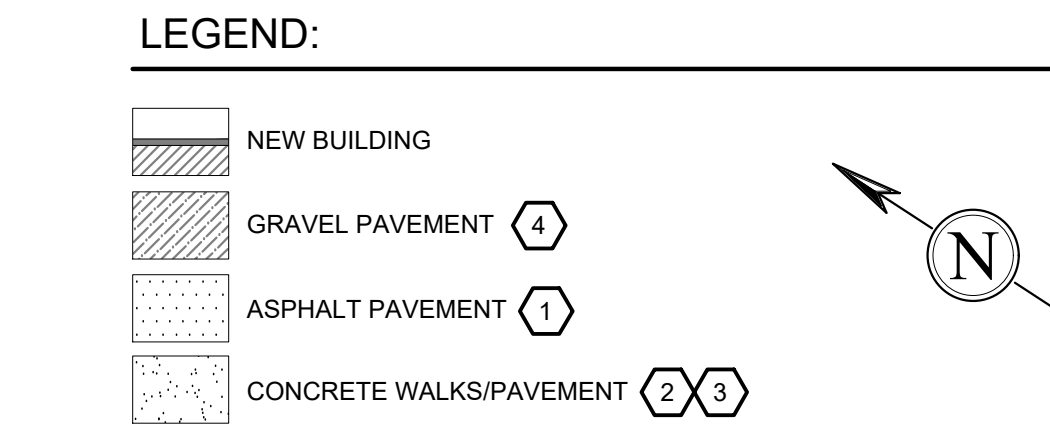
30'-0" TALL FLAGPOLE  
SCALE: NOT TO SCALE



BOLLARD  
SCALE: NOT TO SCALE



BOLLARD  
SCALE: NOT TO SCALE



GENERAL IMPROVEMENT NOTES:

- REFER TO C001 FOR ADDITIONAL GENERAL NOTES.
- PROVIDE EXPANSION JOINTS BETWEEN ALL SITE CONCRETE WALKS/PAVEMENTS AND EXISTING/PROPOSED BUILDING STRUCTURES AND WALLS. PER SHEET NOTE #7.
- PLACE CONTROL JOINTS AND EXPANSION JOINTS AS SHOWN ON THE PLANS AND PER THE DETAILS.
- COORDINATES ARE PROVIDED ON SELECTED BUILDING CORNERS FOR INFORMATIONAL PURPOSES. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT AND PRECISE DIMENSIONS.

SHEET NOTES:

- ASPHALT PAVEMENT PER DETAIL A/C201.
- 5" CONCRETE WALK PER DETAIL B/C201 - MEDIUM BROOM FINISH. (REFER TO CORRESPONDING ADJACENT DIMENSION FOR THE LENGTH OF PAVEMENT TYPE)
- 8" CONCRETE PAVEMENT PER DETAIL C/C201 - HEAVY BROOM FINISH. (REFER TO CORRESPONDING ADJACENT DIMENSION FOR THE LENGTH OF PAVEMENT TYPE). PROVIDE TURN DOWN PER D/C401. REFER TO STRUCTURAL PLANS FOR ADDITIONAL INFORMATION WHERE PAVEMENT INTERSECTS BUILDING.
- DGA GRAVEL PAVEMENT BY KYTC. N.I.C. (ASSUME 12" THICK)
- CONTROL JOINT PER DETAIL E/C201.
- SAWED CONTROL JOINT PER DETAIL F/C201.
- EXPANSION JOINT PER DETAIL G/C201 - ALSO NOTED E.J.
- PARKING BUMPER PER DETAIL H/C201.
- BOLLARD. REFER TO DETAIL L/C201. REFER TO ARCHITECTURAL PLANS FOR ADDITIONAL INFORMATION REGARDING LOCATIONS. NOT ALL BOLLARDS ARE KEYPED IN. COORDINATE BOLLARD PLACEMENT AROUND THE UTILITIES. CONFIRM BOLLARD LOCATIONS WITH ARCHITECT PRIOR TO INSTALL.
- FLAGPOLE PER DETAIL K/C201.
- GATES AND FENCING BY KYTC. N.I.C.
- CONCRETE SPLASH BLOCK TO BE PLACED UNDER ALL DOWNSPOUTS THAT DRAIN ONTO ASPHALT PAVEMENT - REFER TO ARCHITECTURAL PLAN FOR EXACT QUANTITY/ LOCATION OF DOWNSPOUTS.
- ACCESSIBLE PARKING AND VAN ACCESSIBLE PARKING SIGNS PER DETAIL J/C201.
- 4" WHITE PARKING STRIPE.
- 4" BLUE PARKING LOT STRIPING PER ADA STANDARDS - REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
- STORM STRUCTURE - REFER TO SHEET C101 FOR ADDITIONAL INFORMATION.
- UTILITIES - REFER TO SITE UTILITY SHEETS FOR ADDITIONAL INFORMATION.

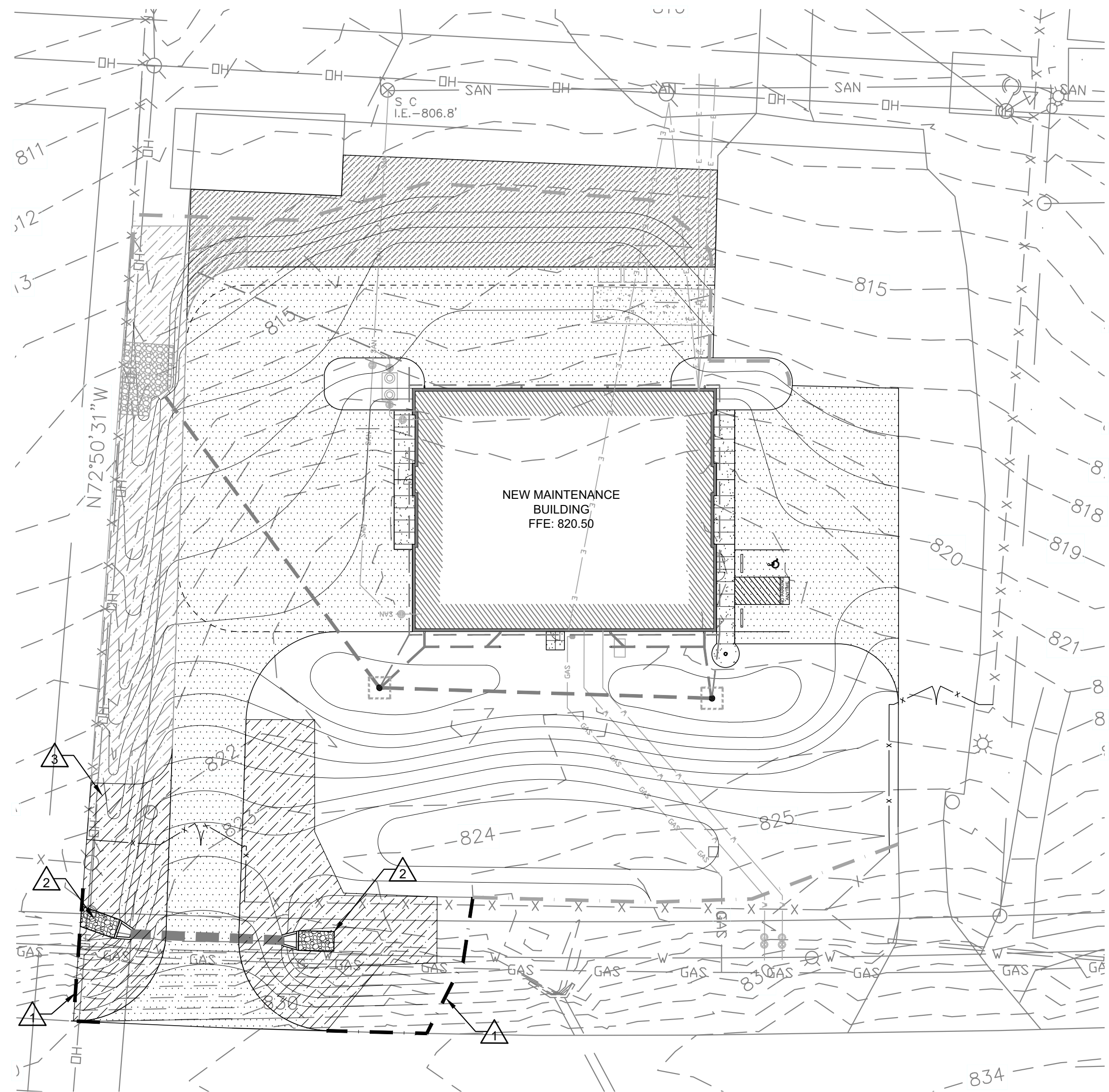
COORDINATE CHART:

BUILDING COORDINATES		
COORDINATE	X	Y
B1	5605.45	7801.05
B2	5581.85	7703.57
B3	5503.81	7722.46
B4	5527.41	7819.95
SITE COORDINATES		
A	5626.45	7794.41
B	5597.30	7688.71
C	5485.98	7642.10

ALL "X" COORDINATES ARE PREFACED WITH 515 AND ALL "Y" COORDINATES WITH 363.

DRAWING INFORMATION		KYTC MAINTENANCE FACILITY LIBERTY, KENTUCKY	
A & E FILE NO.	2011	SITE IMPROVEMENT PLAN	
DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-2001-A10
DRAWN BY	BRB/RAL	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET	
CHECKED BY	LSJ	DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
PHASE	RTA	C201	
RTA DATE	12/16/20	AS-BUILT DATE	As-Built Date
		DECA LOG #	A1C-8636
		228 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH: 859.273.3700 / FAX: 859.271.8605	
REVISION HISTORY OF THIS DRAWING			
NO.	DATE	DESCRIPTION OF REVISIONS	DATE
1			5
2			6
3			7
4			8



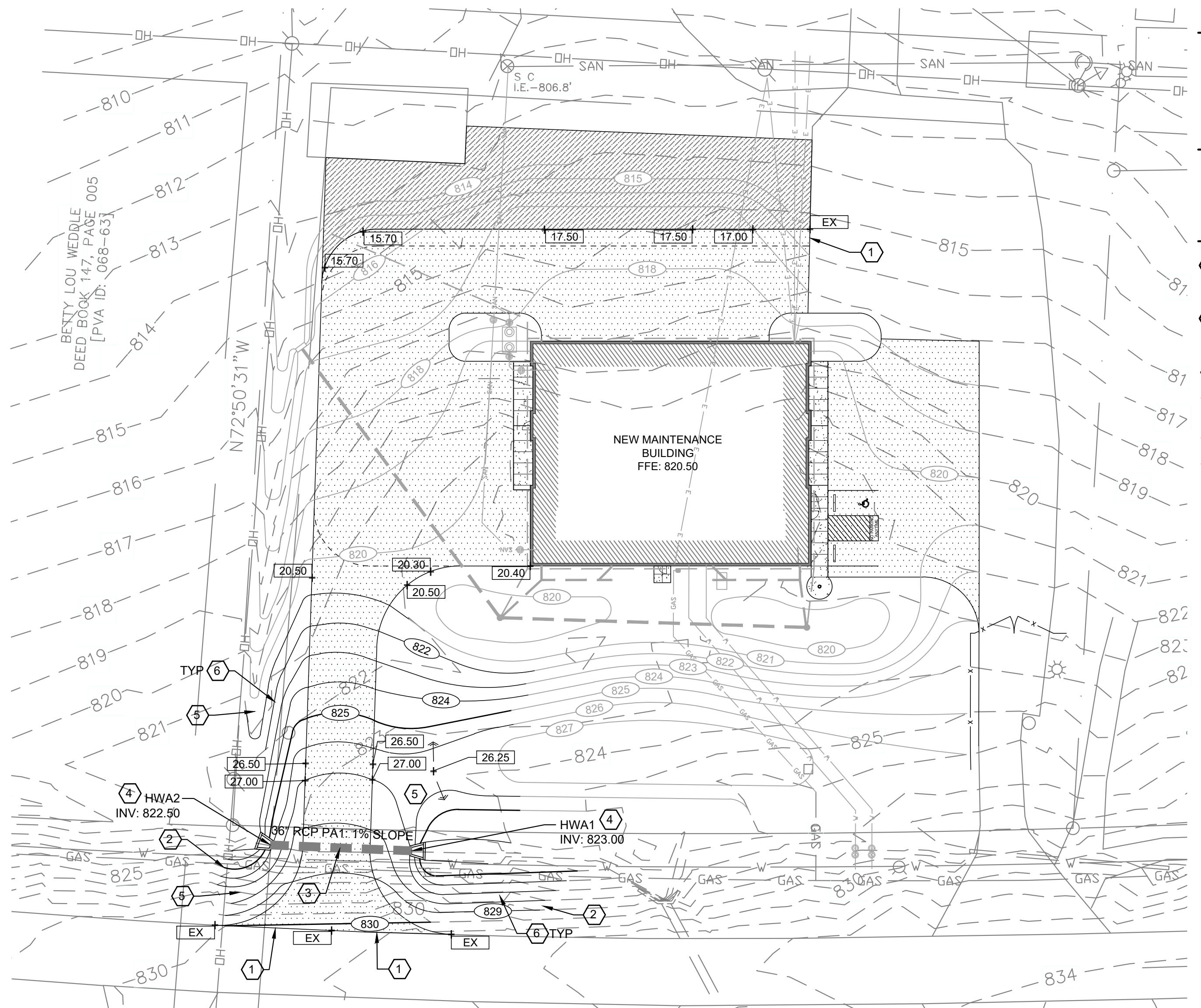


**SITE BMP PLAN - ALT. #1**

SCALE: 1"=30'-0"



- BMP NOTES:**
- 1. SILT FENCE PER DETAIL C/C002. PROVIDE SILT FENCE AROUND ALL STOCKPILED AREAS. DO NOT INSTALL SILT FENCE INSIDE THE DRIP LINE OF THE TREES.
  - 2. RIP RAP, 6" TO 8" SIZE. PROVIDE A MINIMUM 8' WIDE, 15' LONG AND 12" DEEP RIP RAP BED AND TO EXTENT SHOWN ON PLANS. INSTALL A 4 OZ. NON-WOVEN FILTER FABRIC BETWEEN SOIL AND ROCK. RIP RAP SHALL REMAIN. REFER TO DETAIL B/C002 FOR MORE INFORMATION.
  - 3. PROVIDE EROSION CONTROL BLANKETS. REFER TO SPECIFICATIONS FOR MORE INFORMATION.



**SITE GRADING PLAN AND EROSION CONTROL - ALT. #1**

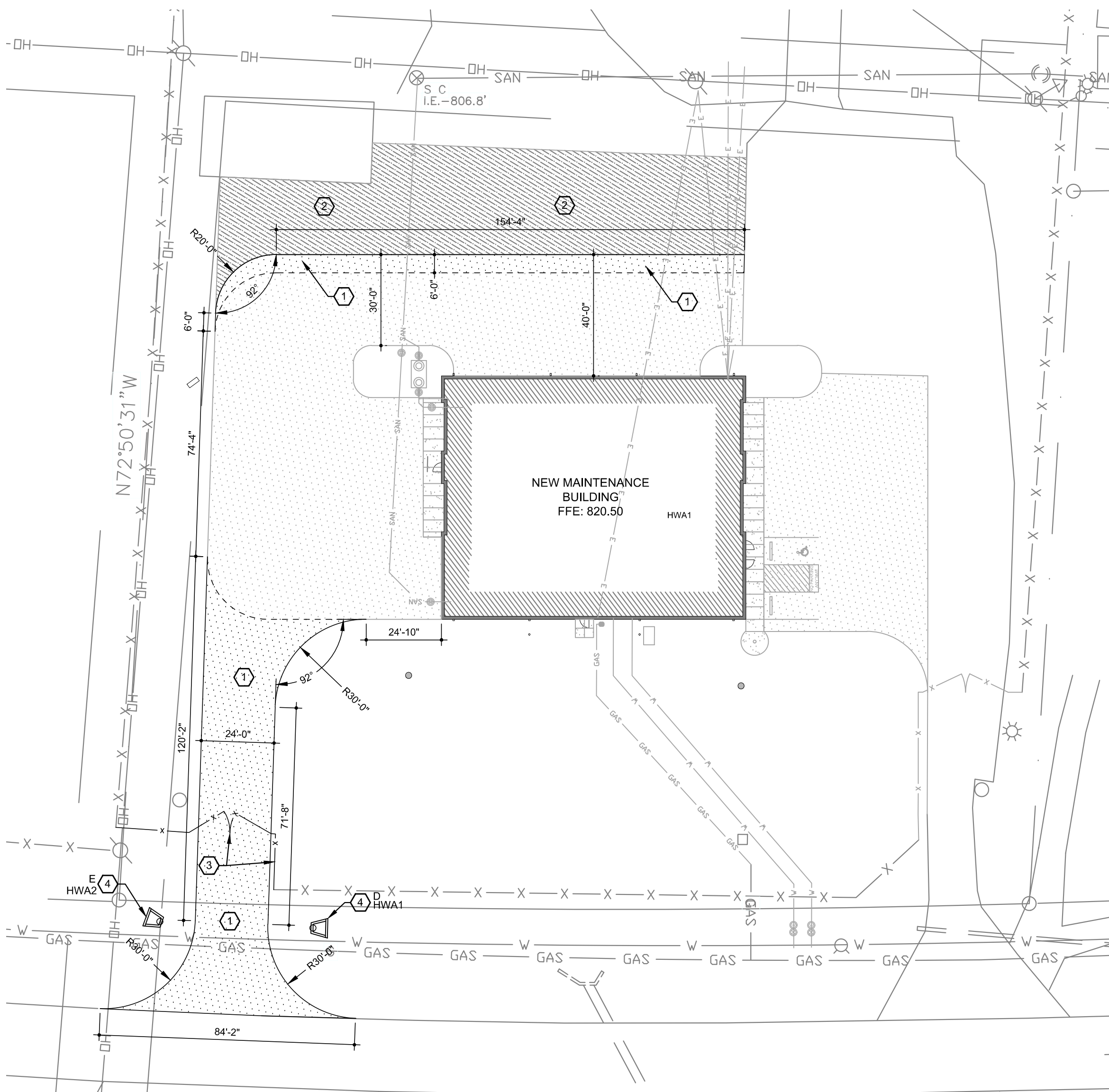
SCALE: 1"=30'-0"



- GENERAL GRADING NOTES:**
1. REFER TO SHEET C001 FOR ADDITIONAL GENERAL NOTES.
  2. REFER TO SHEET C101 FOR ADDITIONAL GRADING NOTES.
  3. COORDINATE ALTERNATE #1 SPOT ELEVATIONS AND GRADES WITH THOSE IN BASE BID WORK.

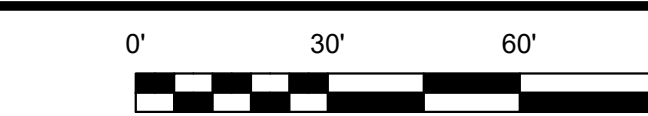
- ALTERNATE #1 DEMOLITION NOTES:**
1. REFER TO SHEET C002 FOR DEMOLITION WORK RELATED TO ALTERNATE #1.

- SHEET NOTES:**
1. MEET AND MATCH ELEVATION OF EXISTING IMPROVEMENTS AT POINT OF TIE IN. THE CONTRACTOR IS RESPONSIBLE TO VERIFY THAT IMPROVEMENTS WILL BLEND SMOOTHLY INTO EXISTING FEATURES. NOTIFY ARCHITECT IMMEDIATELY OF ANY DISCREPANCIES.
  2. UNIFORMLY GRADE BETWEEN PROPOSED CONTOUR AND EXISTING CONTOUR/GRADES TO REMAIN. EVENLY SMOOTH OUT GRADES TO AVOID ABRUPT CHANGES IN GRADE. WATER SHALL FLOW UNINTERRUPTED FROM NEWLY GRADED AREAS TO EXISTING UNCHANGED AREAS AND VISE VERSA.
  3. 36" RCP STORM DRAINAGE PIPE. REFER TO DETAIL B/C101 FOR MORE INFORMATION.
  4. HEADWALL PER KYTC STANDARD DRAWING RDH-110-02 TO ACCOMMODATE 36" RCP PIPE. PROVIDE TRAFFIC IMPACT DEFLECTION GRATES AND ENERGY DISSIPATION BLOCKS (MINIMUM 3).
  5. INSTALL 6" OF TOPSOIL OVER ALL DISTURBED LAWN AREAS.
  6. MAXIMUM SLOPE (OF EITHER NEW FILL OR CUT) SHALL NOT EXCEED 1V IN 3H.



**SITE IMPROVEMENT PLAN - ALT. #1**

SCALE: 1"=30'-0"



- GENERAL IMPROVEMENT NOTES:**
1. REFER TO C001 FOR ADDITIONAL GENERAL NOTES.
  2. REFER TO SHEET C101 FOR ADDITIONAL IMPROVEMENT NOTES.
  3. COORDINATE ALTERNATE #1 LAYOUT AND IMPROVEMENTS WITH THOSE IN BASE BID WORK. DIMENSIONS NOT OTHERWISE SPECIFIED ARE SHOWN ON C201.

- SHEET NOTES:**
1. ASPHALT PAVEMENT PER DETAIL A/C201.
  2. DGA GRAVEL PAVEMENT BY KYTC. N.I.C. (ASSUME 12" THICK)
  3. GATES AND FENCING BY KYTC. N.I.C.
  4. STORM STRUCTURE - REFER TO THE SITE GRADING PLAN ON THIS SHEET AND TO C101 FOR DETAILS.

**COORDINATE CHART:**

SITE COORDINATES			
COORDINATE	X	Y	
D	HWA1	5670.82	7638.45
E	HWA2	5656.91	7589.91

ALL 'X' COORDINATES ARE PREFACED WITH 515 AND ALL 'Y' COORDINATES WITH 563.  
REFER TO C201 FOR THE LOCATIONS OF OTHER SITE AND BUILDING COORDINATES.

**LEGEND:**

	NEW BUILDING		EXISTING CONTOURS
	GRAVEL PAVEMENT		PROPOSED CONTOURS
	ASPHALT PAVEMENT		SLOPE DIRECTION
	CONCRETE WALKS/PAVEMENT		STORM DRAINAGE STRUCTURES
	EXISTING SPOT ELEVATIONS		EXISTING STRUCTURES
	PROPOSED SPOT ELEVATIONS		HIGH POINT

<b>DRAWING INFORMATION</b>		<b>KYTC MAINTENANCE FACILITY LIBERTY, KENTUCKY</b>	
A & E FILE NO.	2011	ALTERNATE #1 SITE WORK	
DRAWING DATE	12/16/09	ACCOUNT NO.	609-C9NW-Z001-A10
DRAWN BY	BRB/RAL	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET	
CHECKED BY	LSJ	DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
PHASE	RTA	DRAWING NO.	C801
RTA DATE	12/16/09	AS-BUILT DATE	As-Built Date
		DECA LOG #	A1C-8637
		228 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH: 859.273.3700 / FAX: 859.271.6605	
REVISION HISTORY OF THIS DRAWING			
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE
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2		6	
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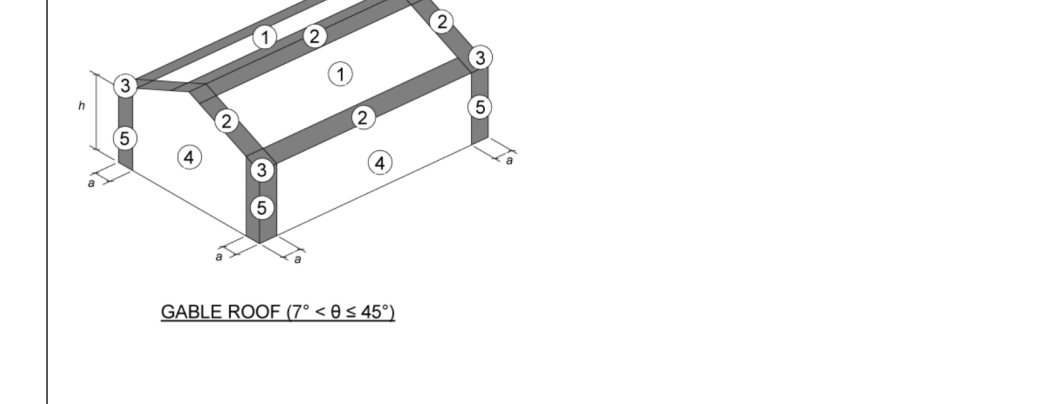


GENERAL NOTES

DESIGN LOADS (FOR GARAGE BUILDING)
STRUCTURAL RISK CATEGORY
FLOOR LIVE LOAD
SLAB ON GRADE (MAINTENANCE BAY)
SLAB ON GRADE (OFFICE, STORAGE, ETC.)
ROOF LIVE LOAD
ROOF SNOW LOAD (PER ASCE 7-10)
GROUND SNOW LOAD
IMPORTANCE FACTOR
SNOW EXPOSURE FACTOR
THERMAL FACTOR
RAIN ON SNOW SURCHARGE
FLAT ROOF SNOW LOAD (P)
MINIMUM ROOF SNOW LOAD (P)
SLOPED ROOF SNOW LOAD (P)
WIND LOAD (PER ASCE 7-10)
ULTIMATE DESIGN WIND SPEED
NOMINAL DESIGN WIND SPEED
WIND EXPOSURE
INTERNAL PRESSURE COEFFICIENT
END ZONE WIDTH

COMPONENTS & CLADDING EXTERNAL PRESSURE ULTIMATE (LRF) LOADS (PSF)
EFFECTIVE WIND AREA (SQ FT)
LOCATION PER ASCE 7-10: (1) (2) (3) (4) (5)
-10
20
50
100
500

- NOTES:
1. WIND LOADING PROVIDED ARE ULTIMATE (LRF) LOADING. FOR ALLOWABLE STRESS DESIGN MULTIPLY LOADS PROVIDED BY 0.6.
2. LOADING PROVIDED IS FOR WORST CASE ROOF HEIGHT. DELEGATED DESIGNERS MAY RECALCULATE LOADS FOR SPECIFIC COMPONENT HEIGHTS USING PARAMETERS SPECIFIED.
3. PRESSURES SHOWN ARE APPLIED NORMAL TO THE SURFACE.
4. PLUS AND MINUS SIGNS INDICATE PRESSURES ACTING TOWARD AND AWAY FROM THE SURFACES, RESPECTIVELY.
5. EACH COMPONENT MUST BE DESIGNED FOR MAXIMUM POSITIVE AND NEGATIVE FORCES.
6. FOR COMPONENTS HAVING EFFECTIVE AREAS IN BETWEEN TABULATED VALUES, DESIGN LOADS MAY BE INTERPOLATED. OTHERWISE DESIGN LOAD MUST BE TAKEN FROM THE NEXT LOWEST EFFECTIVE AREA.
7. INTERNAL PRESSURE FOR ENCLOSED BUILDING IS INCLUDED IN ABOVE VALUES.
8. THE NET C&C PRESSURE (INCLUDING INTERNAL PRESSURE) FOR ANY COMPONENT SHALL NOT BE TAKEN LESS THAN 18 PSF ACTING IN EITHER DIRECTION NORMAL TO THE SURFACE.
9. NOTATION:
a. 10 PERCENT OF LEAST HORIZONTAL DIMENSION OR 0.4', WHICHEVER IS SMALLER, BUT NOT LESS THAN EITHER 4% OF LEAST HORIZONTAL DIMENSION OR 3 FT.
b. MEAN ROOF HEIGHT, IN FEET, EXCEPT THAT EAVE HEIGHT SHALL BE USED FOR ROOF ANGLES 45° < 90°.
c. ANGLE OF PLANE OF ROOF FROM HORIZONTAL, IN DEGREES.



EARTHQUAKE DESIGN DATA
COUNTY / STATE: CASEY / KENTUCKY
IMPORTANCE FACTOR: Ie = 1.0
MAPPED SHORT PERIOD RESPONSE ACCELERATION: Ss = 0.189
MAPPED 1 SECOND PERIOD RESPONSE ACCELERATION: S1 = 0.102
SITE CLASS: CLASS C
DESIGN SHORT PERIOD SPECTRAL RESPONSE COEFFICIENT: Sps = 0.147
DESIGN 1 SECOND PERIOD SPECTRAL RESPONSE COEFFICIENT: S1p = 0.113
SEISMIC DESIGN CATEGORY: CATEGORY A

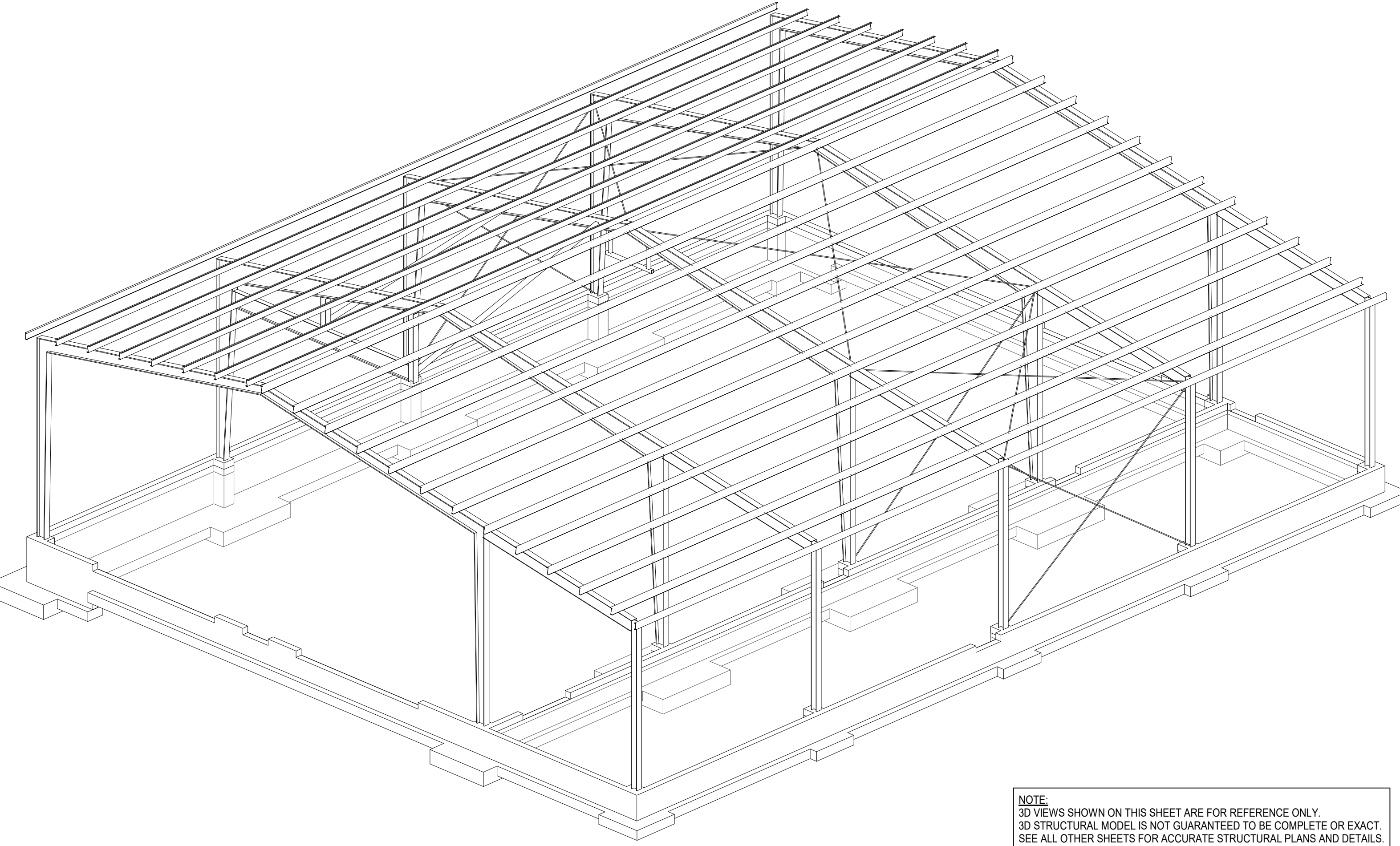
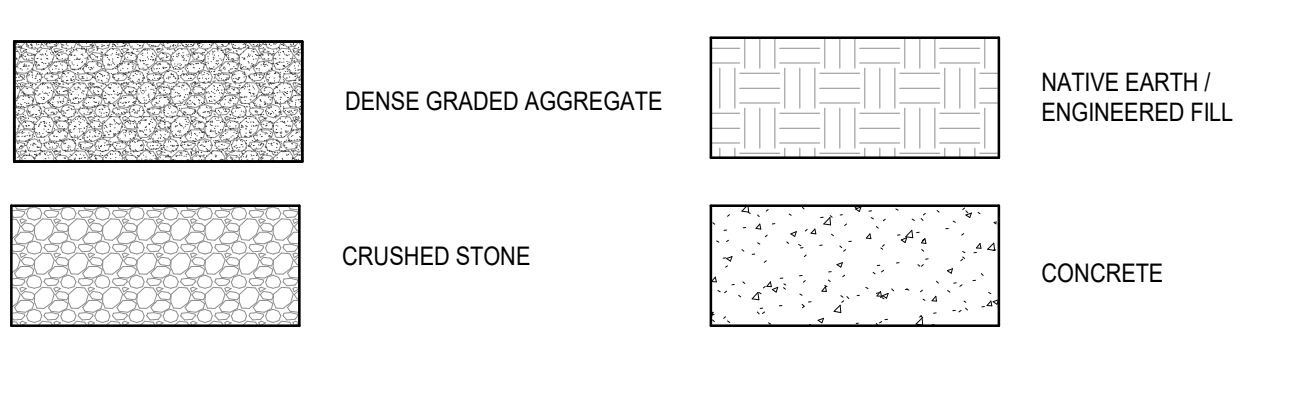
DESIGN STRESSES
CONCRETE (STRENGTH DESIGN) MINIMUM COMPRESSIVE STRENGTH IN 28 DAYS:
FOOTINGS: fc = 3,000 PSI
FOUNDATION WALLS, PIERS AND INTERIOR SLABS ON GRADE: fc = 4,000 PSI
CONCRETE EXPOSED TO FREEZE/THAW: fc = 5,000 PSI
WELDED WIRE FABRIC (ASTM A108): fy = 60,000 PSI
REINFORCING BARS (ASTM A615 GRADE 60): fy = 60,000 PSI
WIDE FLANGE AND TEE SHAPES DESIGNATED AS W AND WT (ASTM A992): fy = 50,000 PSI
CHANNELS, ANGLES, PLATES AND BARS (ASTM A36): fy = 50,000 PSI
HOLLOW STRUCTURAL SECTIONS - RECTANGULAR STEEL TUBES (ASTM A500 GRADE C): fy = 50,000 PSI
SOIL BEARING PRESSURE FOR FOUNDATIONS (REMEDIATED IN-SITU SOILS OR NEW ENGINEERED FLL): 2,500 PSF

- DESIGN CRITERIA
1. STRUCTURE IS DESIGNED IN ACCORDANCE WITH THE 2010 KENTUCKY BUILDING CODE, 2<sup>ND</sup> EDITION (2015 IBC).
2. MAXIMUM ESTIMATED DEFLECTIONS (IN INCHES) ARE AS FOLLOWS:
ROOF MEMBERS: LIVE LOAD DEAD + LIVE LOAD
WHERE: L = SPAN LENGTH BETWEEN CENTERLINE OF SUPPORTS (INCHES) FOR CANTILEVERS L = TWICE THE LENGTH OF THE CANTILEVER.
3. NO PROVISION HAS BEEN MADE FOR FUTURE HORIZONTAL OR VERTICAL EXPANSION.

STRUCTURAL ABBREVIATIONS

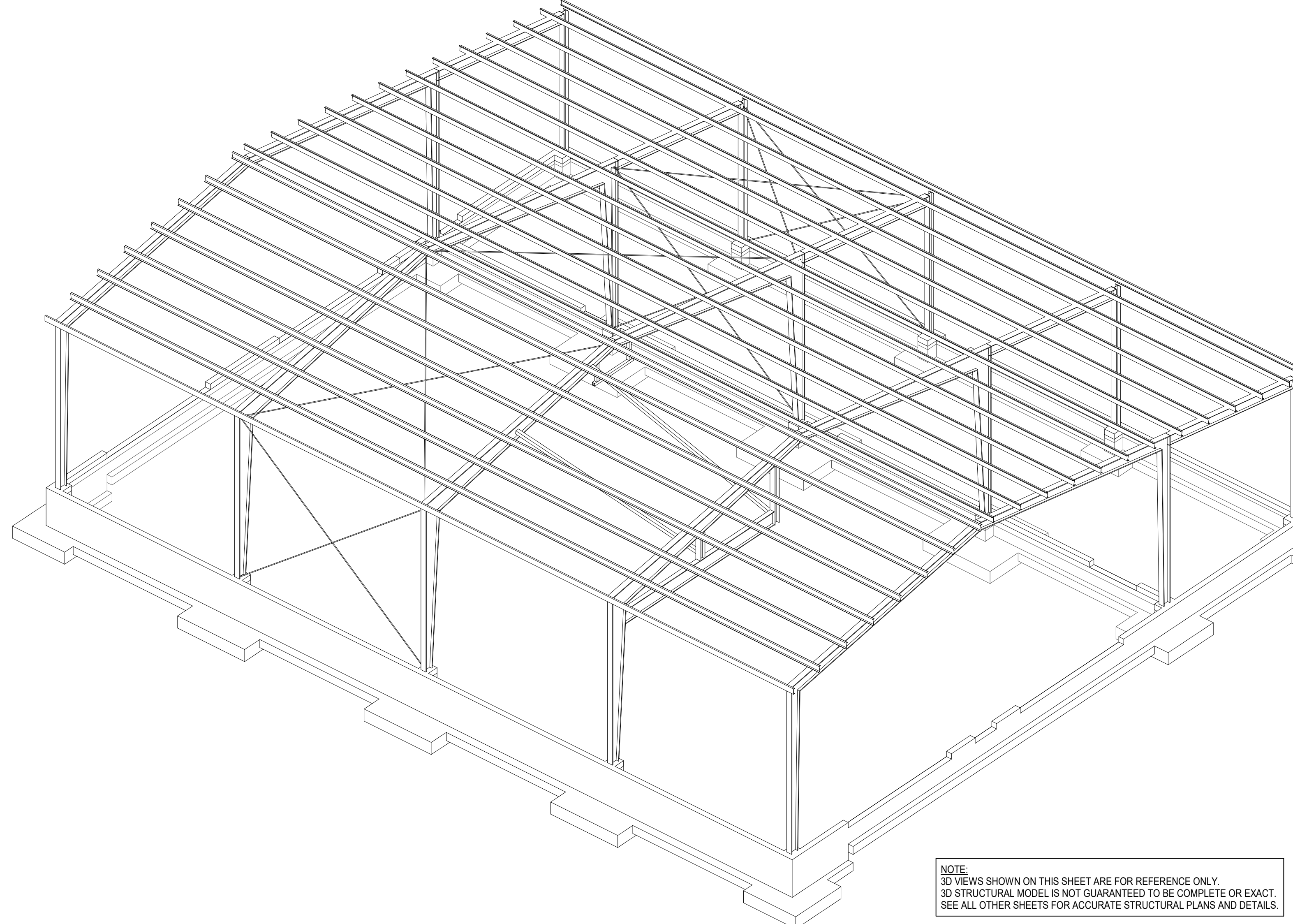
Table listing structural abbreviations and their corresponding full names, such as APA (AMERICAN PLYWOOD ASSOCIATION), ARCH (ARCHITECTURAL), BOT (BOTTOM), BTWN (BETWEEN), CLR (CLEAR), CANT (CANTILEVER BEAM), C.M.L. (CONCRETE MASONRY UNIT), COL (COLUMN), CONC (CONCRETE), CONT (CONTINUOUS), D (DEEP), D.G.A. (DENSE GRADE AGGREGATE), DET (DETAIL), DWGS (DRAWINGS), EA (EACH), E.F. (EACH FACE), ELEV (ELEVATION), EMB (EMBED), E.O.S. (EDGE OF SLAB), E.W. (EACH WAY), EX (EXISTING), EXP (EXPANSION), F.F. (FINISHED FLOOR ELEVATION), F.T. (FIRE RESISTANCE TREATED), FTG (FOOTING), GALV (GALVANIZED), GA (GAUGE), HORZ (HORIZONTAL), HOLLOW (HOLLOW STRUCTURAL SECTION), I.C.F. (INSULATED CONCRETE FORM), L.D.H. (LONG DIMENSION HORIZONTAL), L.D.V. (LONG DIMENSION VERTICAL), LVL (LAMINATED VENEER LUMBER), MAX (MAXIMUM), MECH (MECHANICAL), M.E.P. (MECHANICAL/ELECTRICAL/PLUMBING), MIN (MINIMUM), N.T.S. (NOT TO SCALE), O.C. (ON CENTER), O.P.H. (OPPOSITE HAND), P.F. (POWDER ACTUATED FASTENER), P.E.M.B. (PRE-ENGINEERED METAL BUILDING), PL (PLATE), R (RADIUS), REINF (REINFORCEMENT), S.C. (SLIP CRITICAL), SIM (SIMILAR), S.O.G. (SLAB ON GRADE), TYP (TYPICAL), U.N.O. (UNLESS NOTED OTHERWISE), VERT (VERTICAL), W (WIDE), W.W.F. (WELDED WIRE FABRIC).

MATERIAL LEGEND



3D VIEW 1

A S101



3D VIEW 2

B S101

- GENERAL
1. THE REQUIREMENTS OF THESE GENERAL NOTES APPLY UNLESS OTHERWISE NOTED ON PLANS OR IN SPECIFICATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL CONTRACT DOCUMENTS, ADDENDA, AND SUPPLEMENTARY INFORMATION AND DISTRIBUTE TO ALL SUBCONTRACTORS AND MATERIAL SUPPLIERS PRIOR TO THE PREPARATION AND SUBMITTAL OF SHOP DRAWINGS, FABRICATION, AND INSTALLATION OF ANY STRUCTURAL MEMBERS.
3. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD PRIOR TO COMMENCING WORK. THE ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCIES THAT MAY EXIST.
4. ANY DISCREPANCIES BETWEEN STRUCTURAL AND ARCHITECTURAL DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT AND STRUCTURAL ENGINEER.
5. DO NOT SCALE DRAWINGS.
6. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR MEANS AND METHODS TO CONSTRUCT THE STRUCTURE, INCLUDING VERIFICATION OF LOAD CAPACITY OF THE STRUCTURE TO SUPPORT CONSTRUCTION ACTIVITIES, EQUIPMENT, ETC. AND FOR LIMITING THE AMOUNT OF CONSTRUCTION LOAD IMPOSED ON THE STRUCTURE. FRAMING, CONSTRUCTION LOADS SHALL NOT EXCEED THE DESIGN CAPACITY OF THE FRAMING AT THE TIME THE LOADS ARE IMPOSED. DAMAGE TO THE STRUCTURE CAUSED BY CONSTRUCTION ACTIVITIES SHALL BE CORRECTED BY THE RESPONSIBLE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
7. SHOP DRAWINGS MUST BE CHECKED AND STAMPED BY THE CONTRACTOR PRIOR TO SUBMISSION.
8. NON-STRUCTURAL ELEMENTS OF THE BUILDING (ARCHITECTURAL FINISHES, INSULATION, SHEATHING, DUCTWORK, PIPING, FOUNDATION/FLOOR/ROOF DRAINS, ETC.) ARE TYPICALLY NOT SHOWN ON THE STRUCTURAL DRAWINGS. WHERE NON-STRUCTURAL ELEMENTS ARE SHOWN ON THE STRUCTURAL DRAWINGS, THEY ARE SHOWN FOR REFERENCE AND DESIGN INTENT ONLY. NON-STRUCTURAL ELEMENTS SHALL BE CONSTRUCTED AS SHOWN ON THE ARCHITECTURAL, ELECTRICAL, MECHANICAL AND PLUMBING DRAWINGS.
9. WALL OPENINGS AND TERMINATIONS SHOWN ON THE STRUCTURAL DRAWINGS ARE DIAGRAMMATIC ONLY. WALL TERMINATIONS AND OPENING JAMBS, HEADS, AND SILLS SHALL BE CONSTRUCTED AS SHOWN ON THE ARCHITECTURAL DRAWINGS.
10. IN GRANULAR SOILS (SANDS AND GRAVEL), THE SOIL SHALL BE MECHANICALLY TAMPERED TO A HARD SURFACE IMMEDIATELY PRIOR TO PLACING FOOTING.
11. FOUNDATIONS AND COMPACTON OF FLL UNDER SLABS ON GRADE, SEE SPECIFICATIONS. IF NOT OTHERWISE NOTED, COMPACT ALL FLL TO 98% OF OPTIMUM LABORATORY DENSITY IN ACCORDANCE WITH ASTM D698 STANDARD PROCTOR METHOD. PLACE FLL IN 6" TO 8" LAYERS AND COMPACT WITH VIBRATORY TAMPING EQUIPMENT.
12. WHERE ELECTRICAL CONDUIT CONCREGATES BELOW ELECTRICAL ROOMS AND PANELS, CONTRACTOR SHALL HOLD DOWN SUBGRADE APPROPRIATELY FOR CONDUIT TO BE MEAN ROOF SLAB. CONDUIT WITH FLOWABLE FILL CONCRETE TO BOTTOM OF SLAB ELEVATION.
13. HIGH PLASTICITY (P.A.T.) CLAYS WITH A PLASTICITY INDEX OF 30 OR MORE WHICH ARE PRESENT WITHIN THE FOOTPRINT PROTECT AT UNDERCUT ELEVATION AND FURTHER UNDERCUT SOFT AND YIELDING MATERIALS TO FIRM MATERIAL AT THE PERIPHERY OF THE SPECIAL INSPECTOR. BACKFILL UNDERCUT WITH LEAN CLAY SOILS OR BORROW MATERIALS WITH A PLASTICITY INDEX LESS THAN 18.
14. FOUNDATION CONCRETE SHALL BE PLACED IMMEDIATELY FOLLOWING EXCAVATION. A LEAN CONCRETE (1,500 PSI) MUD MAT SHALL BE PLACED OVER THE PREPARED BEARING MATERIALS IF EXCAVATION MUST REMAIN OPEN DURING IMPLEMENT WEATHER OR FOR MORE THAN 72 HOURS.
15. CONTRACTOR SHALL EXERCISE CAUTION THAT DENSE GRADED AGGREGATE BLANKET BELOW FLOOR SLAB DOES NOT BECOME SATURATED DURING CONSTRUCTION. CONTRACTOR SHALL CAST FLOOR SLAB OR PROVIDE TEMPORARY PROTECTION FOR SUBGRADE UNTIL SLAB IS CAST TO PREVENT WATER INFILTRATION TO SUBGRADE. SURFACE RUNOFF SHALL BE DIRECTED AWAY FROM FOUNDATION EXCAVATIONS AND NOT BE PERMITTED TO POND WITHIN THE BUILDING FOOTPRINT. PROVIDE DRAINAGE TRENCHES FROM FOUNDATION EXCAVATIONS TO DRAIN RUNOFF AWAY OF CONCRETE CONSTRUCTION.
1. ALL CONCRETE CONSTRUCTION TO BE IN ACCORDANCE WITH THE BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE ACI 301-10, ACI 318-14 AND ACI DETAILING MANUAL.
2. FURNISH BAR SUPPORTS WHERE NECESSARY DURING CONSTRUCTION.
3. PROVIDE PLASTIC, PLASTIC-COATED (NOT PLASTIC-TIPPED) OR STAINLESS STEEL CHAIRS IN ALL CONCRETE EXPOSED TO VIEW IN COMPLETED STRUCTURE.
4. PROVIDE PIPE SLEEVES AND INSERTS IN CONCRETE WORK WHERE REQUIRED. SEE ARCHITECTURAL AND MECHANICAL DRAWINGS.
5. OBTAIN APPROVAL OF STRUCTURAL ENGINEER BEFORE LOCATING SLEEVES, HOLES, OR INSERTS IN SLABS WITHIN 2" OF FACE OF PIERS.
6. CONSTRUCTION JOINTS SHALL BE POSITIONED SO AS NOT TO CHANGE THE STRUCTURAL DESIGN REQUIREMENTS. SLABS HAVE CONSTRUCTION JOINTS THAT NO MORE THAN 10,000 SF IS IN ANY SINGLE POUR AND THE MAXIMUM LENGTH OF POUR IS 160'-0". RATIO OF LENGTH TO WIDTH OF POUR SHALL NOT EXCEED 2. LOCATION OF ALL CONSTRUCTION JOINTS SHALL BE APPROVED BY THE ENGINEER.
7. WELDING OF REINFORCING BARS (INCLUDING TACK WELDING) IS NOT PERMITTED.
8. PROVIDE HORIZONTAL KEYWAYS IN CONSTRUCTION JOINTS IN WALLS AND WALL FOOTINGS; MINIMUM 1 1/2" DEPTH WITH HEIGHT EQUAL TO ONE-THIRD OF MEMBER DEPTH, UNLESS OTHERWISE SHOWN OR NOTED.
9. ALL EXPOSED CORNERS OF CONCRETE SHALL BE CHAMFERED AS DEGREES. MINIMUM CHAMFER TO BE 1/2" CURVE THE LEADING EDGE OF STAIR TREADS TO 1/2" RADIUS.
10. REINFORCING FOR SLABS ON GROUND (IN FLAT SHEETS) SHALL BE IN THE MIDDLE OF THE SLAB EXCEPT AS OTHERWISE NOTED AND SHALL BE POSITIVELY SUPPORTED AND MAINTAINED IN THIS POSITION DURING PLACEMENT OF CONCRETE.
11. BEND ALL HORIZONTAL WALL AND FOOTING BARS 1'-0" AROUND CORNERS OR PROVIDE CORNER BARS WITH 2'-0" LAP.
12. PROVIDE FOUNDATION DOWELS FOR ALL WALLS AND PIERS SAME SIZE AND SPACING AS VERTICAL STEEL.
13. SPLICES: ALL REINFORCING SPLICES SHALL BE AS TENSION LAP, U.N.O.
A. LAP ALL COMPRESSION SPLICES 30 BAR DIAMETERS OF THE LARGER BAR.
B. LAP ALL TENSION SPLICES ALL SPLICES EXCEPT COLUMN SPLICES, IN 0.001 L IN ACCORDANCE WITH THE FOLLOWING TABLE. MOODY LENGTHS AS NOTED.

- FOUNDATION CONSTRUCTION
1. FOUNDATIONS ON THIS PROJECT ARE DESIGNED IN ACCORDANCE WITH RECOMMENDATIONS MADE BY SOLID GROUND CONSULTING ENGINEERS, PLLC, GEOTECHNICAL ENGINEERS, IN THEIR REPORT DATED SEPTEMBER 30, 2020. THE GEOTECHNICAL REPORT IS PROVIDED FOR REFERENCE INFORMATION AVAILABLE TO BIDDERS, BUT IS NOT PART OF THE CONTRACT DOCUMENTS. THE STRUCTURAL ENGINEER IS RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION PRESENTED IN THE GEOTECHNICAL REPORT.
2. ELEVATIONS GIVEN ARE TO THE TOP OF FOOTINGS.
3. ALL FOOTINGS MUST BE SUPPORTED ON REMEDIATED IN-SITU SOILS OR ENGINEERED FLL CAPABLE OF SUPPORTING DESIGN LOADS WITHOUT APPRECIABLE SETTLEMENT.
4. IN GRANULAR SOILS (SANDS AND GRAVEL), THE SOIL SHALL BE MECHANICALLY TAMPERED TO A HARD SURFACE IMMEDIATELY PRIOR TO PLACING FOOTING.
5. LOCATE EXISTING UNDERGROUND UTILITIES IN AREAS OF CONSTRUCTION. COORDINATE WITH UTILITY COMPANIES FOR ANY SHUT-OFF REQUIREMENTS OF STILL-ACTIVE LINES.
6. WHEN EXCAVATIONS APPROACH THE GROUND WATER LEVEL, THE WATER LEVEL SHALL BE MONITORED BY AN ACCEPTABLE DRILLING SYSTEM SO THAT THE WATER LEVEL IS MAINTAINED CONTINUOUSLY A MINIMUM OF 2'-0" BELOW THE EXCAVATION.
7. BEFORE BACKFILL, ALL WALLS MUST BE ADEQUATELY BRACED. FOR BACKFILL REQUIREMENTS, SEE SPECIFICATIONS AND/OR GEOTECHNICAL ENGINEERS REPORT.
8. RETAINING WALLS SHALL NOT BE BACKFILLED UNTIL COMPRESSIVE STRENGTH TESTS DEMONSTRATE THAT THE CONCRETE HAS DEVELOPED 100% OF THE REQUIRED 28-DAY COMPRESSIVE STRENGTH FOR THE CLASS OF CONCRETE SPECIFIED. THE CONTRACTOR MAY ELECT TO PREPARE ADDITIONAL TEST CYLINDERS IN ORDER TO DEMONSTRATE THAT THE REQUIRED COMPRESSIVE STRENGTH PRIOR TO THE MANDATORY 28-DAY COMPRESSIVE STRENGTH TESTS. IN NO CASE SHALL WALLS BE BACKFILLED PRIOR TO SEVEN (7) DAYS FROM PLACEMENT.
9. FOR PLACEMENT AND COMPACTON OF FLL UNDER SLABS ON GRADE, SEE SPECIFICATIONS. IF NOT OTHERWISE NOTED, COMPACT ALL FLL TO 98% OF OPTIMUM LABORATORY DENSITY IN ACCORDANCE WITH ASTM D698 STANDARD PROCTOR METHOD. PLACE FLL IN 6" TO 8" LAYERS AND COMPACT WITH VIBRATORY TAMPING EQUIPMENT.
10. WHERE ELECTRICAL CONDUIT CONCREGATES BELOW ELECTRICAL ROOMS AND PANELS, CONTRACTOR SHALL HOLD DOWN SUBGRADE APPROPRIATELY FOR CONDUIT TO BE MEAN ROOF SLAB. CONDUIT WITH FLOWABLE FILL CONCRETE TO BOTTOM OF SLAB ELEVATION.
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12. FOUNDATION CONCRETE SHALL BE PLACED IMMEDIATELY FOLLOWING EXCAVATION. A LEAN CONCRETE (1,500 PSI) MUD MAT SHALL BE PLACED OVER THE PREPARED BEARING MATERIALS IF EXCAVATION MUST REMAIN OPEN DURING IMPLEMENT WEATHER OR FOR MORE THAN 72 HOURS.
13. CONTRACTOR SHALL EXERCISE CAUTION THAT DENSE GRADED AGGREGATE BLANKET BELOW FLOOR SLAB DOES NOT BECOME SATURATED DURING CONSTRUCTION. CONTRACTOR SHALL CAST FLOOR SLAB OR PROVIDE TEMPORARY PROTECTION FOR SUBGRADE UNTIL SLAB IS CAST TO PREVENT WATER INFILTRATION TO SUBGRADE. SURFACE RUNOFF SHALL BE DIRECTED AWAY FROM FOUNDATION EXCAVATIONS AND NOT BE PERMITTED TO POND WITHIN THE BUILDING FOOTPRINT. PROVIDE DRAINAGE TRENCHES FROM FOUNDATION EXCAVATIONS TO DRAIN RUNOFF AWAY OF CONCRETE CONSTRUCTION.

CONCRETE CONSTRUCTION
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4. PROVIDE PIPE SLEEVES AND INSERTS IN CONCRETE WORK WHERE REQUIRED. SEE ARCHITECTURAL AND MECHANICAL DRAWINGS.
5. OBTAIN APPROVAL OF STRUCTURAL ENGINEER BEFORE LOCATING SLEEVES, HOLES, OR INSERTS IN SLABS WITHIN 2" OF FACE OF PIERS.
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7. WELDING OF REINFORCING BARS (INCLUDING TACK WELDING) IS NOT PERMITTED.
8. PROVIDE HORIZONTAL KEYWAYS IN CONSTRUCTION JOINTS IN WALLS AND WALL FOOTINGS; MINIMUM 1 1/2" DEPTH WITH HEIGHT EQUAL TO ONE-THIRD OF MEMBER DEPTH, UNLESS OTHERWISE SHOWN OR NOTED.
9. ALL EXPOSED CORNERS OF CONCRETE SHALL BE CHAMFERED AS DEGREES. MINIMUM CHAMFER TO BE 1/2" CURVE THE LEADING EDGE OF STAIR TREADS TO 1/2" RADIUS.
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B. LAP ALL TENSION SPLICES ALL SPLICES EXCEPT COLUMN SPLICES, IN 0.001 L IN ACCORDANCE WITH THE FOLLOWING TABLE. MOODY LENGTHS AS NOTED.

Table with 3 columns: BAR SIZE, CONCRETE COMPRESSIVE STRENGTH, and INCREASE SPLICE LENGTH BY THE FOLLOWING:
1. NOTE INCREASED LENGTHS ARE ACCUMULATIVE.
2. NOTE INCREASED LENGTHS ARE ACCUMULATIVE.
3. HORIZONTAL TOP BARS WITH GREATER THAN 12" OF CONCRETE BELOW: +20%
4. 2 BAR SPACING LESS THAN 2 BAR DIAMETERS: +50%

- CONCRETE PROTECTION FOR REINFORCEMENT
A. CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH.
B. CONCRETE EXPOSED TO EARTH OR WEATHER
NO. 6 THROUGH NO. 18 BARS
NO. 3 BAR, W31 OR D31 WIRE AND SMALLER
C. CONCRETE NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND SLABS
NO. 11 BAR AND SMALLER

- STEEL CONSTRUCTION
1. STEEL DETAILING, FABRICATION, AND ERECTION SHALL CONFORM TO THE AISC SPECIFICATIONS AND CODE OF STANDARD PRACTICE, AND THE AISC STRUCTURAL WELDING CODE.
2. CONNECTIONS - WELDED OR HIGH-STRENGTH BOLTED:
A. USE STANDARD HOLES WITH THE FOLLOWING EXCEPTIONS: OVERSIZE HOLES ARE PERMITTED WHEN BOLTS ARE LOADED IN TENSION; SHORT-SLOTTED HOLES ARE PERMITTED FOR SHEAR LOADING PERPENDICULAR TO THE SLOT IN ANY ONE PLY AT EACH FAYING SURFACE.
B. HARDENED WASHERS SHALL BE USED OVER ALL OVERSIZED OR SHORT-SLOTTED HOLES IN AN OUTER PLY.
3. WELDING ELECTRODES SHALL BE E70XX EXCEPT WHERE OTHER ELECTRODES ARE REQUIRED FOR COMPATIBILITY WITH MATERIAL BEING WELDED.
4. SHOP DRAWINGS ARE REQUIRED AND SHALL NOTE TYPE OF ELECTRODES, SIZE OF ALL WELDS, AND TYPE AND SIZE OF ALL BOLTS.

- PRE-ENGINEERED STEEL BUILDING CONSTRUCTION
1. PRE-ENGINEERED BUILDING CONTRACTOR IS SOLELY RESPONSIBLE FOR THE DESIGN AND INSTALLATION OF THE BUILDING STRUCTURE.
2. CONTRACTOR SHALL SUBMIT DRAWINGS AND CALCULATIONS SIGNED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF KENTUCKY FOR REVIEW BY THE ARCHITECT AND ENGINEER.
3. STRUCTURE SHALL BE DESIGNED FOR:
A. STRUCTURE SELFWEIGHT (INCLUDING ROOF SYSTEM),
B. COLLATERAL DEAD LOAD OF 8 PSF,
C. SNOW, WIND, EARTHQUAKE AND ROOF LIVE LOAD AS SHOWN IN DESIGN LIVE LOADS SECTION,
D. ROOF TOP MECHANICAL UNITS COORDINATE WITH MECHANICAL CONTRACTOR.
4. LIMIT BUILDING DRIFT TO H/100 UNDER LOAD COMBINATIONS THAT INCLUDE WIND DRIFT LIMITATIONS FOR SEISMIC LOADING ARE DEFINED IN THE KENTUCKY BUILDING CODE.
5. IN ADDITION TO THE BUILDING FRAME, THE PRE-ENGINEERED BUILDING CONTRACTOR SHALL DESIGN, PROVIDE, AND INSTALL:
A. ANCHOR BOLTS (DIAMETER SELECTION FOR SHEAR AND TENSION)
B. FRAMING FOR WALL OPENINGS
C. FRAMING FOR ROOF OPENINGS
6. COLUMN PIPERS AND FOOTINGS ARE DESIGNED ASSUMING PINNED COLUMN BASES. FIXED COLUMN BASES ARE NOT PERMITTED.
7. THE COMPLETE FOUNDATION SYSTEM MUST BE INSTALLED PRIOR TO ERECTING THE STEEL STRUCTURE.
8. ROOFING SHALL BE ASSUMED TO HAVE ZERO CAPACITY FOR DIAPHRAGM ACTION.
9. DEFLECTION OF FRAME BEAM SHALL NOT EXCEED L/250, WHERE L IS THE DISTANCE FROM EAVE TO EAVE.

- SPECIAL INSPECTION
1. SPECIAL INSPECTIONS AS DEFINED IN SECTIONS 1704 AND 1705 OF THE KENTUCKY BUILDING CODE ARE REQUIRED.
2. SPECIAL INSPECTIONS SHALL BE PERFORMED BY A QUALIFIED TESTING AGENCY APPROVED BY THE ARCHITECT AND THE STRUCTURAL ENGINEER AND PAID FOR BY THE OWNER.
3. THE INSPECTOR SHALL OBSERVE WORK FOR CONFORMANCE WITH THE APPROVED STRUCTURAL DRAWINGS AND SPECIFICATIONS AND PREPARE INSPECTION REPORTS STATING HIS OBSERVATIONS. COPIES OF THE INSPECTION REPORTS SHALL BE SUBMITTED TO THE ARCHITECT AND THE STRUCTURAL ENGINEER.
4. ALL DISCREPANCIES BETWEEN THE CONSTRUCTION DOCUMENTS AND THE WORK BEING PERFORMED MUST BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION. IF THE DISCREPANCIES ARE NOT CORRECTED, THE DISCREPANCIES MUST BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE STRUCTURAL ENGINEER PRIOR TO THE COMPLETION OF THAT PHASE OF THE WORK.
5. THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL REPORT OF INSPECTION AND DOCUMENTING COMPLETION OF ALL REQUIRED SPECIAL INSPECTIONS AND CORRECTION OF ANY DISCREPANCIES NOTED IN THE INSPECTIONS.
6. SPECIAL INSPECTIONS ARE REQUIRED FOR THE FOLLOWING WORK:

- INSPECTION OF FABRICATIONS
PERFORM SPECIAL INSPECTIONS PER SECTION 1704.2.5 OF THE KENTUCKY BUILDING CODE.
STEEL CONSTRUCTION
PERFORM SPECIAL INSPECTIONS PER SECTION 1705.2 OF THE KENTUCKY BUILDING CODE.

- CONCRETE CONSTRUCTION
PERFORM SPECIAL INSPECTIONS PER SECTION 1705.3 OF THE KENTUCKY BUILDING CODE.
SOILS
PERFORM SPECIAL INSPECTIONS PER SECTION 1705.6 OF THE KENTUCKY BUILDING CODE.

- SITE OBSERVATION BY THE STRUCTURAL ENGINEER
1. THE ENGINEER HAS NO CONTROL OR CHARGE OF, AND SHALL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, OR PROCEDURES; FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK; FOR THE ACTS OR OMISSIONS OF THE CONTRACTOR, SUBCONTRACTOR, OR ANY OTHER PERSONS PERFORMING ANY OF THE WORK; OR FOR THE FAILURE OF ANY OF THEM TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
2. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR ANY ACTS OR OMISSIONS OF THE CONTRACTOR, ANY SUBCONTRACTOR, MATERIAL SUPPLIER, OR AGENTS THEREOF. THE ENGINEER DOES NOT GUARANTEE THE PERFORMANCE OF THE CONTRACTOR AND SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO PERFORM ITS WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS OR APPLICABLE LAWS, CODES, RULES, OR REGULATIONS. THE CONTRACTOR SHALL MAINTAIN SOLE RESPONSIBILITY FOR DEFECTS AND DEFICIENCIES, INCLUDING PROVIDING TESTING AND INSPECTION ONCE SUCH ARE DISCOVERED, AND FOR PROVIDING NECESSARY CORRECTIVE ACTION FOR DESIGN TEAM REVIEW.
3. PERIODIC SITE OBSERVATION BY FIELD REPRESENTATIVES OF BROWN/HUBICAN, PSC IS SOLELY FOR THE PURPOSE OF DETERMINING IF THE WORK OF THE CONTRACTOR IS PROCEEDING IN GENERAL ACCORDANCE WITH THE STRUCTURAL CONTRACT DOCUMENTS. THIS LIMITED SITE OBSERVATION SHALL NOT BE CONSTRUED AS EXHAUSTIVE OR CONTINUOUS TO CHECK THE QUALITY, QUANTITY, OR ACCURACY OF THE CONSTRUCTION WORK, BUT RATHER PERIODIC IN EFFORT TO INFORM THE CLIENT ABOUT GENERAL PROGRESS AND TO ADVISE THE CLIENT ABOUT OBSERVED DEFECTS AND DEFICIENCIES IN THE WORK OF THE CONTRACTOR.

- ROOF OR WALL OPENINGS
1. THE CONTRACTOR SHALL VERIFY AND COORDINATE THE NUMBER, SIZE, AND LOCATION OF ALL SLEEVES AND OPENINGS REQUIRED FOR MECHANICAL, OR ELECTRICAL ITEMS.
2. SLEEVES AND OPENINGS SHALL BE LOCATED IN A MANNER THAT WILL MAINTAIN THE STRUCTURAL INTEGRITY OF THE ROOF, FLOOR, OR WALL SYSTEM.
3. NO STRUCTURAL ELEMENTS ARE TO BE CUT UNLESS SPECIFICALLY APPROVED BY THE ENGINEER.

- OPENINGS / PENETRATIONS / ATTACHMENTS TO STRUCTURE BY OTHER TRADES
1. THE CONTRACTOR SHALL COORDINATE AND VERIFY THE NUMBER, SIZE, AND LOCATION OF ALL SLEEVES AND OPENINGS REQUIRED FOR OTHER TRADES IN STRUCTURAL ELEMENTS.

- MAINTENANCE STATEMENT AND STRUCTURE LIFESPAN
1. THE ENGINEER MAKES NO CLAIM OR AGREEMENT AS TO THE LIFESPAN OF THE BUILDING STRUCTURE. THE CLIENT AND OWNER SHALL UNDERSTAND THAT STRUCTURAL TYPES DO HAVE LIFESPAN RELATIVE TO INITIAL COST AND MAINTENANCE AND THAT BY REQUESTING OR ACCEPTING A STRUCTURAL SYSTEM OF LOWER INITIAL COST THAT THE USABLE LIFESPAN WILL DECREASE AND MAINTENANCE INCREASE.
2. ALL STRUCTURES REQUIRE PERIODIC MAINTENANCE TO EXTEND LIFESPAN AND TO ENSURE STRUCTURAL INTEGRITY FROM EXPOSURE TO THE ENVIRONMENT. THE ENGINEER SHALL NOT BE HELD LIABLE FOR MAINTENANCE REQUIREMENTS OR CORRECTION RESULTING FROM LACK OF BUILDING MAINTENANCE.
3. A PLANNED PROGRAM OF MAINTENANCE SHALL INCLUDE ITEMS SUCH AS, BUT NOT LIMITED TO: PAINTING OF STRUCTURAL STEEL AND LINTELS, PROTECTIVE COATING FOR CONCRETE AND TIMBER, SEALANTS, CAULKED JOINTS, EXPANSION JOINTS, CONTROL JOINTS, TIMELY REPAIR OF SPALLS AND CRACKS IN CONCRETE, AND PRESSURE WASHING OF STRUCTURAL ELEMENTS EXPOSED TO A SALT ENVIRONMENT OR OTHER HARSH CHEMICALS.

DRAWING INFORMATION
A & E FILE NO: 2011
DRAWING DATE: 12/16/20
DRAWN BY: JH
CHECKED BY: ZJW
PHASE: C
RTA DATE: 12/16/20
ACCOUNT NO: 609-C9NW-2001-A10
COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY
GENERAL NOTES & 3D VIEWS
S101
AS-BUILT DATE
DECA LOG # A1C-8638
228 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH: 859.273.3700 / FAX: 859.271.6605
DESCRIPTION OF REVISIONS
REVISION HISTORY OF THIS DRAWING
DATE DESCRIPTION OF REVISIONS DATE

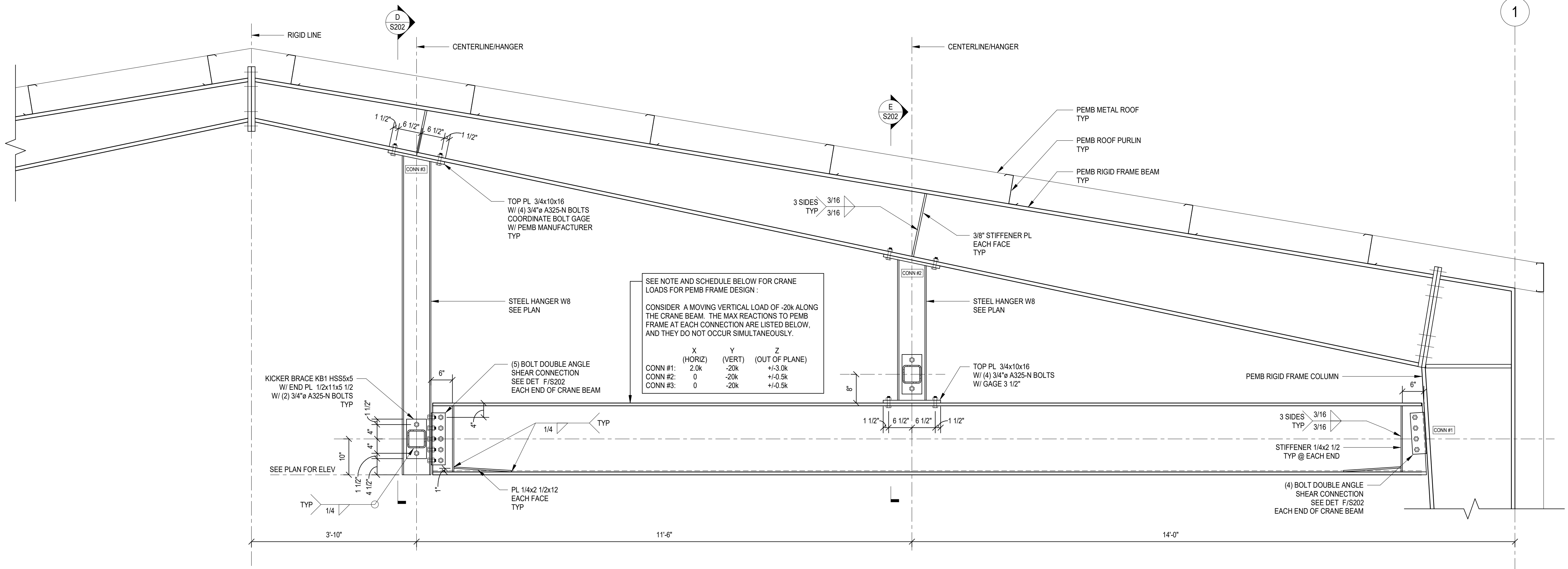
BROWN + KUBICAN STRUCTURAL ENGINEERS
2224 Young Drive Lexington, KY 40505 Phone: 859-543-0933 Fax: 859-543-0733



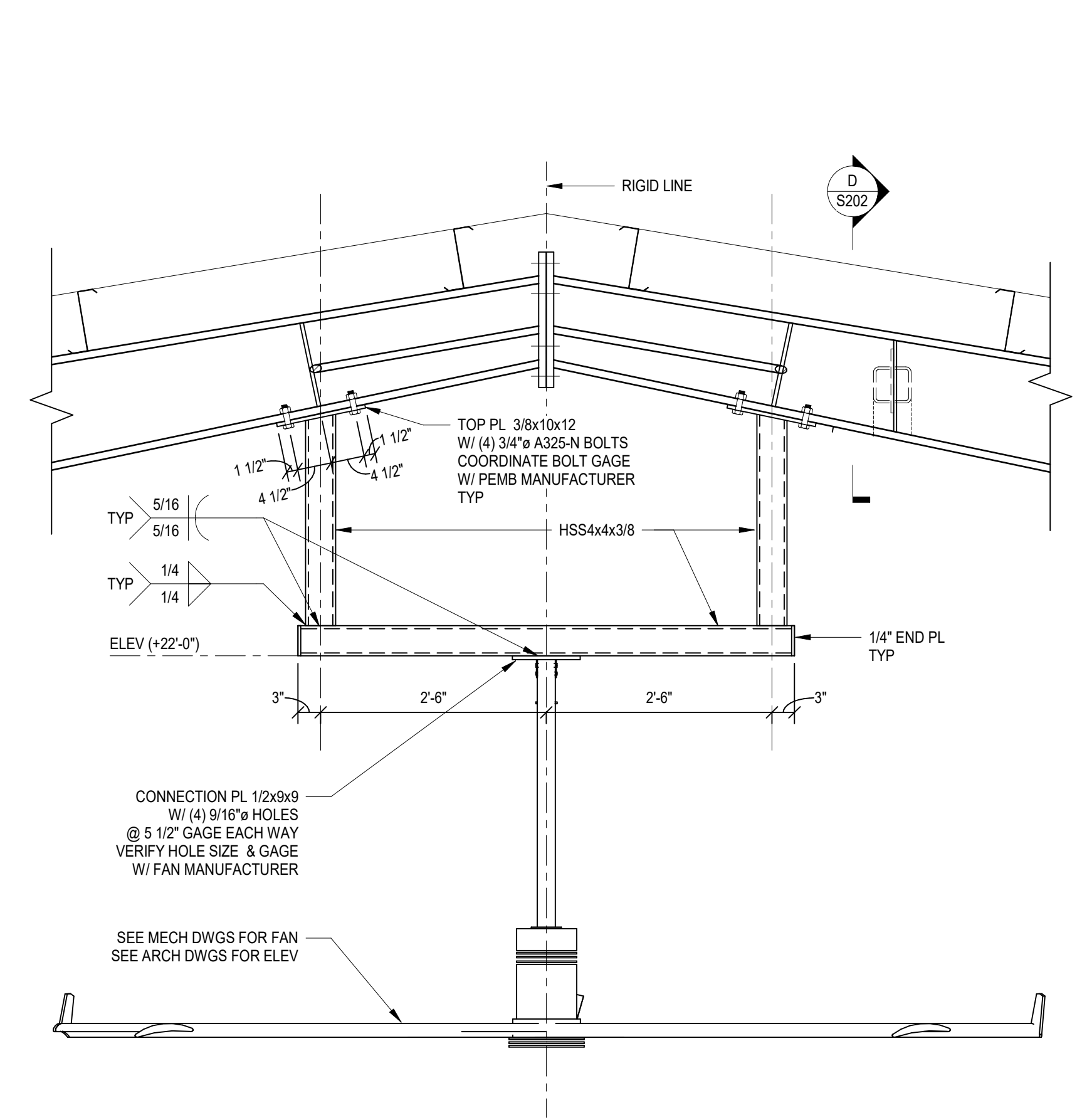




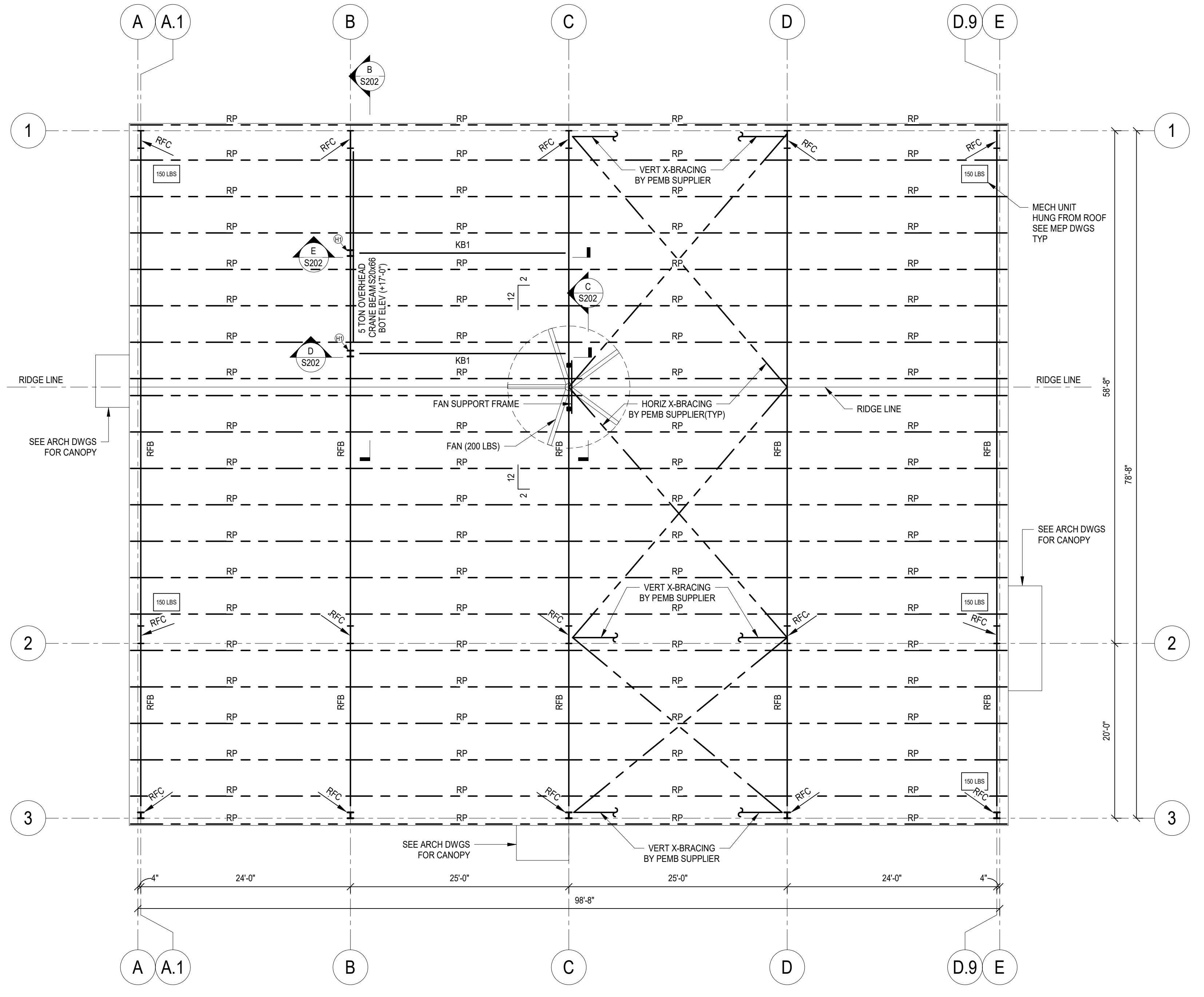




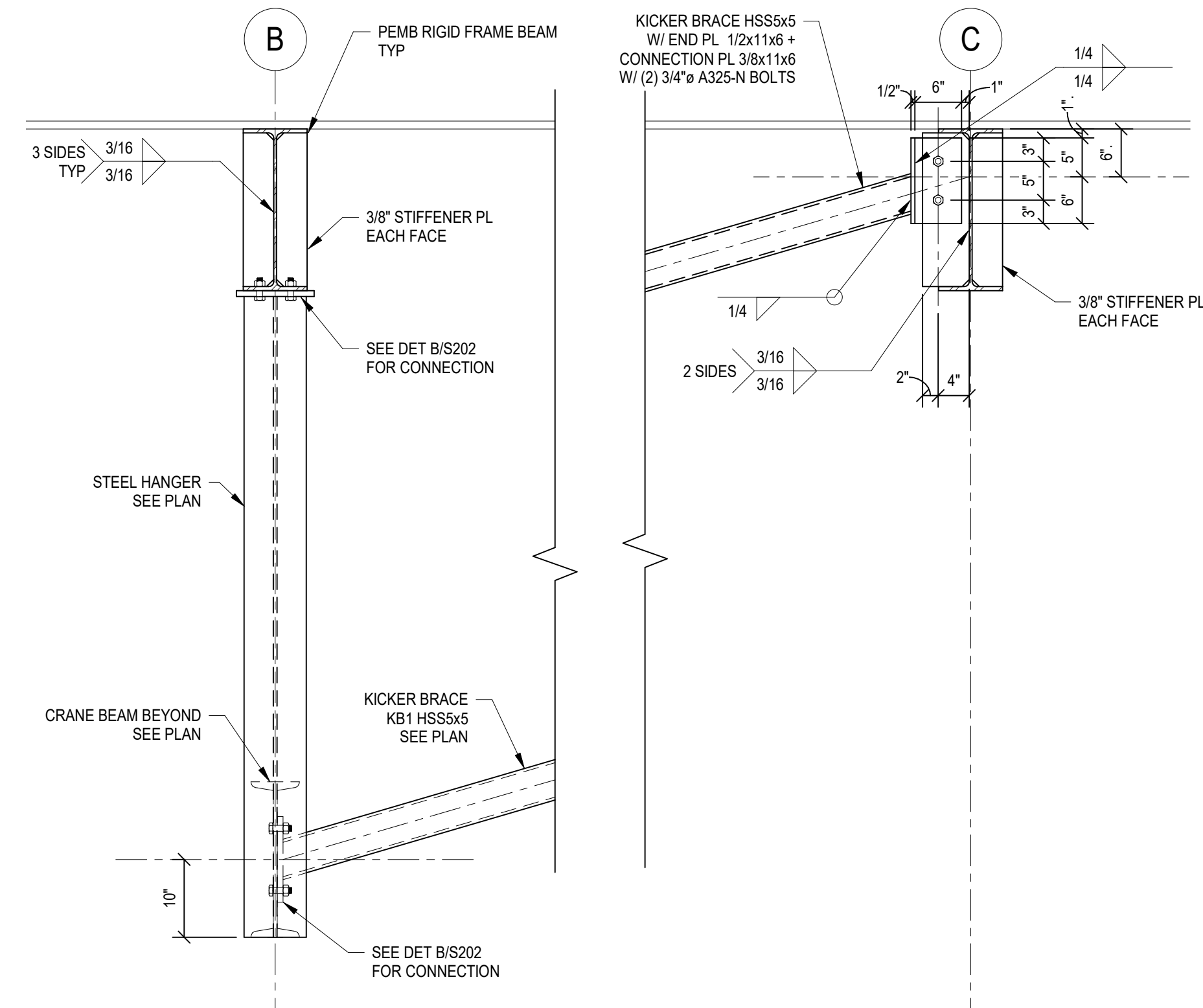
**B**  
S202  
3/4" = 1'-0"



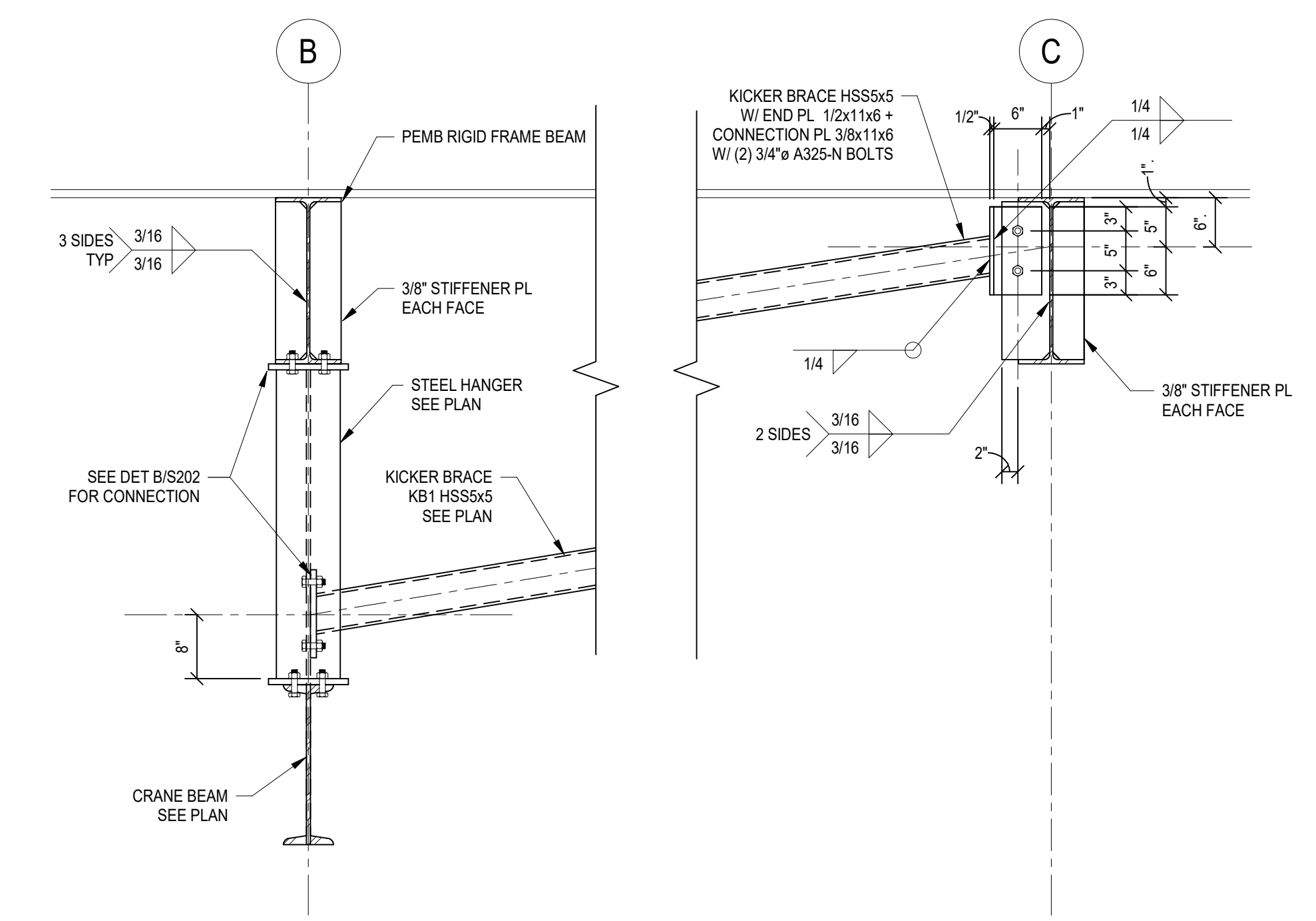
**C**  
S202  
3/4" = 1'-0"



**D**  
S202  
3/4" = 1'-0"



**E**  
S202  
3/4" = 1'-0"



**F**  
S202  
3/4" = 1'-0"

**A**  
S202  
1/8" = 1'-0"

**FRAMING LEGEND**

- S20x66 = STEEL BEAM SIZE
- (+17'-0") = BOTTOM OF STEEL BEAM ELEVATION REFERENCED FROM FINISHED FLOOR ELEVATION 100'-0"
- RFB = PRE-ENGINEERED METAL BUILDING RIGID FRAMING COLUMN
- RFC = PRE-ENGINEERED METAL BUILDING RIGID FRAMING BEAM
- RP = PRE-ENGINEERED METAL BUILDING ROOF PURLIN
- KB1 = CRANE BEAM KICKER BRACE HSS5x5x3/16. SEE DET D&E/S202.
- Ⓜ = STEEL HANGER W8x31 BELOW. SEE DET B/S202.
- Ⓜ = ROOF SLOPE

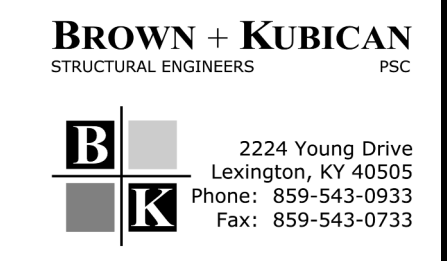
**FRAMING PLAN NOTES**

1. ELEVATIONS SHOWN ARE TO THE BOTTOM OF STEEL AND ARE REFERENCED FROM FINISHED FLOOR REFERENCE ELEVATION 100'-0".
2. SEE DWG S101 FOR GENERAL NOTES.
3. SIZE AND LOCATION OF UNITS HUNG FROM ROOF STRUCTURES SHALL BE COORDINATED WITH THE MECHANICAL CONTRACTOR. OPERATING WEIGHT OF UNIT SHALL NOT EXCEED WEIGHT SHOWN ON PLAN. UNIT WEIGHT SHALL BE INCORPORATED IN PRE-ENGINEERED METAL BUILDING STRUCTURAL DESIGN.
4. SEE ARCHITECTURAL DRAWINGS FOR SIZE AND LOCATION OF CANOPIES. SEE ARCH AND M.E.P. DRAWINGS FOR CANTILEVERED WATER PIPE FACE MOUNTED TO THE EXTERIOR WALL. ADDITIONAL SUPPORT FRAMING SHALL BE INCLUDED IN PRE-ENGINEERED METAL BUILDING STRUCTURAL DESIGN.

CONNECTION CAPACITY TABLE		
NO. OF BOLTS	LENGTH OF ANGLE L (INCHES)	CONNECTION CAPACITY (KIPS)
2	5 1/2	14
3	8 1/2	32
4	11 1/2	53
5	14 1/2	76
6	17 1/2	100
7	20 1/2	125
8	23 1/2	149

- NOTES:  
 1. ALL CONNECTION ANGLES L4x3x3/8 LLD.  
 2. ALL BOLTS ASTM A325-N 3/4"  
 3. BOLT SPACING (S) = 3"  
 4. SHORT HORIZONTAL SLOTTED HOLES MAY BE USED.

DRAWING INFORMATION		KYTC MAINTENANCE FACILITY LIBERTY, KENTUCKY	
A & E FILE NO.	2011	ROOF FRAMING PLAN AND DETAILS	
DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-Z001-A10
DRAWN BY	JH	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
CHECKED BY	ZJW	S202	
PHASE	C	AS-BUILT DATE	
RTA DATE	12/16/20	DECA LOG # A1C-8640	
		228 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH: 859-273-3700 / FAX: 859-271-6605	
ZHENG WANG 25595 12/16/20 PROFESSIONAL ENGINEER		REVISION HISTORY OF THIS DRAWING	
DESCRIPTION OF REVISIONS		DATE	
1.		0	
2.		0	
3.		7	
4.		8	



**BROWN + KUBICAN**  
 STRUCTURAL ENGINEERS  
 2224 Young Drive  
 Lexington, KY 40505  
 Phone: 859-543-0933  
 Fax: 859-543-0733





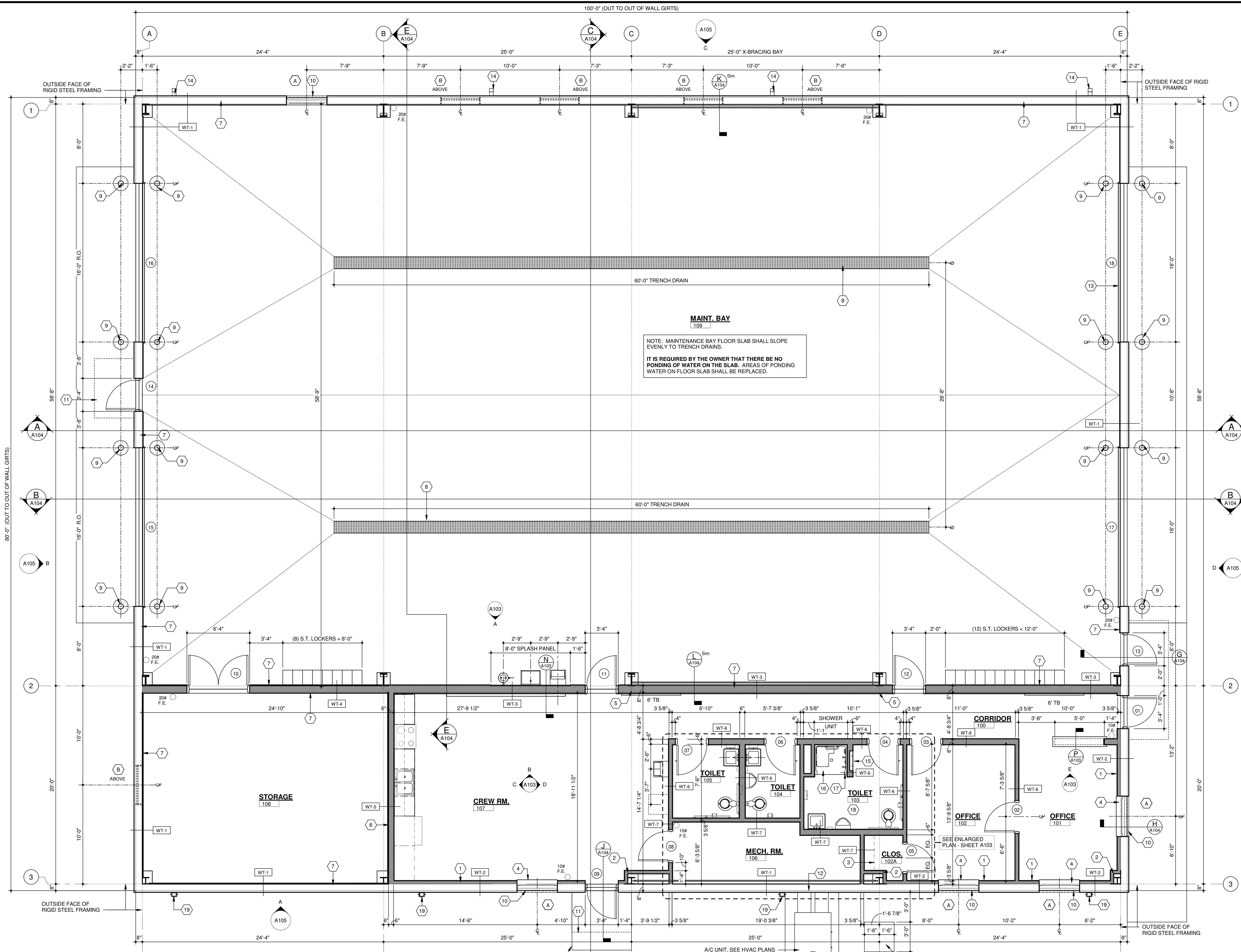


GENERAL NOTES

- GENERAL CONTRACTOR SHALL COORDINATE ALL FOUNDATION DETAILS WITH PRE-ENGINEERED METAL BUILDING (PEMB) MANUFACTURERS ACTUAL REQUIRED CONDITIONS.
- ALL WORK SHALL BE EXECUTED TO SUBSTANTIALLY COMPLY WITH THE CURRENT APPLICABLE KENTUCKY BUILDING CODES AND OTHER APPLICABLE STATE AND LOCAL CODES HAVING JURISDICTION OVER THIS PROJECT, I.E. NATIONAL ELECTRICAL CODE, AND BOCA MECHANICAL CODE.
- ITEMS UNCLEAR AS TO THE DESIGN INTENT OR APPLICATION SHALL BE BROUGHT TO THE OWNER'S ATTENTION PRIOR TO BID FOR WRITTEN CLARIFICATION.
- GENERAL CONTRACTOR MUST RECEIVE SHOP DRAWING APPROVAL FOR PRE-ENGINEERED METAL BUILDING PACKAGE, AND SUBMIT A COMPLETE, STAMPED SET OF METAL BUILDING DRAWINGS TO HBC PLAN REVIEW PRIOR TO RELEASE FOR CONSTRUCTION.
- METAL BUILDING SHOP DRAWINGS, ANCHOR BOLT INFORMATION, AND COLUMN REACTION FORCES MUST BE REVIEWED AND APPROVED BEFORE FOUNDATION WORK BEGINS.
- DO NOT INSTALL MEP CONDUIT OR COMPONENTS AGAINST BOTTOM OF PURLINS PRIOR TO INSTALLATION OF THE FULL DEPTH OF PURLIN INSULATION SYSTEM AND ITS POLY SCRIM.

SHEET NOTES

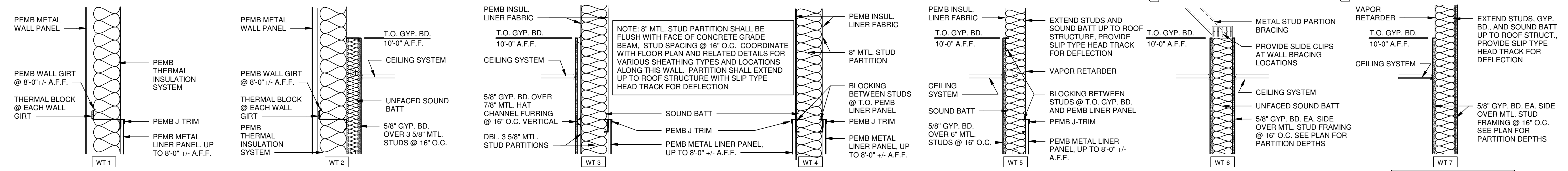
- PERIMETER STUD WALL. PROVIDE 5/8" GYPSUM BOARD OVER 3 5/8" METAL STUD FRAMING WITH UNFACED SOUND BATTS FULL HEIGHT OF STUDS. STUDS SHALL ANCHOR TO WALL GIRTS AND EXTEND UP TO 10'-0" ABOVE FINISH FLOOR ELEVATION UNLESS NOTED OTHERWISE.
- COLUMN FURRING. PROVIDE 5/8" GYPSUM BOARD OVER 3 5/8" METAL STUD FRAMING WITH UNFACED SOUND BATTS FULL HEIGHT OF STUDS. STUDS SHALL ANCHOR TO RIGID FRAME MEMBERS AND EXTEND UP TO 10'-0" ABOVE FINISH FLOOR ELEVATION. FIELD VERIFY REQUIRED DIMENSIONS. ALIGN FACE OF STUDS WITH CONCRETE PIER, EXTEND GYPSUM BOARD TO THE FLOOR.
- PROVIDE 18" WIDE SHELF AND STEEL HANGING ROD. SEE DETAIL ON SHEET A103.
- PROVIDE SOLID SURFACE WINDOW SILL AND APRON FOR WINDOW TYPE 'A & C'. COORDINATE WITH WINDOW DETAILS ON SHEET A102.
- PROVIDE GYPSUM BOARD EXPANSION JOINT AT COLUMN GRID.
- PROVIDE PEMB PRE-FINISHED METAL LINER PANEL ON THIS WALL FROM FINISH FLOOR SLAB UP TO 8'-0" ABOVE FINISHED FLOOR ELEVATION. ALIGN TOP OF PANEL WITH ADJACENT WALL PANELS, AND PROVIDE CONTINUOUS SEALANT JOINT AT SLAB JUNCTURE.
- PROVIDE PEMB PRE-FINISHED METAL LINER PANEL FROM TOP OF CURB TO 8'-0" ABOVE FINISHED FLOOR. COORDINATE WITH RELATED WALL SECTIONS AND DETAILS.
- TRENCH DRAIN, COORDINATE WITH PLUMBING DRAWINGS.
- PROVIDE 6" DIAMETER STEEL PIPE BOLLARD PER DETAIL ON SHEET C104. COORDINATE WITH CIVIL SHEETS FOR ADDITIONAL LOCATIONS AND REQUIREMENTS.
- PROVIDE STEEL SECURITY GRILL AT EACH LOCATION FOR WINDOW TYPE 'A'. SEE DETAIL ON SHEET A102.
- PRE-FINISHED METAL CANOPY ABOVE. SEE ROOF PLAN AND DETAILS. CANOPY SUPPORT FRAMING BY PEMB MANUFACTURER.
- PROVIDE PEMB FRAMING AS REQUIRED FOR DUCT PENETRATIONS THRU EXTERIOR WALL SYSTEM.
- SLOPE SLAB 1/2" TO EXTERIOR ACROSS WIDTH OF FOUNDATION CURB AT OVERHEAD DOOR OPENINGS.
- PRE-FINISHED METAL DOWN SPOUTS BY PEMB SUPPLIER. PROVIDE CONCRETE SPLASH BLOCK AT EACH DOWN SPOUT.
- PROVIDE PLUMBING ACCESS PANEL. PANEL SHALL BE 24" WIDE X 36" TALL. INSTALL ACCESS PANEL WITH BOTTOM AT 18" ABOVE FINISH FLOOR.
- RECESS FLOOR SLAB PER MANUFACTURERS REQUIREMENTS FOR A.D.A. SHOWER INSERT. FLOOR TRANSITION SHALL CONFORM TO ANY LOCAL AND STATE BUILDING CODES.
- ONE-PIECE BARRIER-FREE SHOWER ENCLOSURE. SEE PLUMBING PLANS. COORDINATE WITH MANUFACTURERS ROUGH OPENING REQUIREMENTS FOR METAL STUD WALL LOCATIONS. PROVIDE BLOCKING AS REQUIRED FOR INSTALLATION OF SHOWER INSERT. SHOWER ENCLOSURE STUD WALLS SHALL BE COVERED WITH 5/8" GYPSUM BOARD FULL HEIGHT. SEE PLUMBING PLANS FOR RELATED INFORMATION. INSTALL GYPSUM BOARD OVER WALL FRAMING PRIOR TO SHOWER UNIT INSTALLATION.
- TOILET ROOM 103 SHALL HAVE MOISTURE-RESISTANT GYPSUM BOARD ON ALL SURFACES.
- PRE-FINISHED METAL DOWN SPOUTS BY PEMB SUPPLIER. PROVIDE CAST IRON DOWN SPOUT BOOTS.
- PROVIDE CONCRETE FOUNDATION / BASE FOR RADIO COMMUNICATIONS ANTENNA. TOP ELEVATION AT 883.90'. 5,000 PSI CONCRETE 3' X 3' X 3'. WITH #5 BARS AT 8" O.C. E.W., E.F. ANTENNA EMBED ITEMS (BASE HARDWARE, ANCHOR BOLTS, ETC.). TO BE PROVIDED AND INSTALLED BY OWNER. COORDINATE SCHEDULE WITH OWNER FOR EMBED ITEMS INSTALLATION. COMMUNICATIONS ANTENNA PROVIDED AND INSTALLED BY OWNER.



**MAINT. BAY**  
109

NOTE: MAINTENANCE BAY FLOOR SLAB SHALL SLOPE EVENLY TO TRENCH DRAINS.  
IT IS REQUIRED BY THE OWNER THAT THERE BE NO PONDING OF WATER ON THE SLAB. AREAS OF PONDING WATER ON FLOOR SLAB SHALL BE REPLACED.

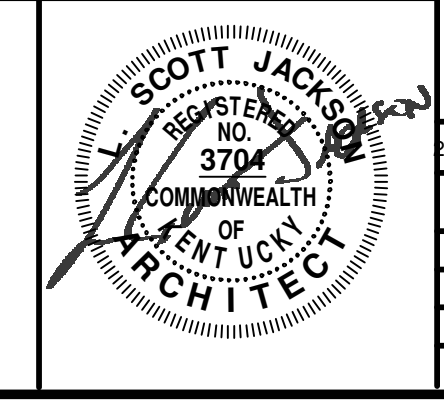
**FLOOR PLAN**  
SCALE: 1/4" = 1'-0"



**WALL TYPE LEGEND**  
SCALE: 3/4" = 1'-0"

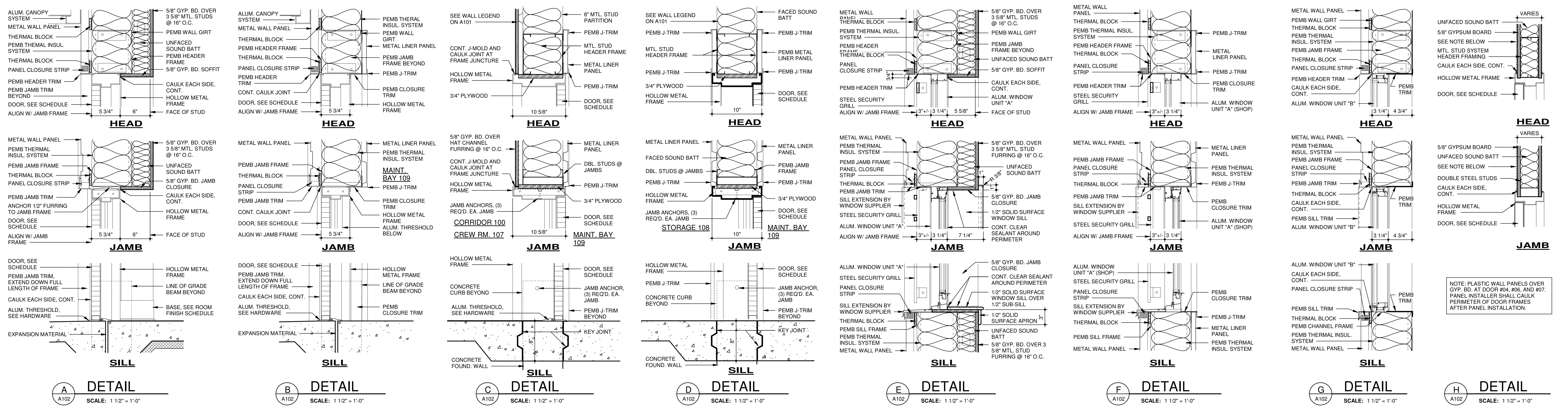
DRAWING INFORMATION	
A & E FILE NO.	2011
DRAWING DATE	12/16/20
DRAWN BY	NICK
CHECKED BY	LSJ
PHASE	C
RTA DATE	12/16/2020

KYTC MAINTENANCE FACILITY CASEY COUNTY - LIBERTY, KENTUCKY		
FLOOR PLAN		
ACCOUNT NO.	609-C9NW-Z001-A10	DRAWING NO.
COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		A101
AS-BUILT DATE		DECA LOG-4
A1C-8642		

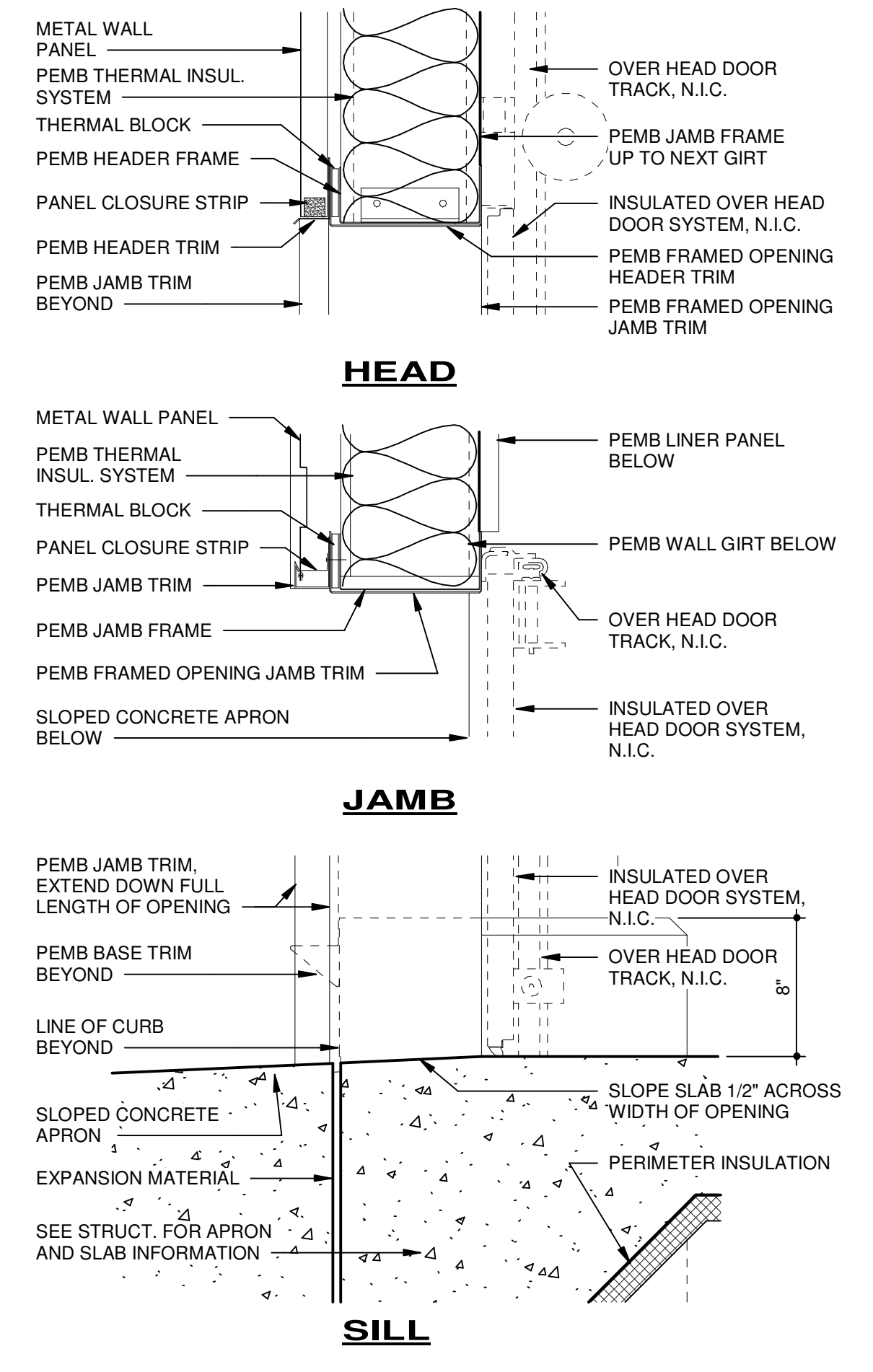


REVISION HISTORY OF THIS DRAWING		
NO.	DATE	DESCRIPTION OF REVISIONS
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3		
4		



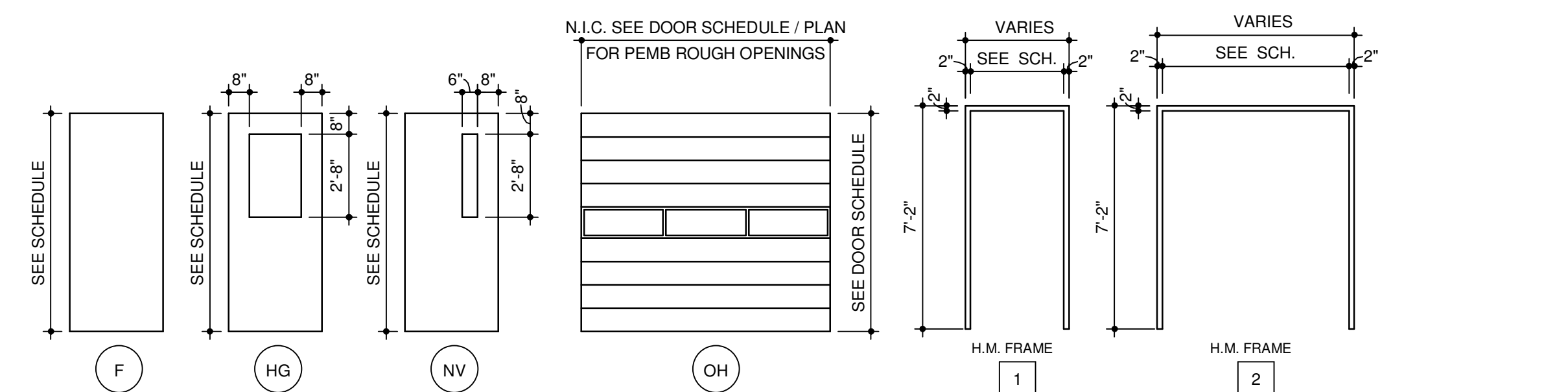
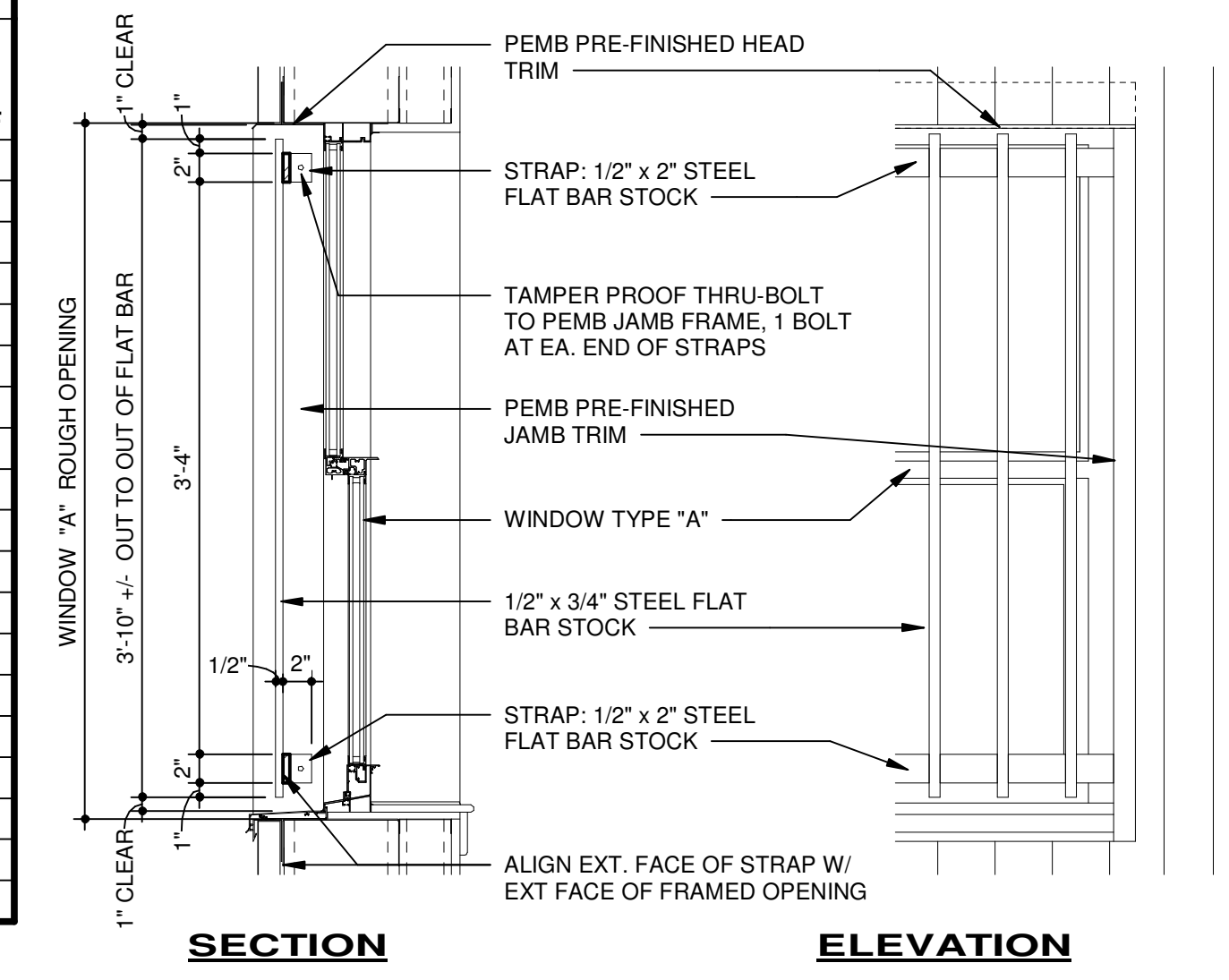


NOTE: PLASTIC WALL PANELS OVER GYP. BD. AT DOOR #04, #06, AND #07. PANEL INSTALLER SHALL CAULK PERIMETER OF DOOR FRAMES AFTER PANEL INSTALLATION.

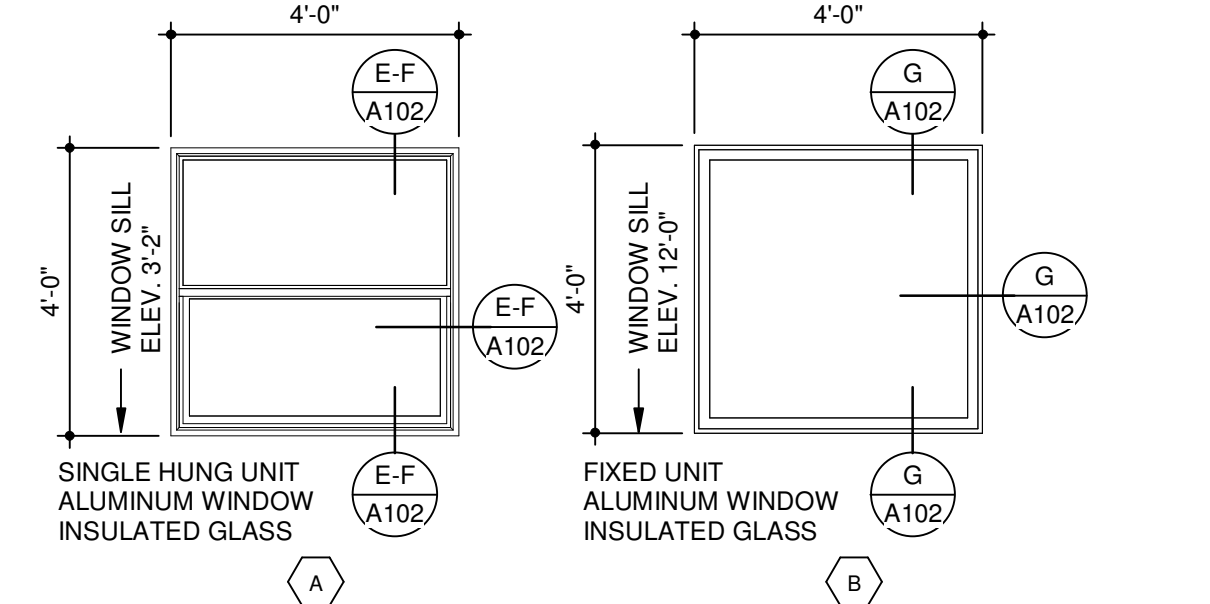


**K DETAIL**  
SCALE: 1 1/2" = 1'-0"

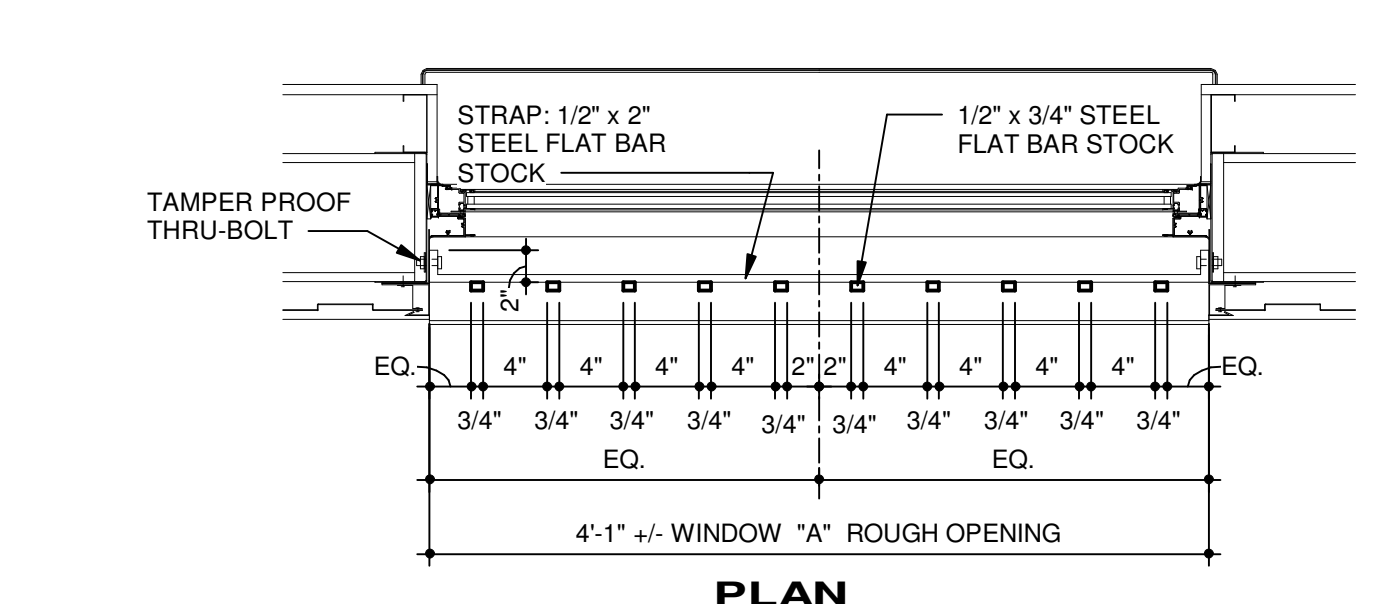
DRS. DR #	PER FRAME	DOOR				FRAME				HD. / JMB.	SILL	HDW SET	SIGN	COMMENTS	DR #
		W.	H.	TH.	TYPE	MAT.	GLASS	TYPE	MAT.						
01	1	3'-0"	7'-0"	1 3/4"	HG	H.M.	GL-2	1	H.M.	5 3/4"	A/A102	A/A102	1	----	01
02	1	3'-0"	7'-0"	1 3/4"	F	H.M.	----	1	H.M.	6"	H/A102	----	2	----	02
03	1	3'-0"	7'-0"	1 3/4"	HG	H.M.	GL-1	1	H.M.	8 3/8"	H/A102	----	2	A	03
04	1	3'-0"	7'-0"	1 3/4"	F	H.M.	----	1	H.M.	8 3/8"	H/A102	----	3	B	04
05	1	2'-10"	7'-0"	1 3/4"	F	H.M.	----	1	H.M.	6"	H/A102	----	5	----	05
06	1	3'-0"	7'-0"	1 3/4"	F	H.M.	----	1	H.M.	8 3/8"	H/A102	----	4	B	06
07	1	3'-0"	7'-0"	1 3/4"	F	H.M.	----	1	H.M.	8 3/8"	H/A102	----	4	B	07
08	1	3'-0"	7'-0"	1 3/4"	F	H.M.	----	1	H.M.	6"	H/A102	----	6	A	08
09	1	3'-0"	7'-0"	1 3/4"	HG	H.M.	GL-2	1	H.M.	5 3/4"	A/A102	A/A102	1	----	09
10	2	3'-0"	7'-0"	1 3/4"	F	H.M.	----	2	H.M.	10"	D/A102	D/A102	8	A	10
11	1	3'-0"	7'-0"	1 3/4"	NV	H.M.	GL-2	1	H.M.	10 5/8"	C/A102	C/A102	7	----	11
12	1	3'-0"	7'-0"	1 3/4"	NV	H.M.	GL-2	1	H.M.	10 5/8"	C/A102	C/A102	7	----	12
13	1	3'-0"	7'-0"	1 3/4"	HG	H.M.	GL-2	1	H.M.	5 3/4"	B/A102	B/A102	1	----	13
14	1	3'-0"	7'-0"	1 3/4"	HG	H.M.	GL-2	1	H.M.	5 3/4"	B/A102	B/A102	1	----	14
15	1	16'-0"	14'-0"	2"	OH	----	----	----	0"	K/A102	K/A102	----	----	----	15
16	1	16'-0"	14'-0"	2"	OH	----	----	----	0"	K/A102	K/A102	----	----	----	16
17	1	16'-0"	14'-0"	2"	OH	----	----	----	0"	K/A102	K/A102	----	----	----	17
18	1	16'-0"	14'-0"	2"	OH	----	----	----	0"	K/A102	K/A102	----	----	----	18



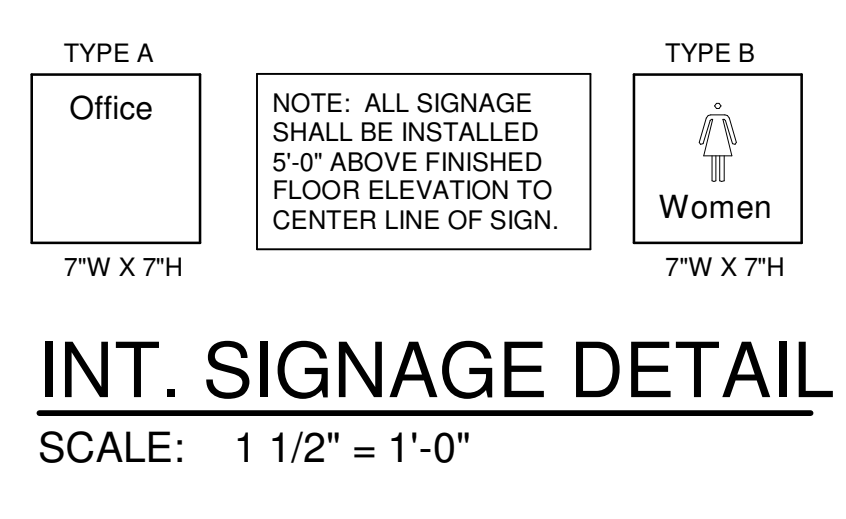
**DOOR / FRAME ELEVATIONS**  
SCALE: 1/4" = 1'-0"



**WINDOW ELEVATIONS**  
SCALE: 3/8" = 1'-0"



**SECURITY GRILL**  
SCALE: 1" = 1'-0"

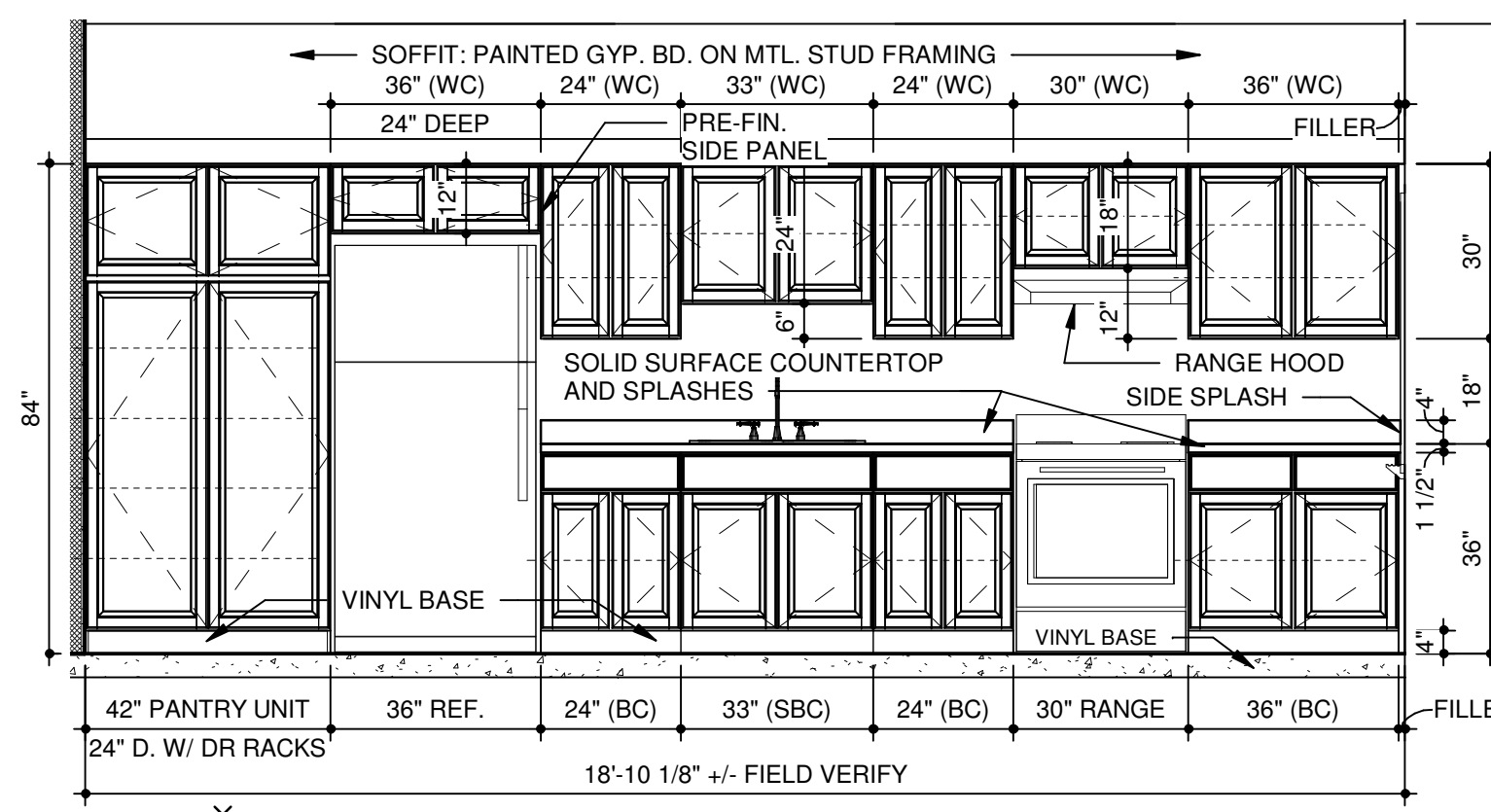
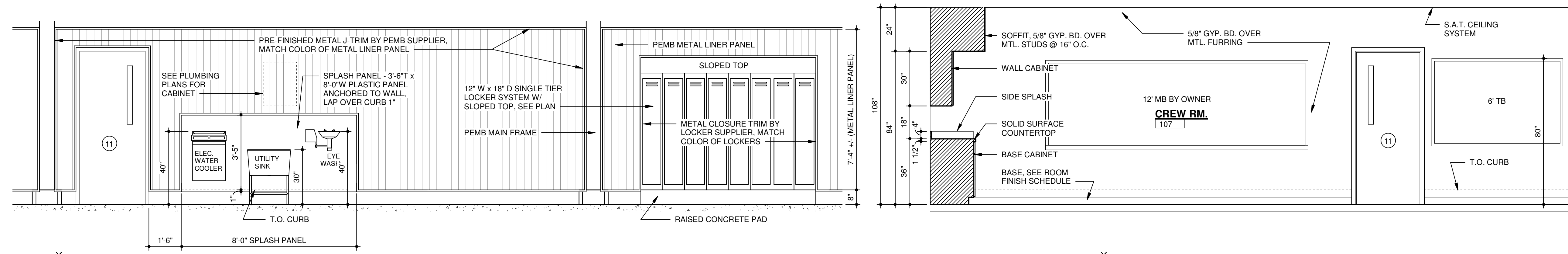


**INT. SIGNAGE DETAIL**  
SCALE: 1 1/2" = 1'-0"

ROOM FINISH SCHEDULE									
NO.	ROOM NAME	FLOOR FINISH	BASE	WALLS	WAINSCOT	CEILING	CLG HT	REMARKS	NO.
100	CORRIDOR	EXPOSED CONCRETE	4" VINYL	LATEX	NONE	S.A.T.	9'-0"		100
101	OFFICE	EXPOSED CONCRETE	4" VINYL	LATEX	NONE	S.A.T.	9'-0"		101
102	OFFICE	EXPOSED CONCRETE	4" VINYL	LATEX	NONE	S.A.T.	9'-0"		102
102A	CLOS.	EXPOSED CONCRETE	4" VINYL	LATEX	NONE	S.A.T.	9'-0"		102A
103	TOILET	EXPOSED CONCRETE	4" VINYL	PLASTIC PANEL	NONE	ACRYLIC	8'-6"	GYP. BD CEILING	103
104	TOILET	EXPOSED CONCRETE	4" VINYL	PLASTIC PANEL	NONE	S.A.T.	9'-0"		104
105	TOILET	EXPOSED CONCRETE	4" VINYL	PLASTIC PANEL	NONE	S.A.T.	9'-0"		105
106	MECH. RM.	EXPOSED CONCRETE	4" VINYL	LATEX	NONE	EXPOSED STRUCT.	VARIES		106
107	CREW RM.	EXPOSED CONCRETE	4" VINYL	LATEX	NONE	S.A.T.	9'-0"		107
108	STORAGE	EXPOSED CONCRETE	EXPOSED CONCRETE		METAL PANEL	EXPOSED STRUCT.	VARIES	WAINSCOT HEIGHT 8'-0" +/-	108
109	MAINT. BAY	EXPOSED CONCRETE	EXPOSED CONCRETE		METAL PANEL	EXPOSED STRUCT.	VARIES	WAINSCOT HEIGHT 8'-0" +/-	109

DRAWING INFORMATION		KYTC MAINTENANCE FACILITY CASEY COUNTY - LIBERTY, KENTUCKY	
A & E FILE NO.	2011	ACCOUNT NO.	609-C9NW-Z001-A10
DRAWING DATE	12/16/20	DRAWING NO.	A102
DRAWN BY	NICK	CHECKED BY	LSJ
PHASE	C	RTA DATE	12/16/2020
DRAWING INFORMATION		REVISION HISTORY OF THIS DRAWING	
NO.	DESCRIPTION OF REVISIONS	DATE	NO.
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2			6
3			7
4			8





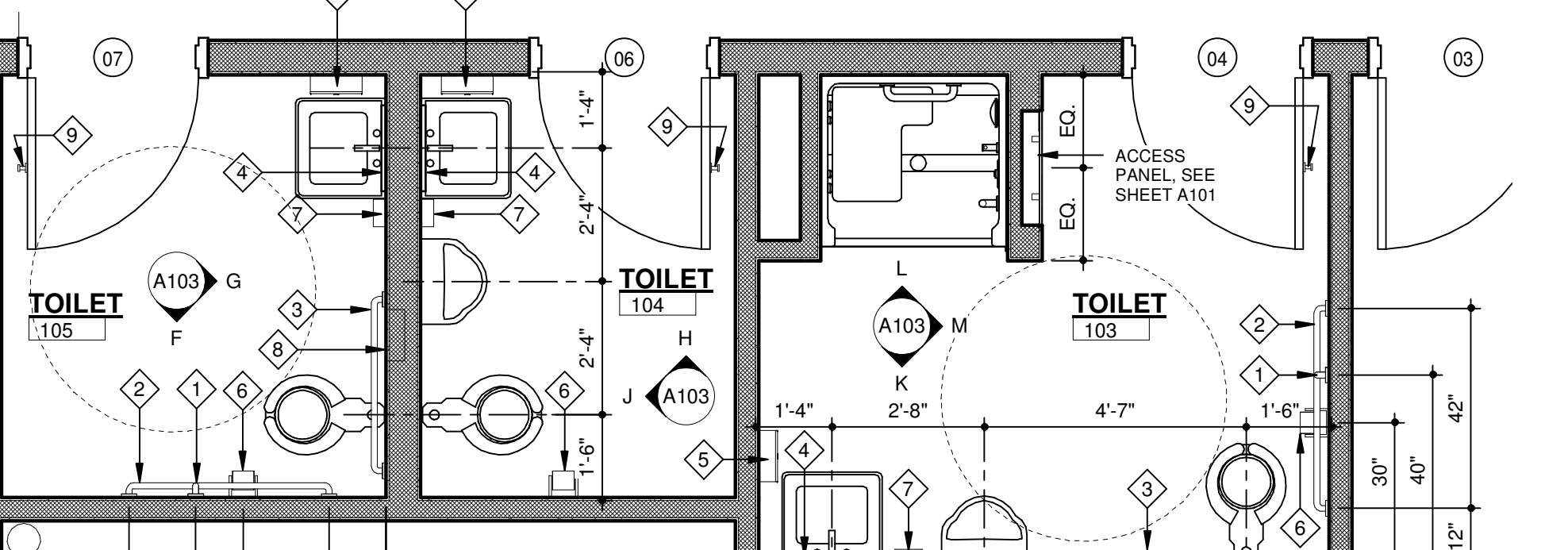
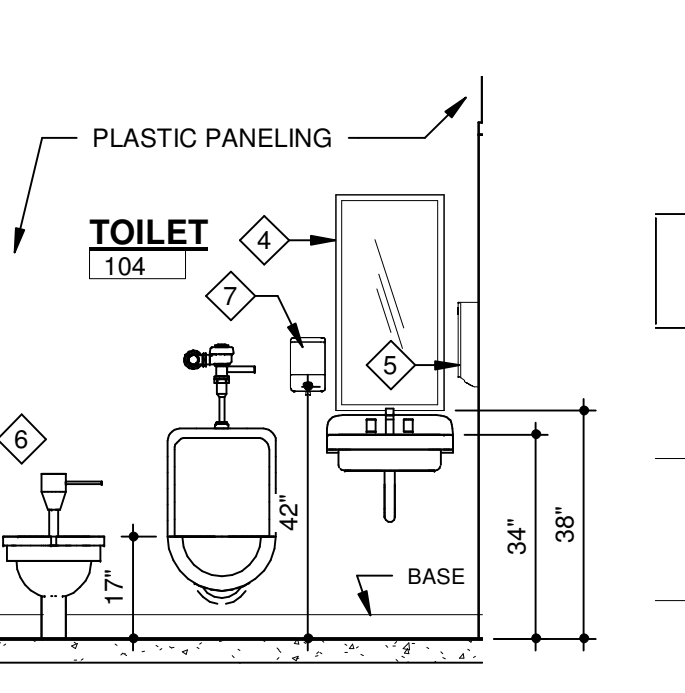
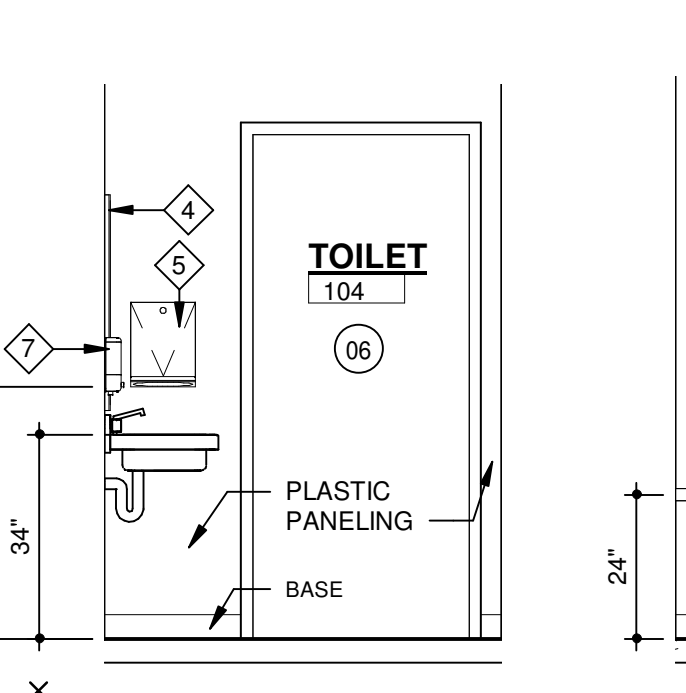
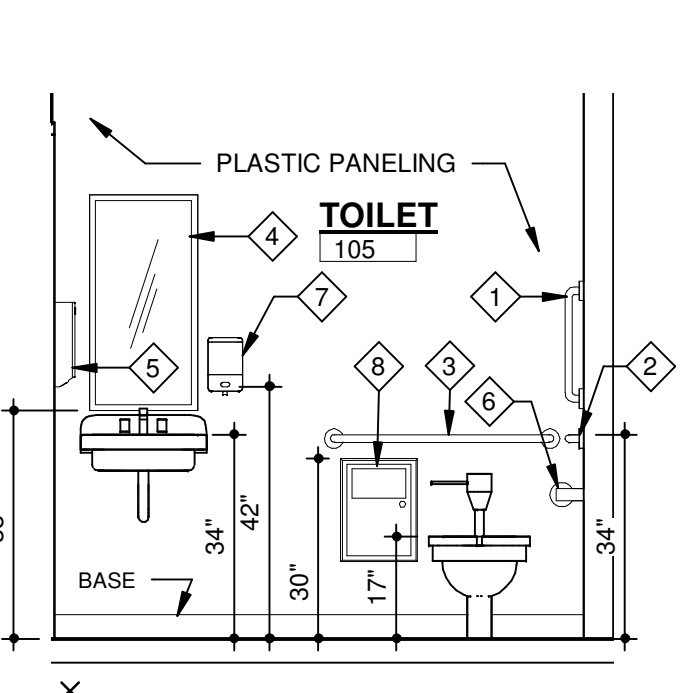
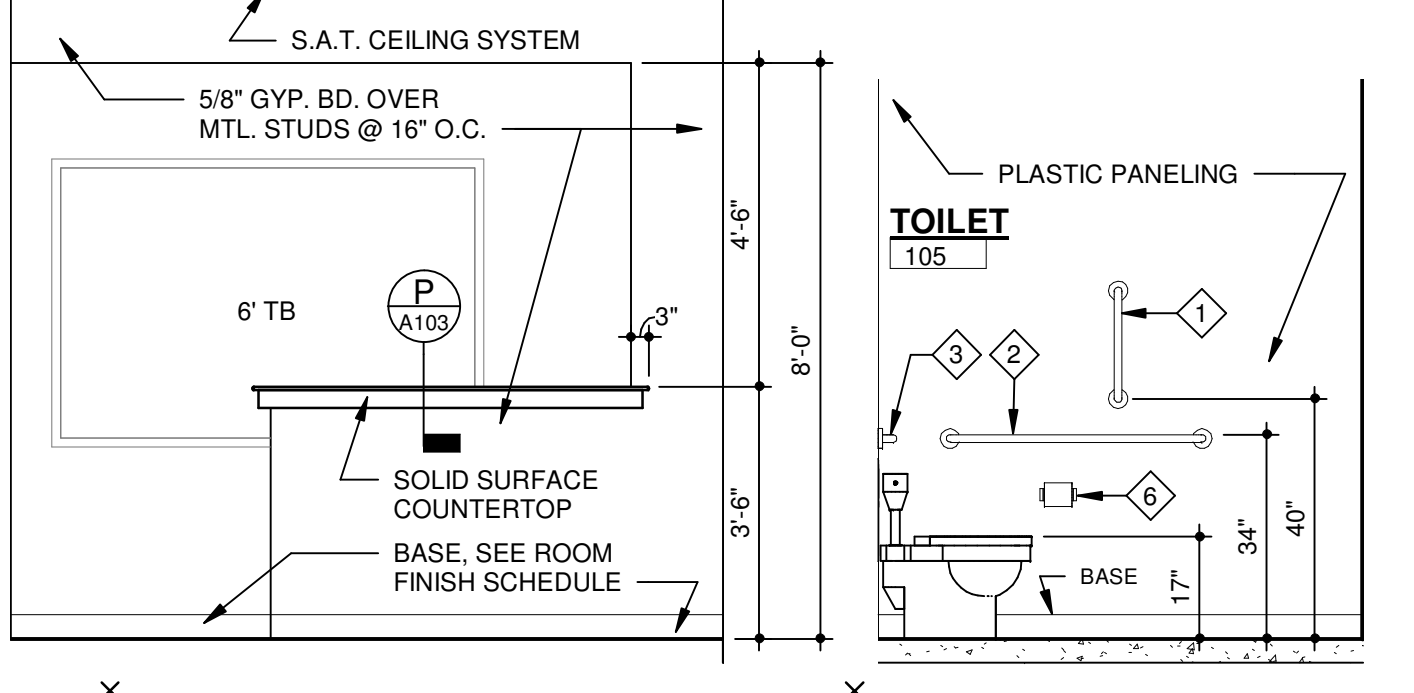
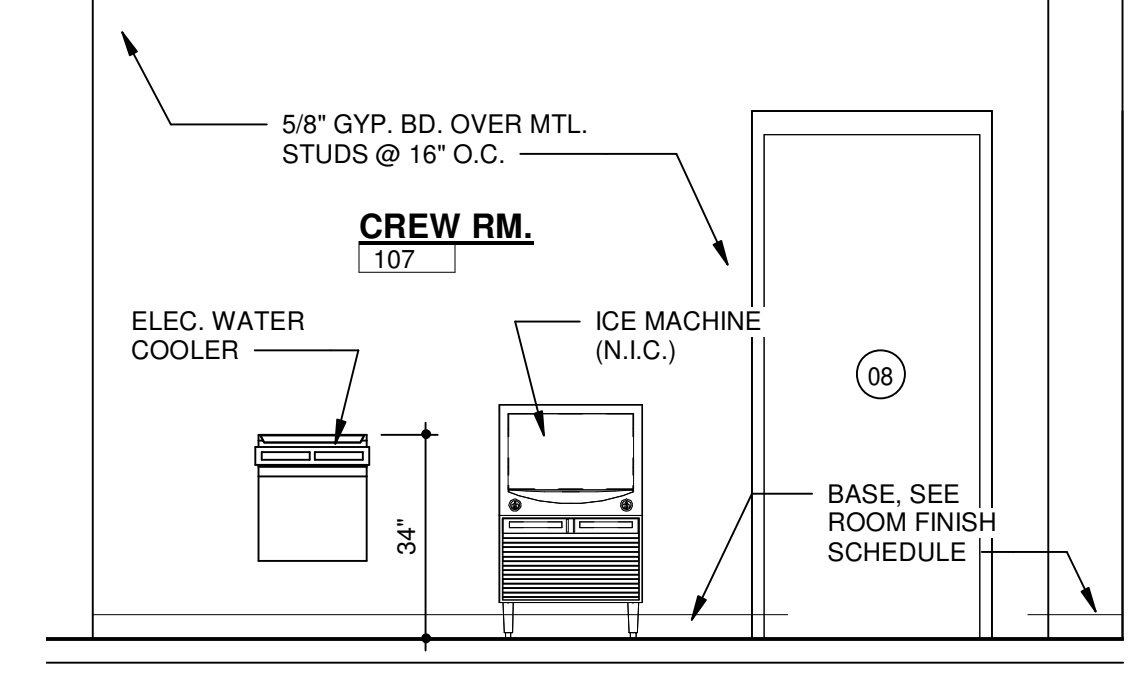
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**A ELEVATION**  
SCALE: 3/8" = 1'-0"

**B ELEVATION**  
SCALE: 3/8" = 1'-0"

**C ELEVATION**  
SCALE: 3/8" = 1'-0"



**D ELEVATION**  
SCALE: 3/8" = 1'-0"

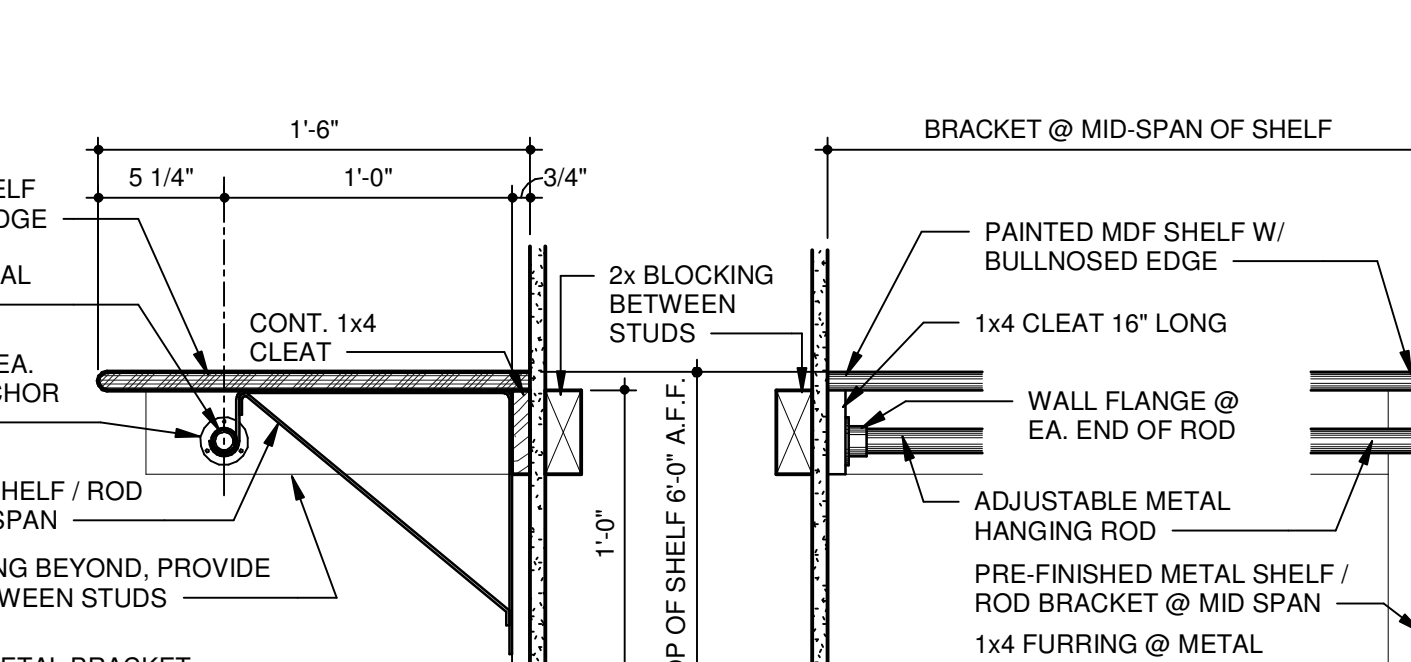
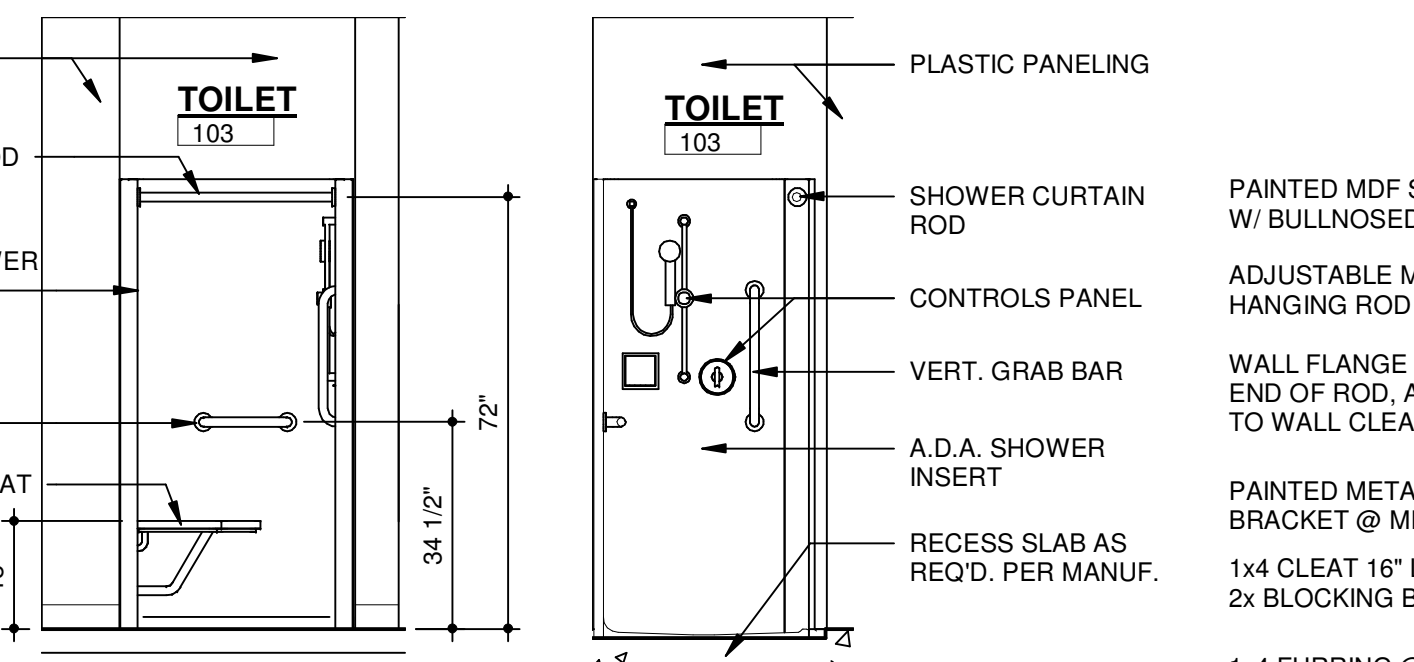
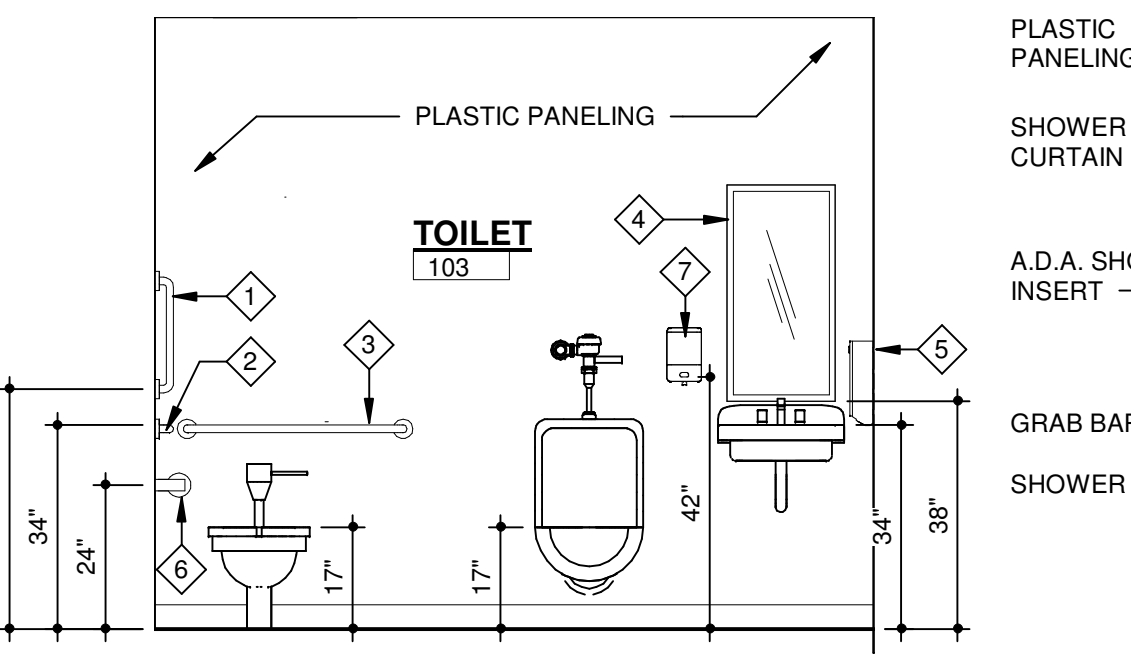
**E ELEVATION**  
SCALE: 3/8" = 1'-0"

**F ELEVATION**  
SCALE: 3/8" = 1'-0"

**G ELEVATION**  
SCALE: 3/8" = 1'-0"

**H ELEVATION**  
SCALE: 3/8" = 1'-0"

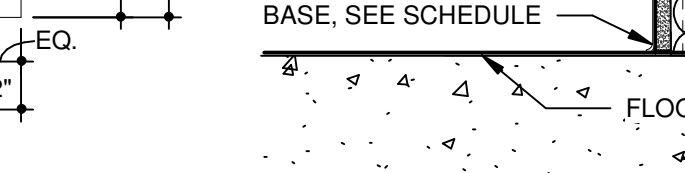
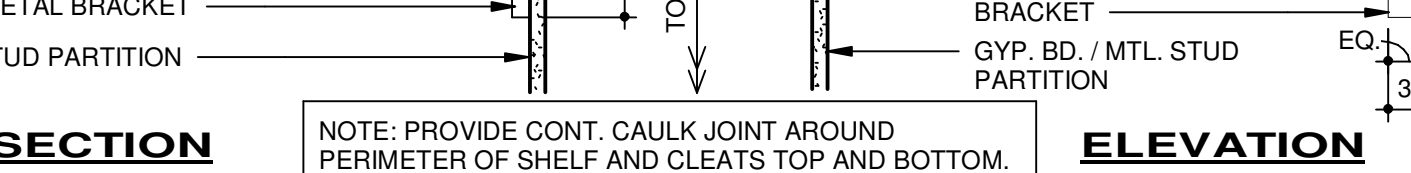
**J ELEVATION**  
SCALE: 3/8" = 1'-0"



**K ELEVATION**  
SCALE: 3/8" = 1'-0"

**L ELEVATION**  
SCALE: 3/8" = 1'-0"

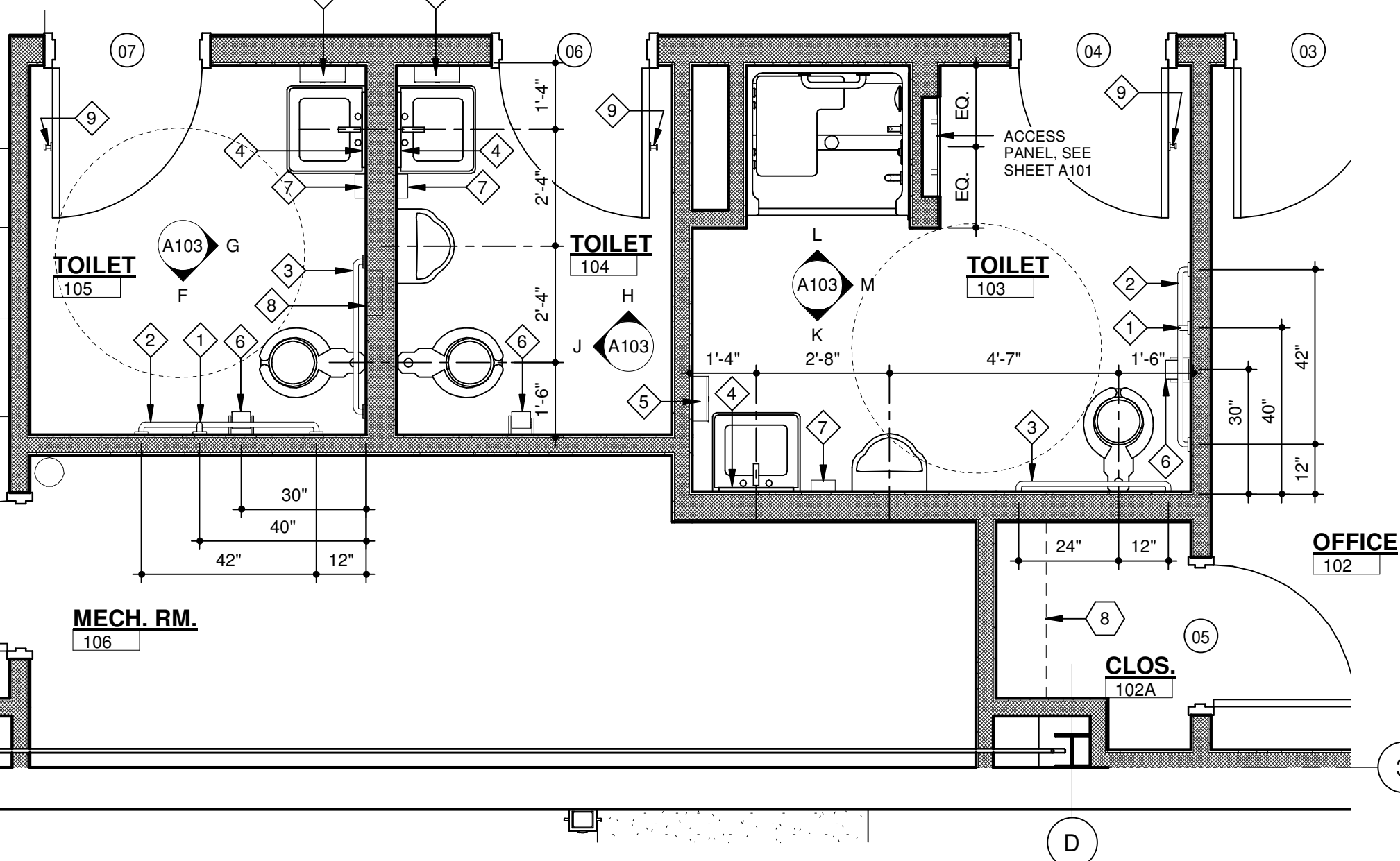
**M ELEVATION**  
SCALE: 3/8" = 1'-0"



**SECTION**  
SCALE: 1 1/2" = 1'-0"

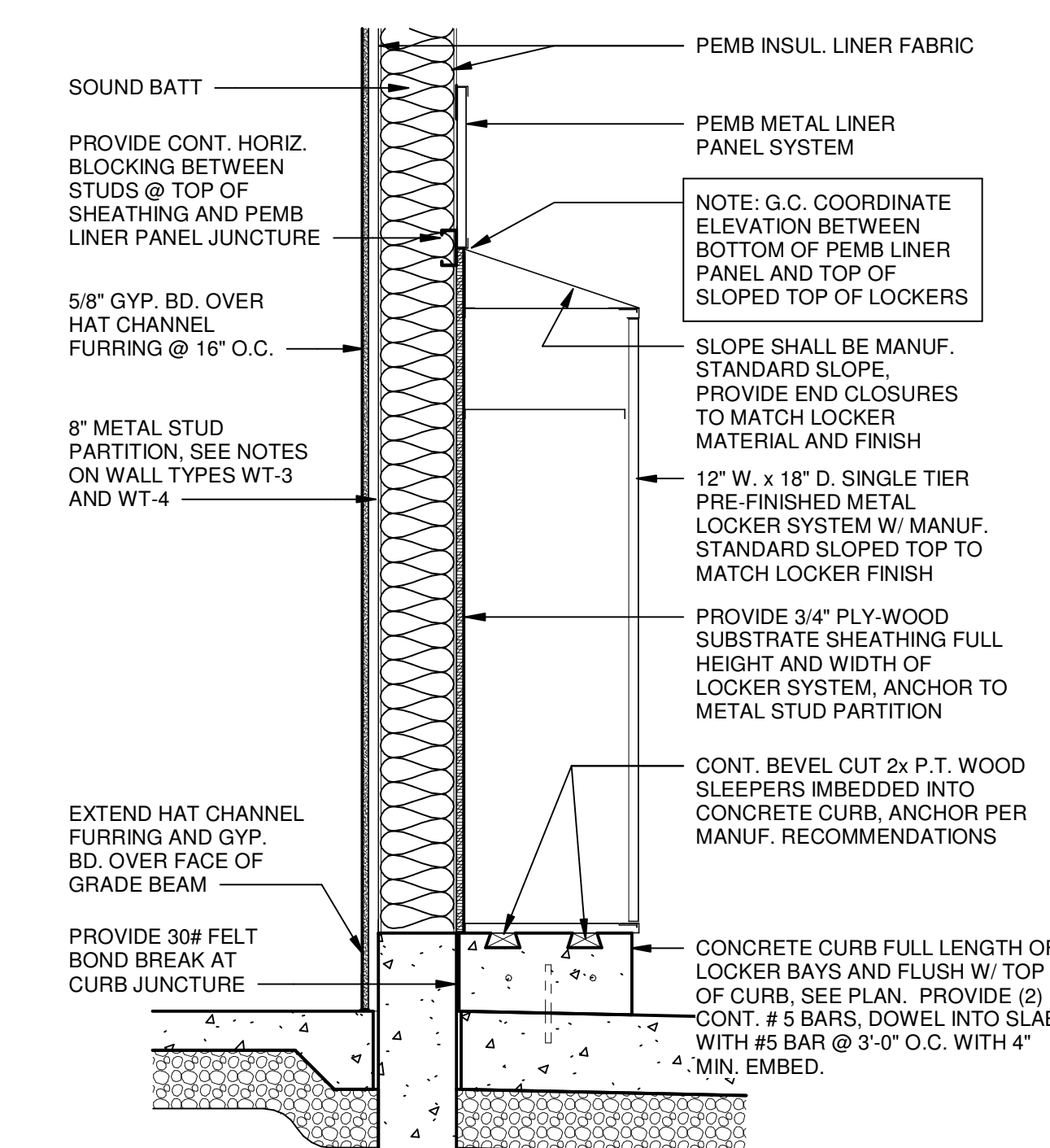
**ELEVATION**  
SCALE: 1 1/2" = 1'-0"

**TOILET / SHOWER PLANS**  
SCALE: 3/8" = 1'-0"

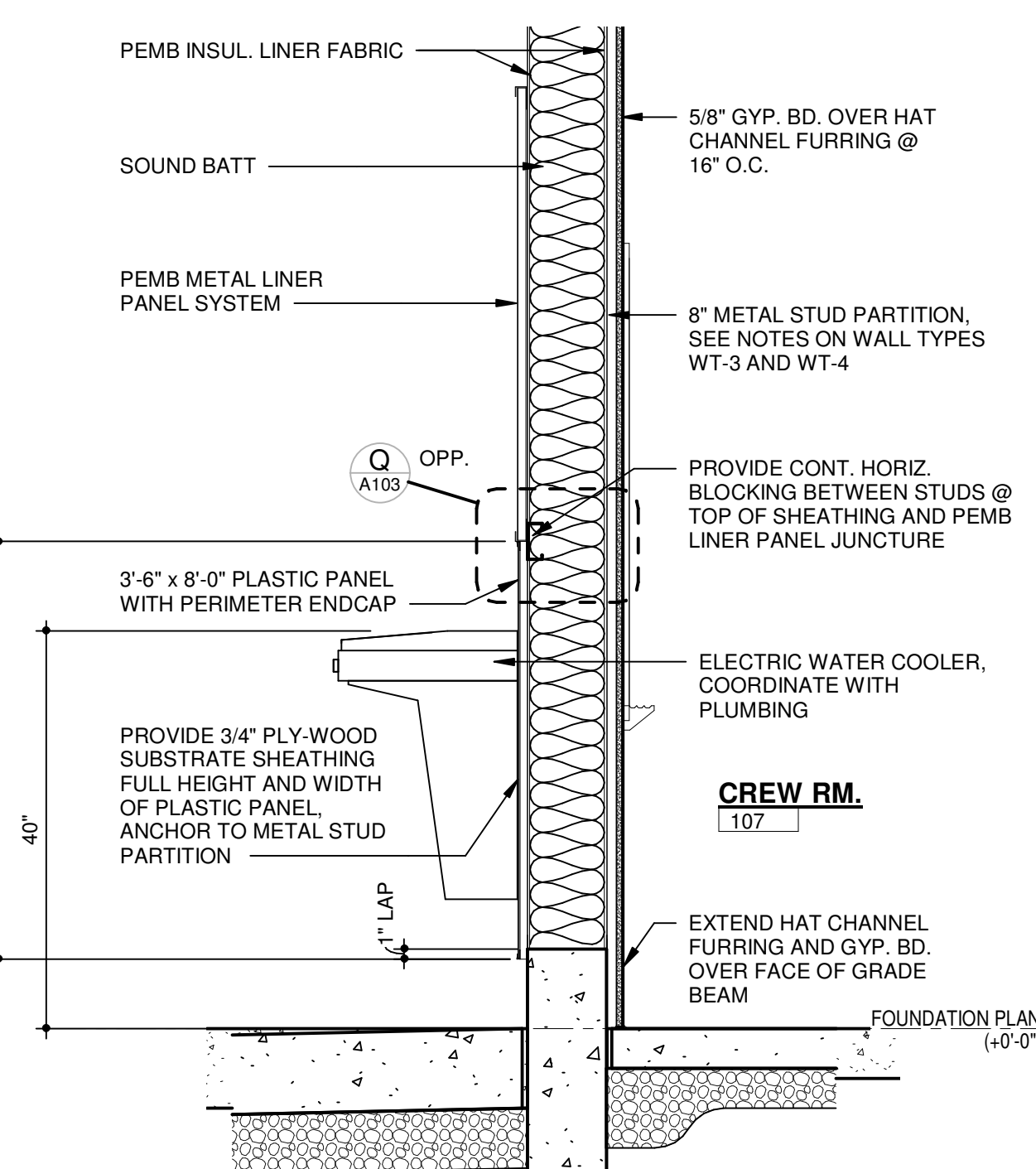


**SHEET NOTES**

- 2x2 ACoustical TILE CEILING SYSTEM @ 9'-0" ABOVE FINISH FLOOR.
- NO CEILING IN THIS ROOM, EXPOSED INSULATION LINER SYSTEM.
- EXTEND METAL STUD WALL AND INSULATION UP TO UNDERSIDE OF ROOF STRUCTURE.
- ALUMINUM CANOPY SYSTEM, COORDINATE WITH ROOF PLAN SHEET A105 AND RELATED DETAILS.
- SLOPED TOP LOCKER SYSTEM BELOW.
- PAINTED 5/8" GYPSUM BOARD CEILING @ 8'-6" ABOVE FINISH FLOOR.
- LIGHT FIXTURE, SEE ELECTRICAL PLANS.
- CLOSET SHELF AND HANGER ROD, SEE DETAIL ON THIS SHEET.
- HOIST BEAM, SEE STRUCTURAL PLANS. HOIST AND TROLLEY SEE SPECIFICATIONS.
- PAINTED 5/8" GYPSUM BOARD SOFFIT OVER METAL STUD FRAMING @ 16" O.C., BOTTOM OF FINISHED SOFFIT @ 7'-0" +/- ABOVE FINISH FLOOR.
- CEILING FAN SUSPENDED FROM PEMB STRUCTURAL FRAMING, SEE ELECTRICAL PLANS.



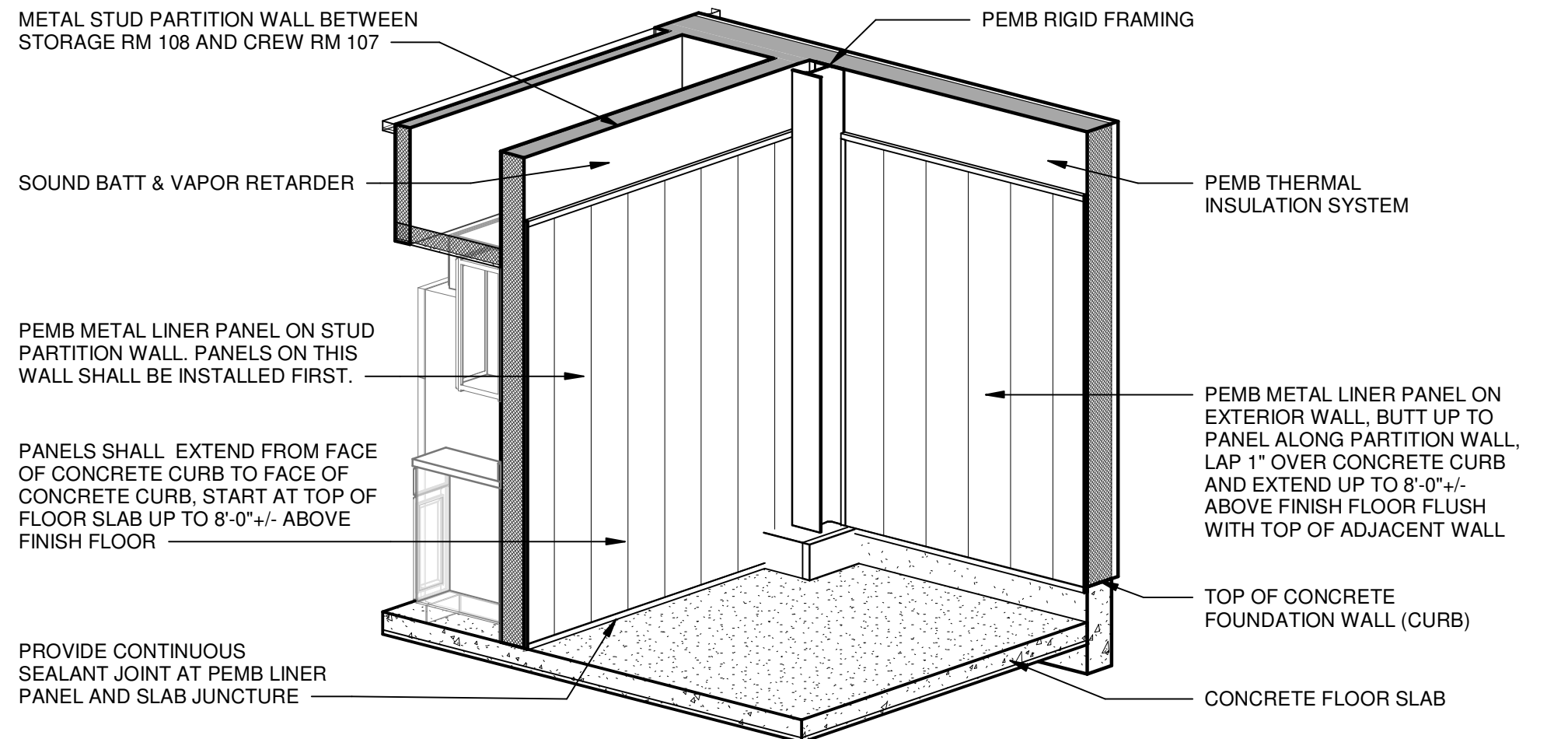
**LOCKER / WALL DETAIL**  
SCALE: 3/4" = 1'-0"



**WALL SECTION**  
SCALE: 3/4" = 1'-0"

**SECTION**  
SCALE: 1 1/2" = 1'-0"

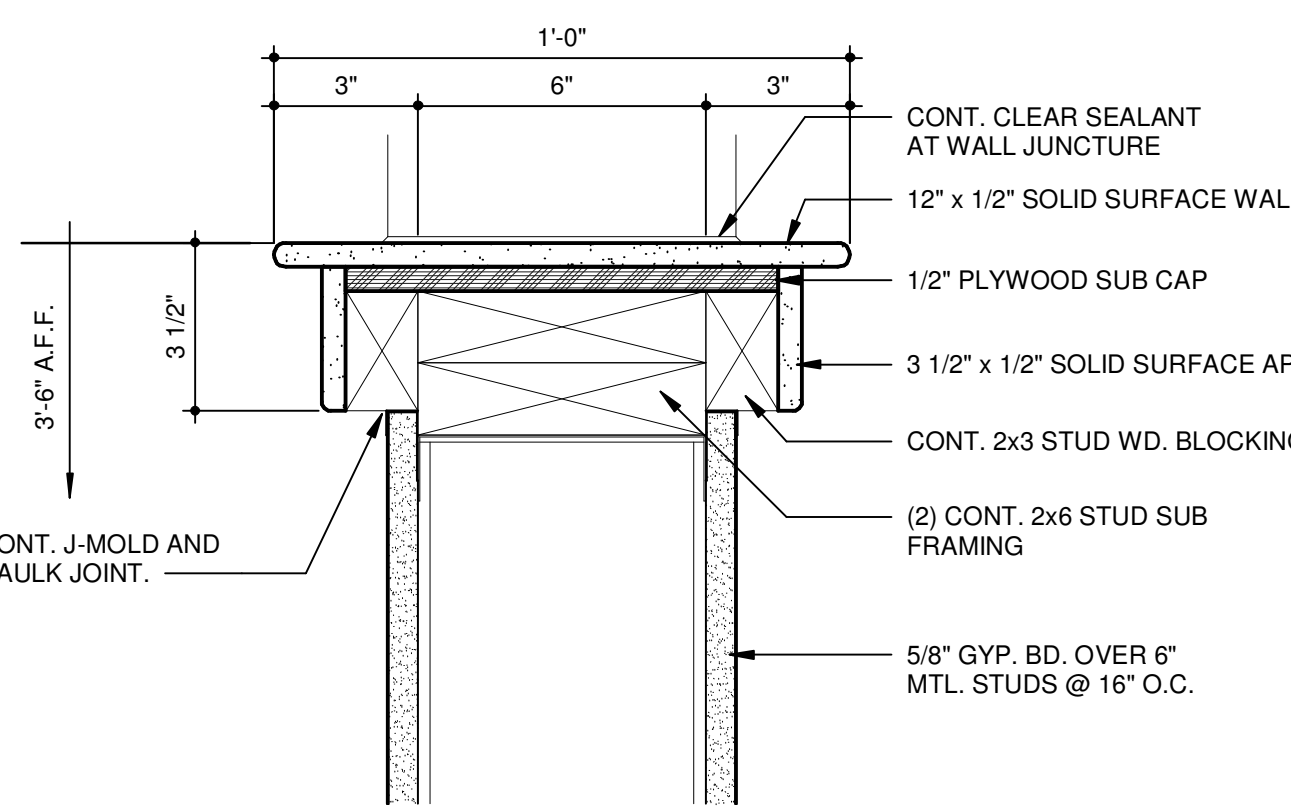
**ELEVATION**  
SCALE: 1 1/2" = 1'-0"



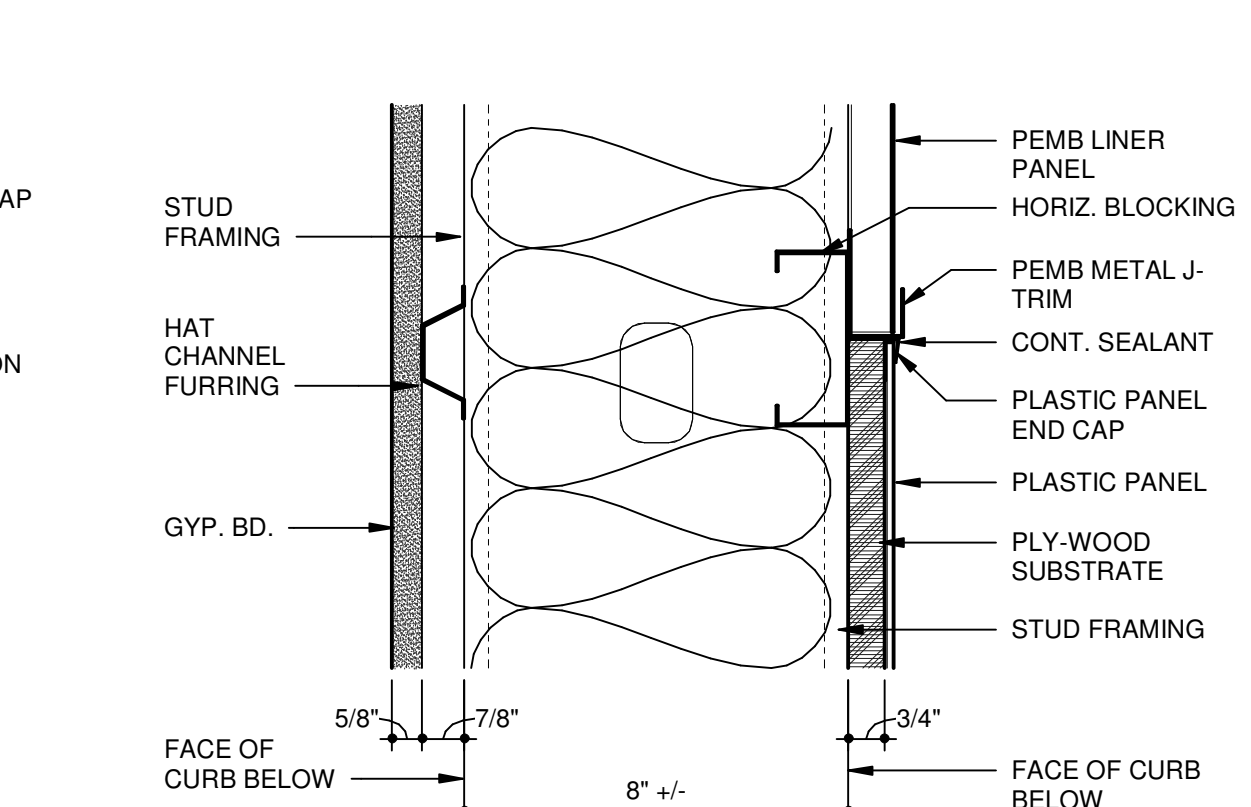
**STORAGE RM108 PEMB LINER PANEL ISO**  
NOT TO SCALE

TOILET ACCESSORY SCHEDULE

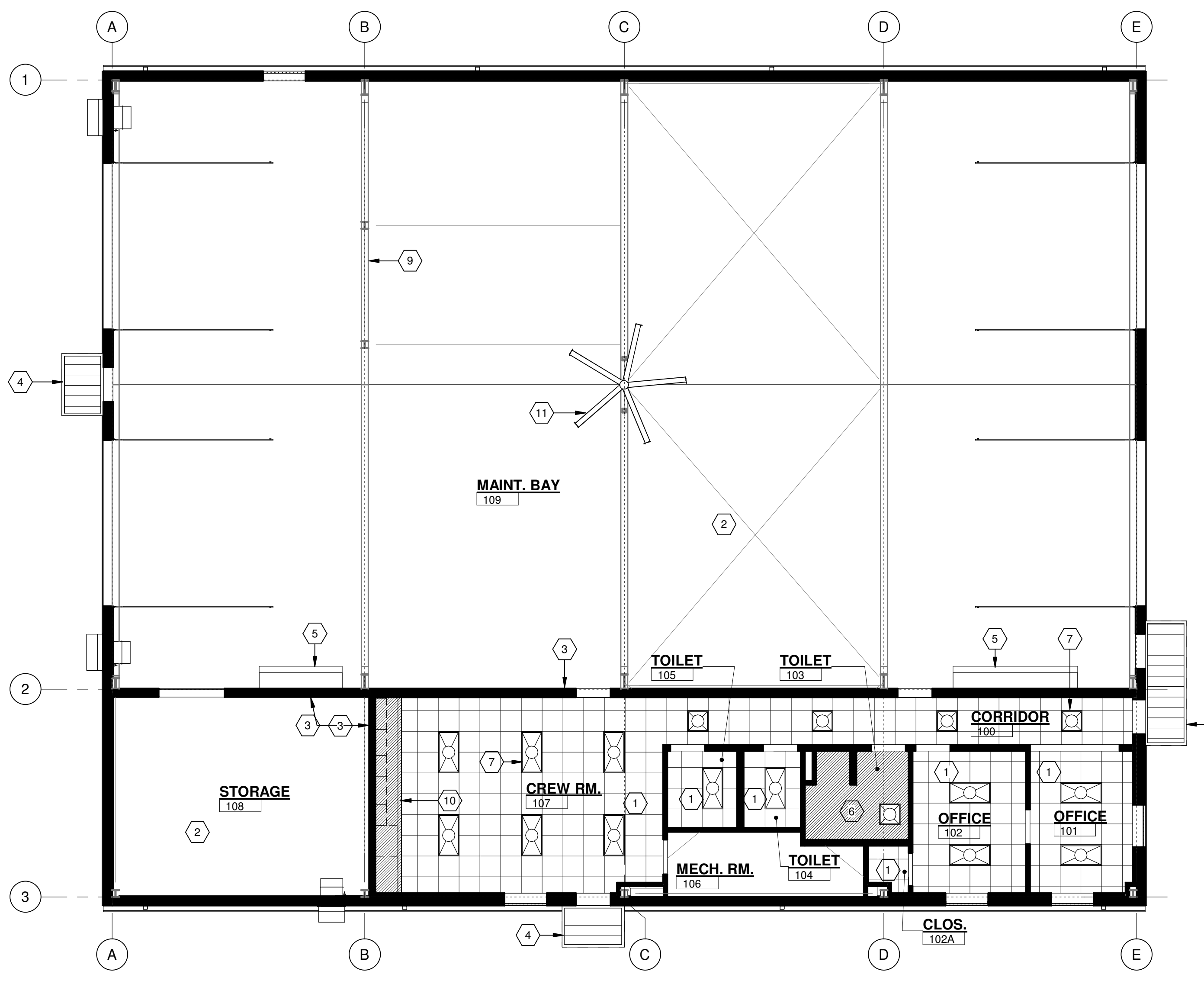
TYPE MARK	DESCRIPTION	COMMENTS
1	VERTICAL GRAB BAR 18" x 1-1/4" O.D.	SEE ELEVATION FOR HEIGHTS
2	GRAB BAR 42" x 1-1/4" O.D.	SEE ELEVATION FOR HEIGHTS
3	GRAB BAR 36" x 1-1/4" O.D.	SEE ELEVATION FOR HEIGHTS
4	MIRROR, 18" x 36"	SEE ELEVATION FOR HEIGHTS
5	PAPER TOWEL DISPENSER	NOT IN CONTRACT
6	TOILET PAPER DISPENSER	NOT IN CONTRACT
7	SOAP DISPENSER	NOT IN CONTRACT
8	RECESSED NAPKIN DISPOSAL	SEE ELEVATION FOR HEIGHTS
9	HAT & COAT HOOK	MOUNT 48" ABOVE FIN. FL.



**DETAIL**  
SCALE: 3" = 1'-0"



**DETAIL**  
SCALE: 3" = 1'-0"



**REFLECTED CEILING PLAN**  
SCALE: 1/8" = 1'-0"

**DRAWING INFORMATION**

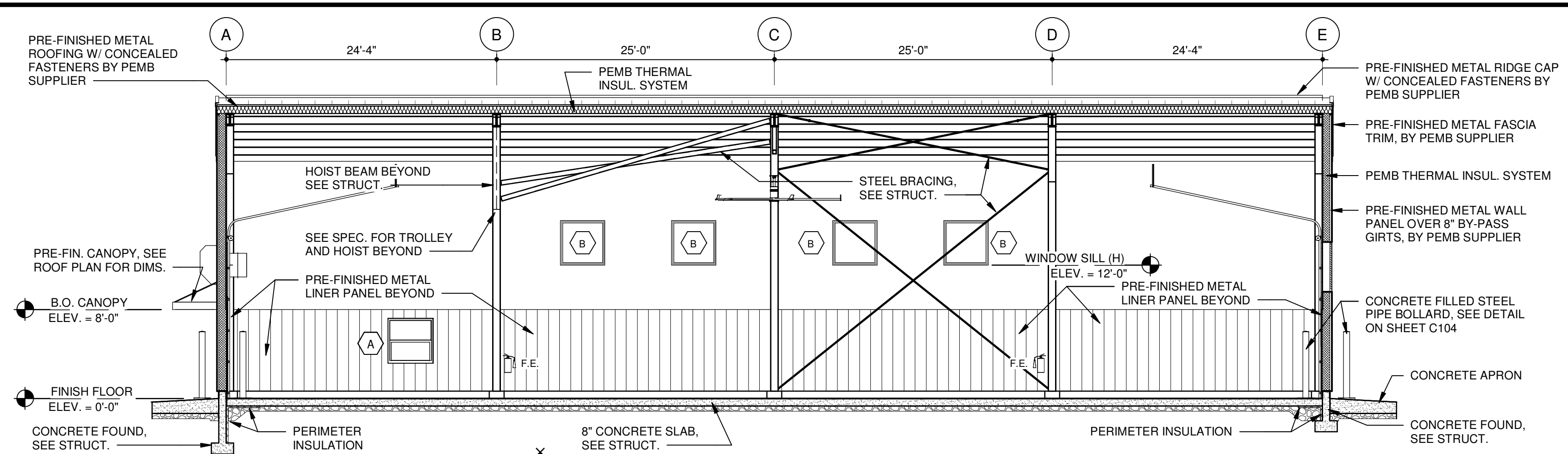
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DRAWING DATE	12/16/20	<b>CASEY COUNTY - LIBERTY, KENTUCKY</b>	
DRAWN BY	NICK	ACCOUNT NO.	609-C9NW-Z001-A10
CHECKED BY	LSJ	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
PHASE	C	A103	
RTA DATE	12/16/2020	AS-BUILT DATE	

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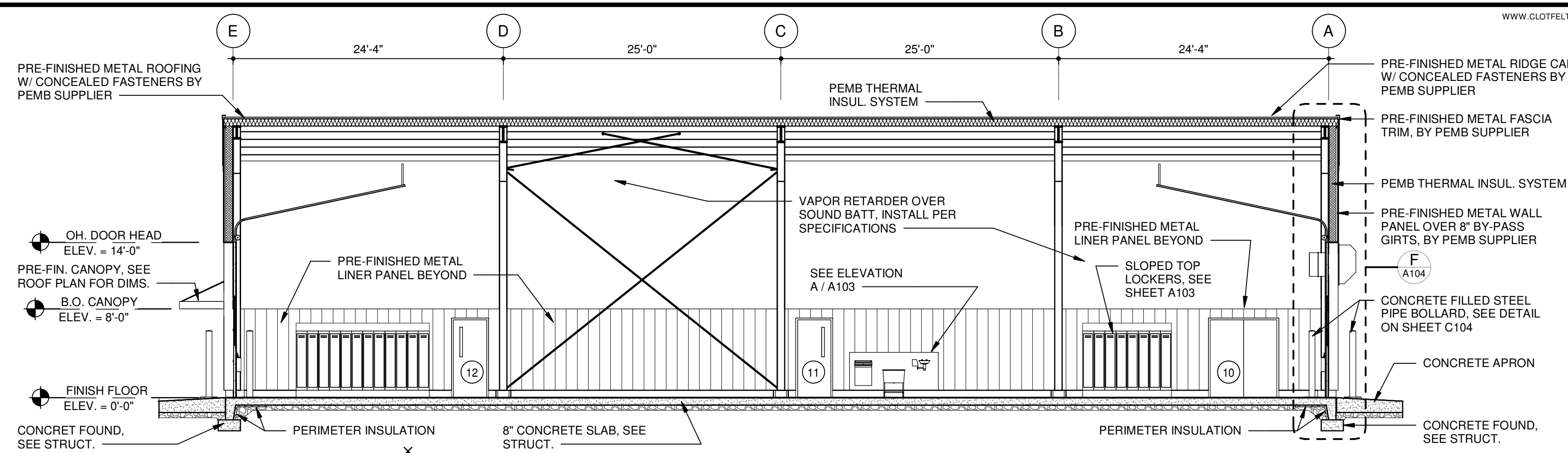
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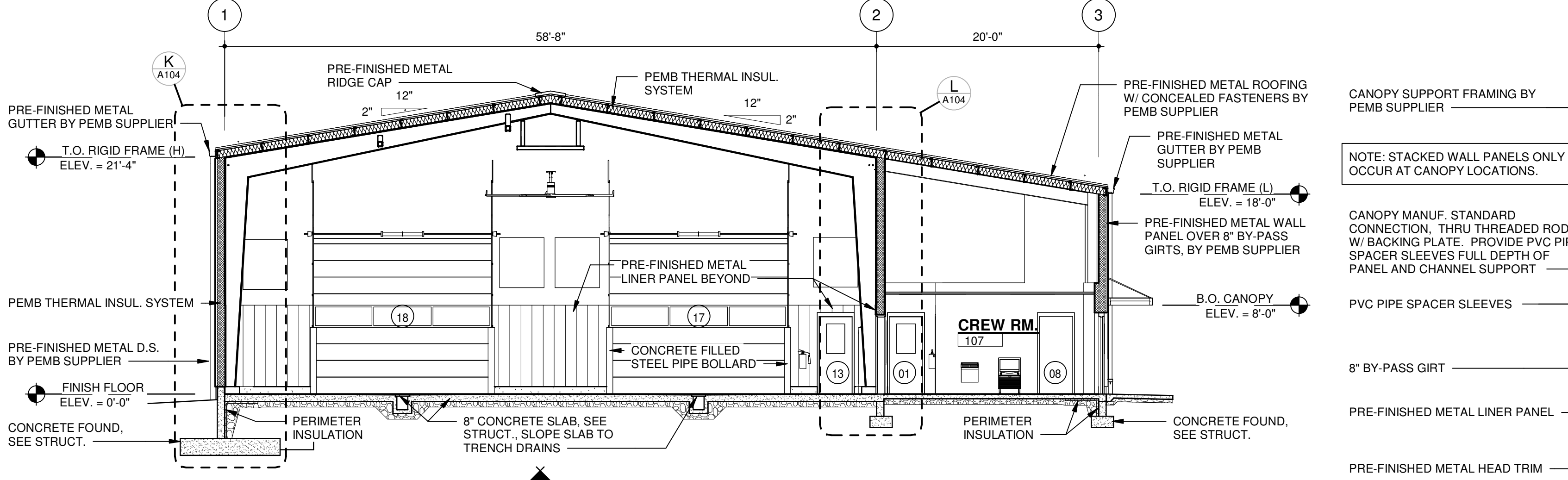




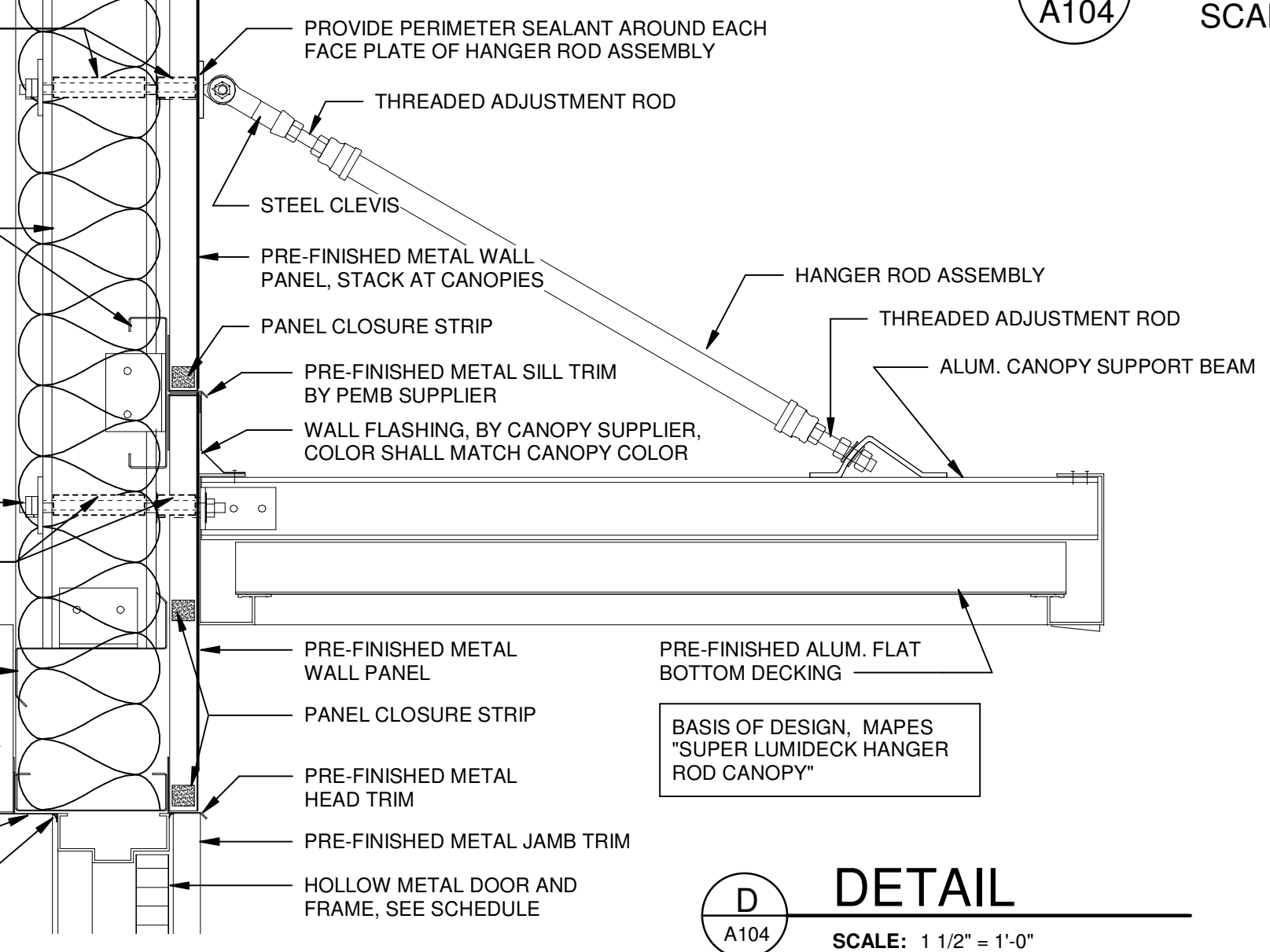
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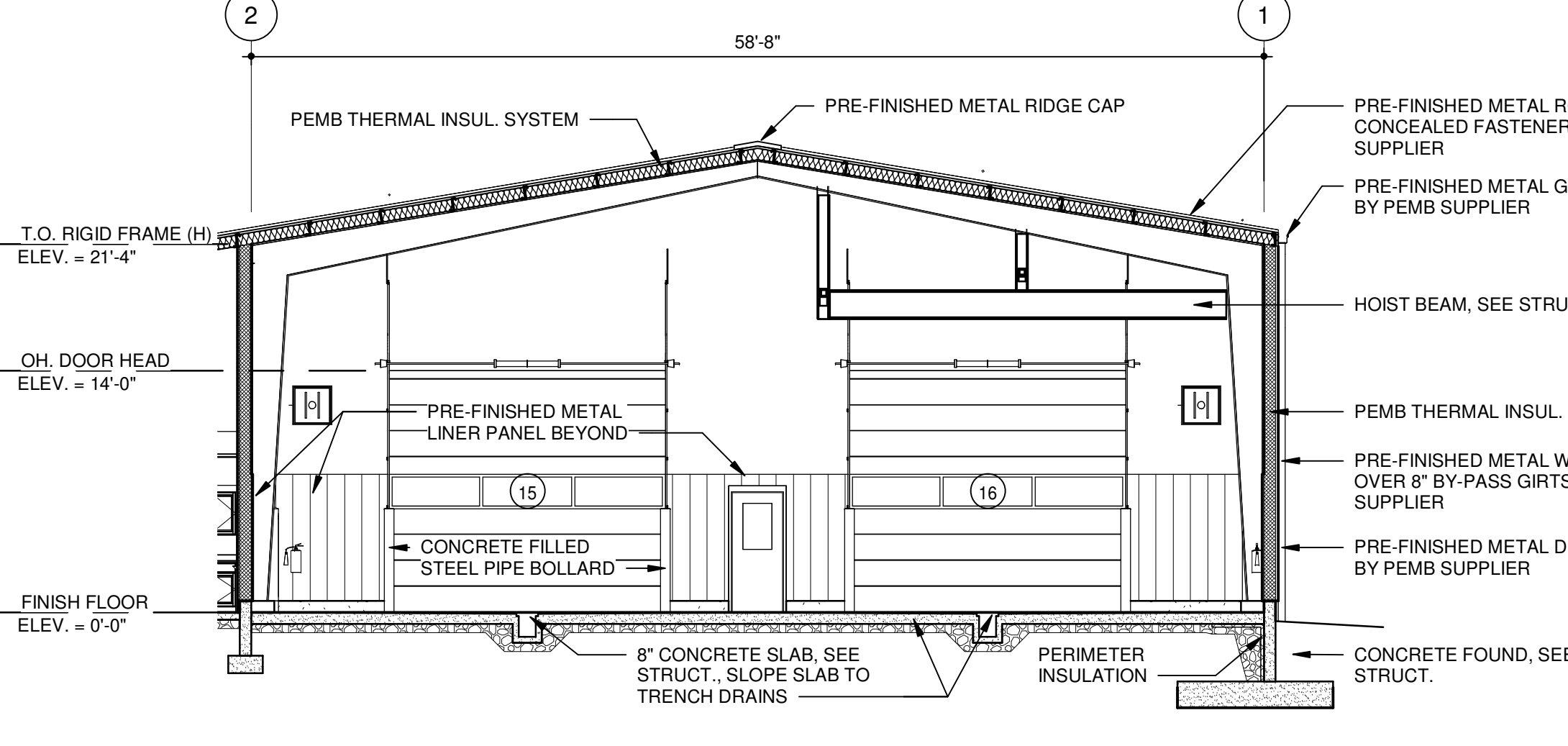
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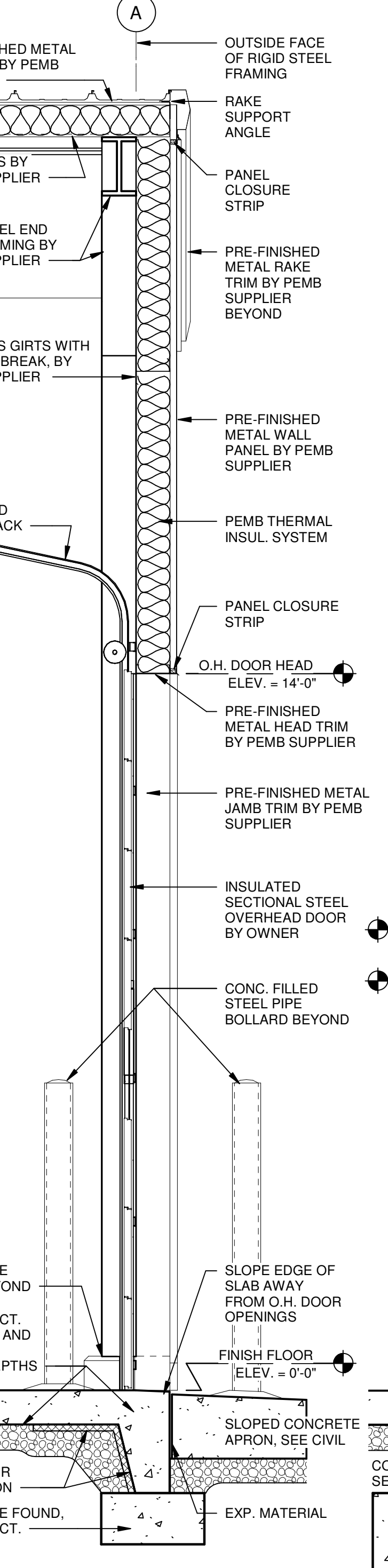
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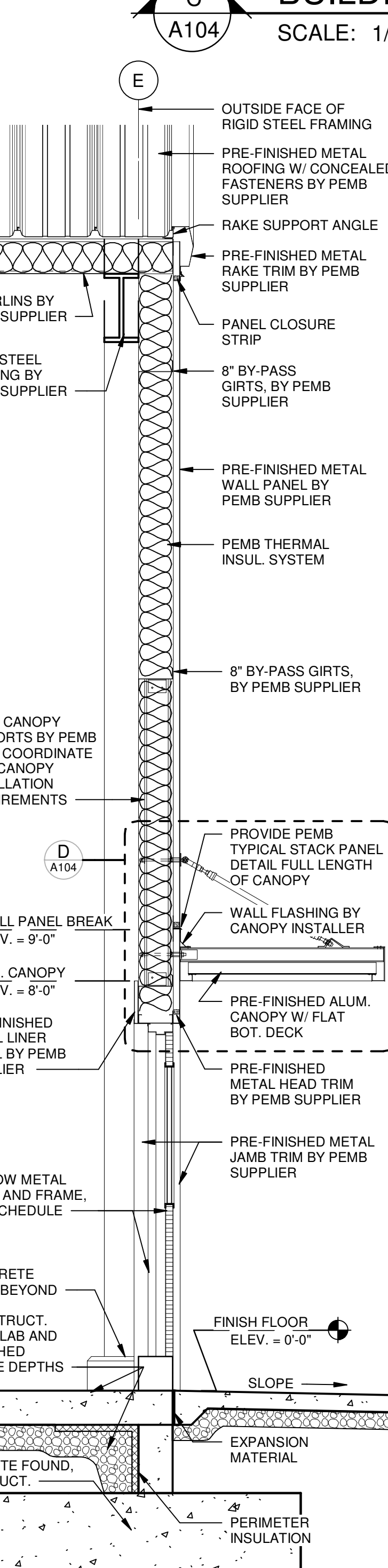
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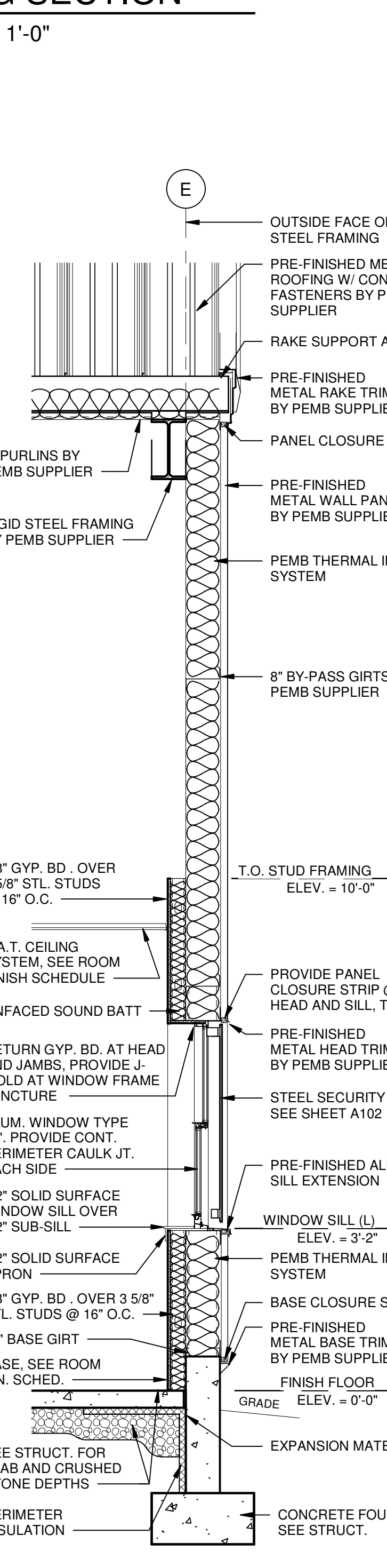
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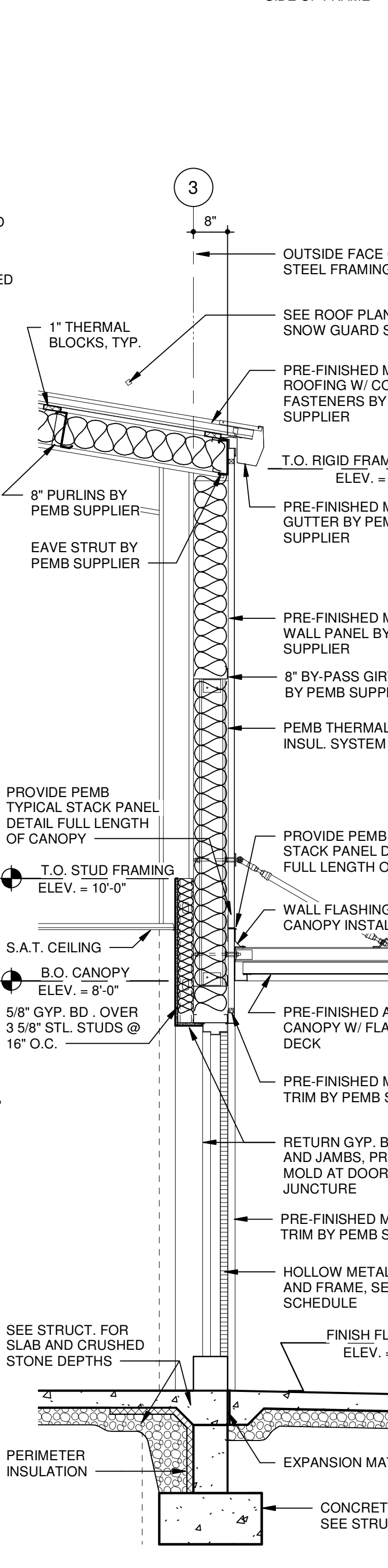
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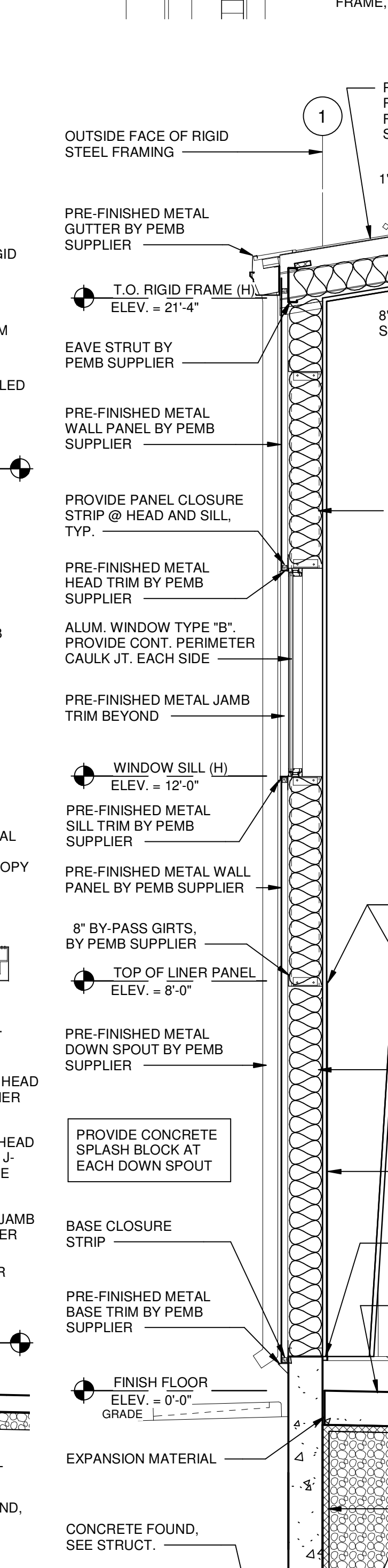
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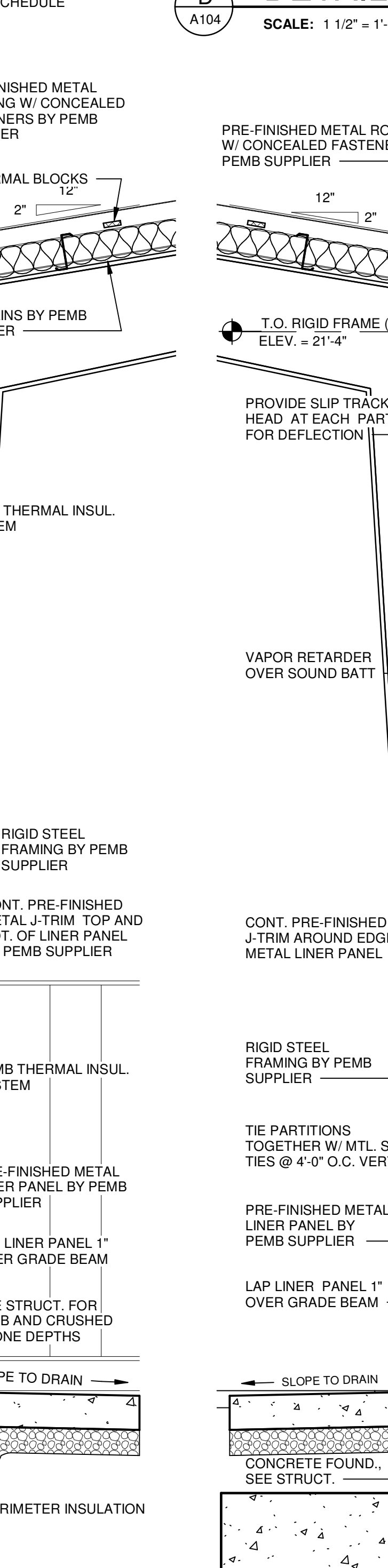
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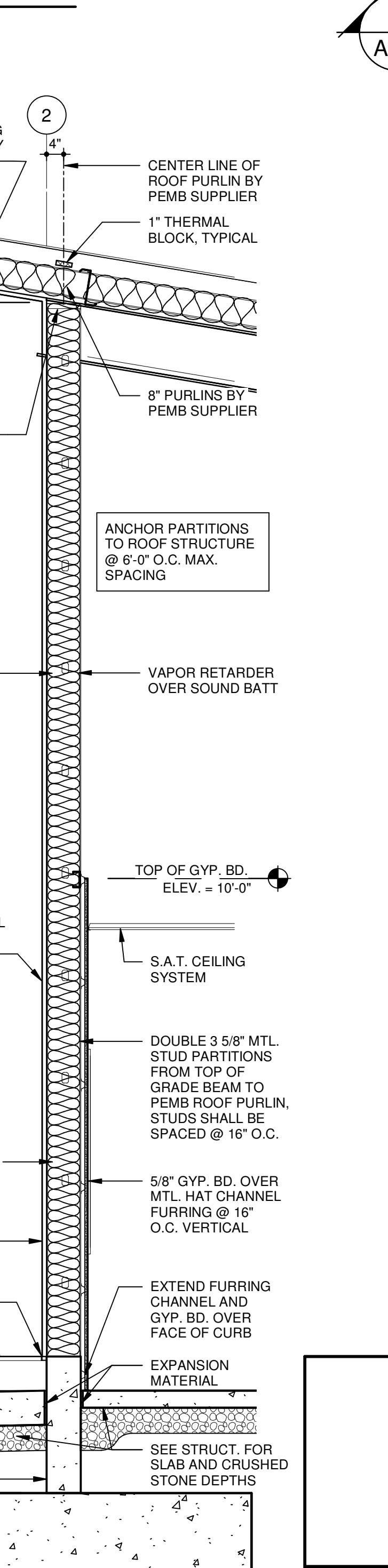
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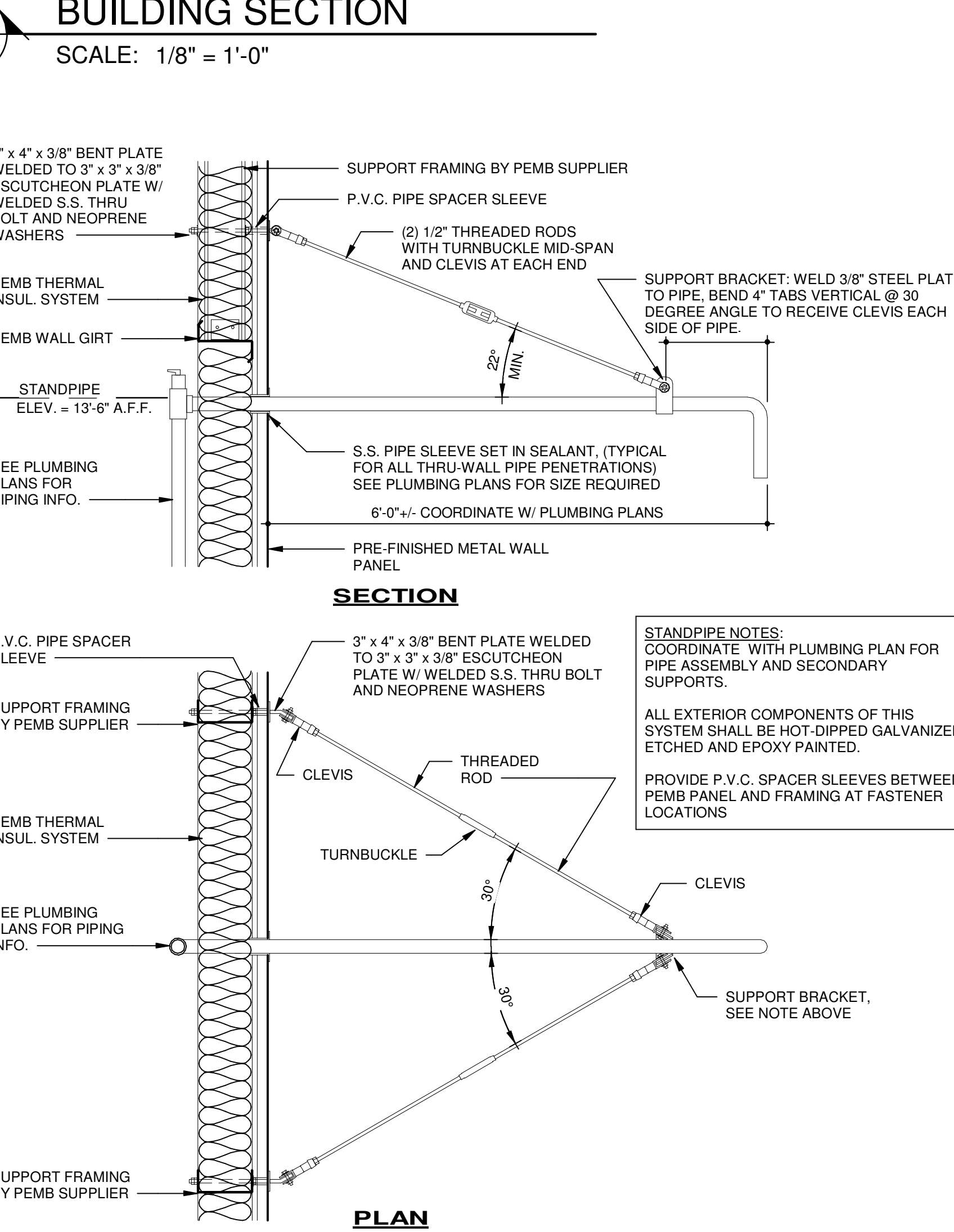
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**L WALL SECTION**  
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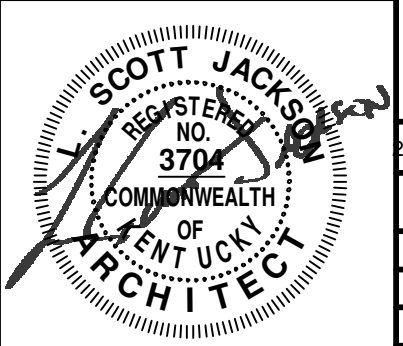


**M WALL SECTION**  
SCALE: 1/2" = 1'-0"



**STANDPIPE SUPPORT DETAIL**  
SCALE: 3/4" = 1'-0"

DRAWING INFORMATION		KYTC MAINTENANCE FACILITY		DRAWING NO.
A & E FILE NO.	2011	CASEY COUNTY - LIBERTY, KENTUCKY		
DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-2001-A10	A104
DRAWN BY	NICK	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		
CHECKED BY	LSJ	RTA DATE	12/16/2020	AS-BUILT DATE
PHASE	C	REVISION HISTORY OF THIS DRAWING		DECA LOG #
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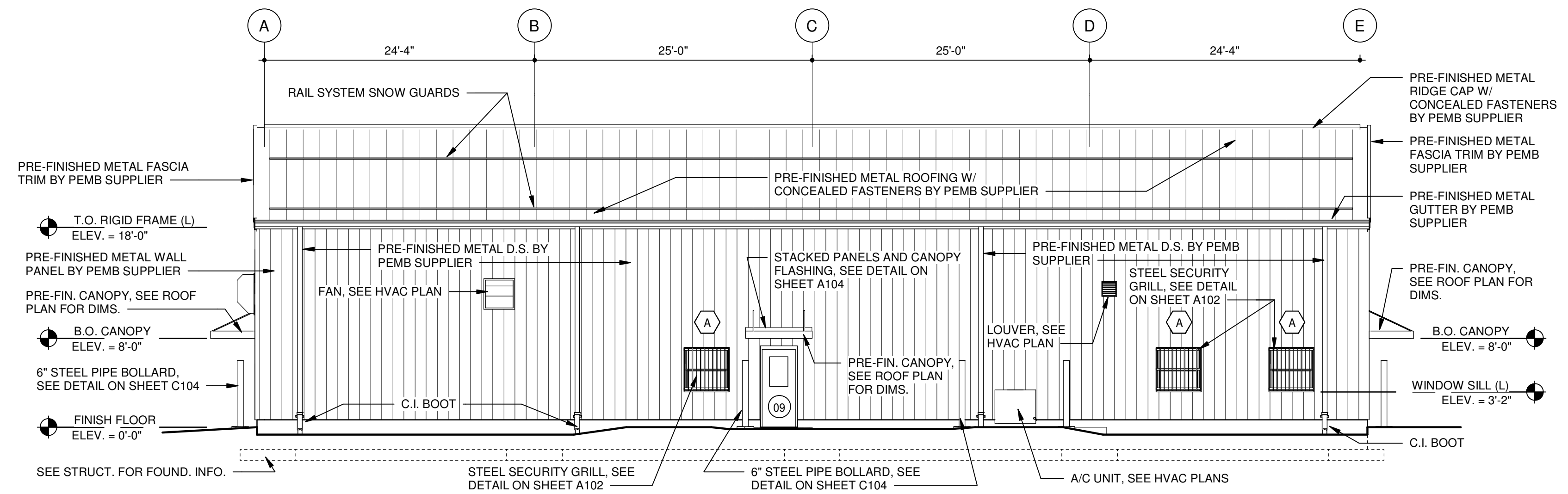


**Clotfelter SAMOKAR**  
Architecture | Interiors | Landscapes | Planning

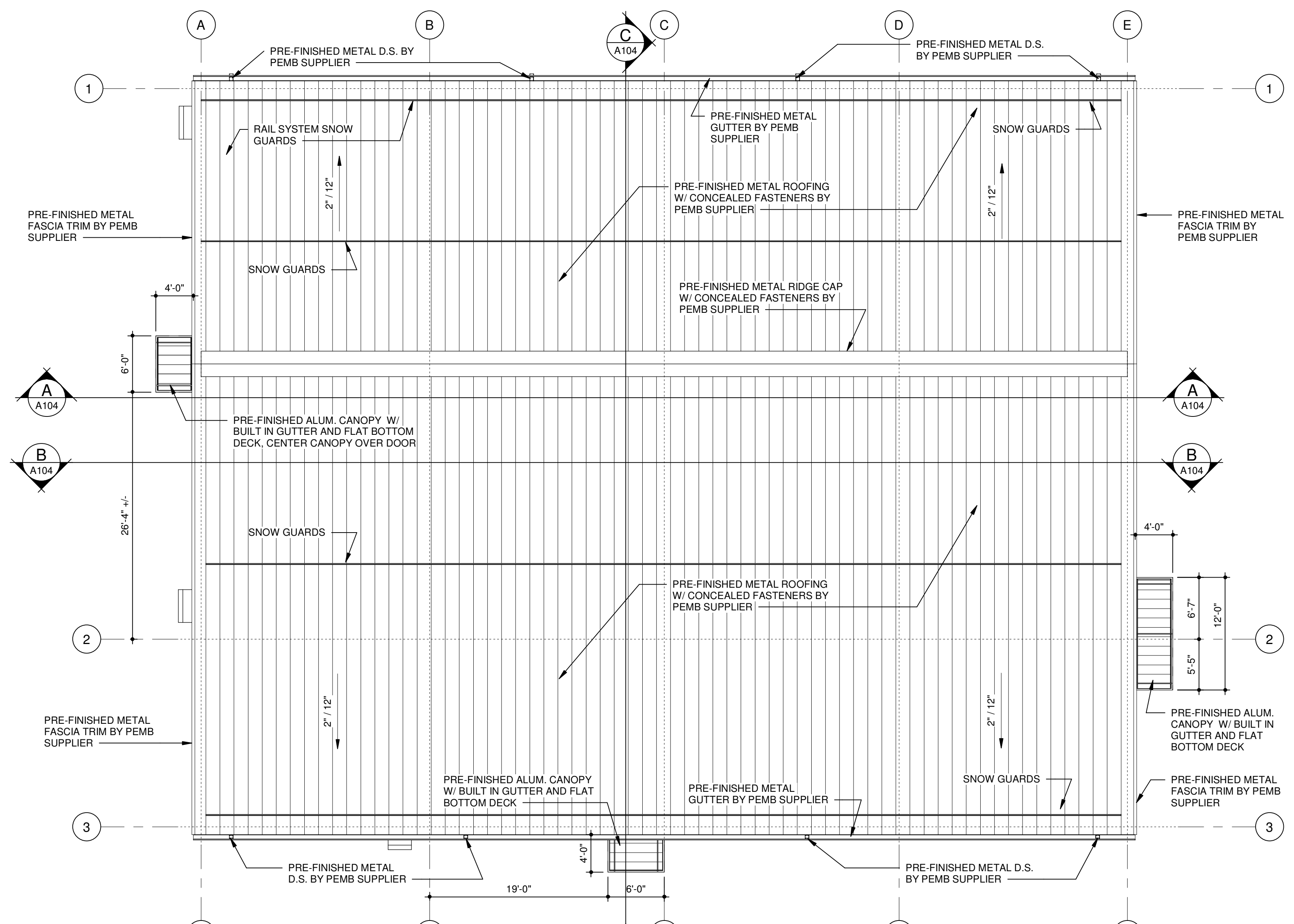
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12-14-2020 3:23:23 PM

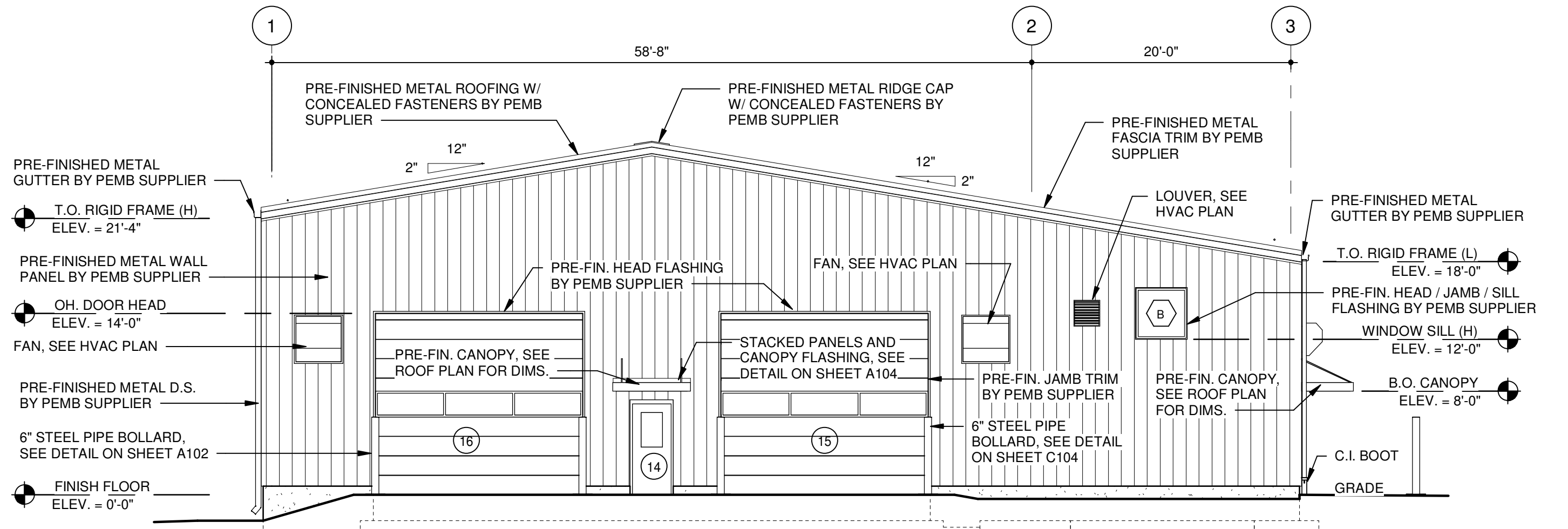




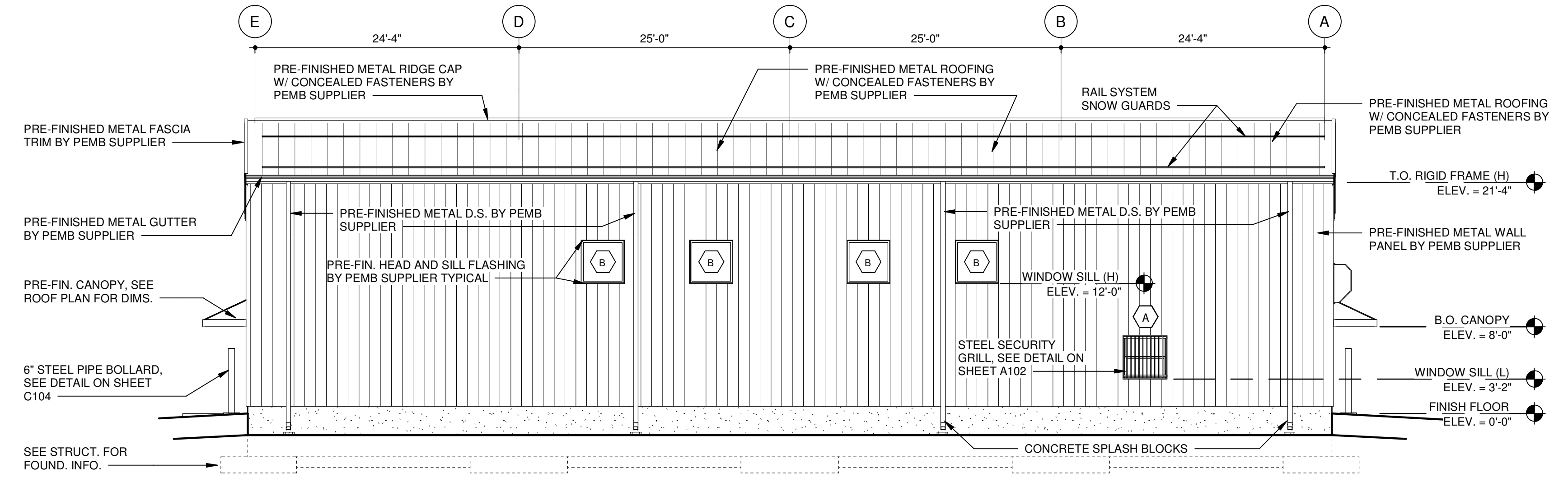
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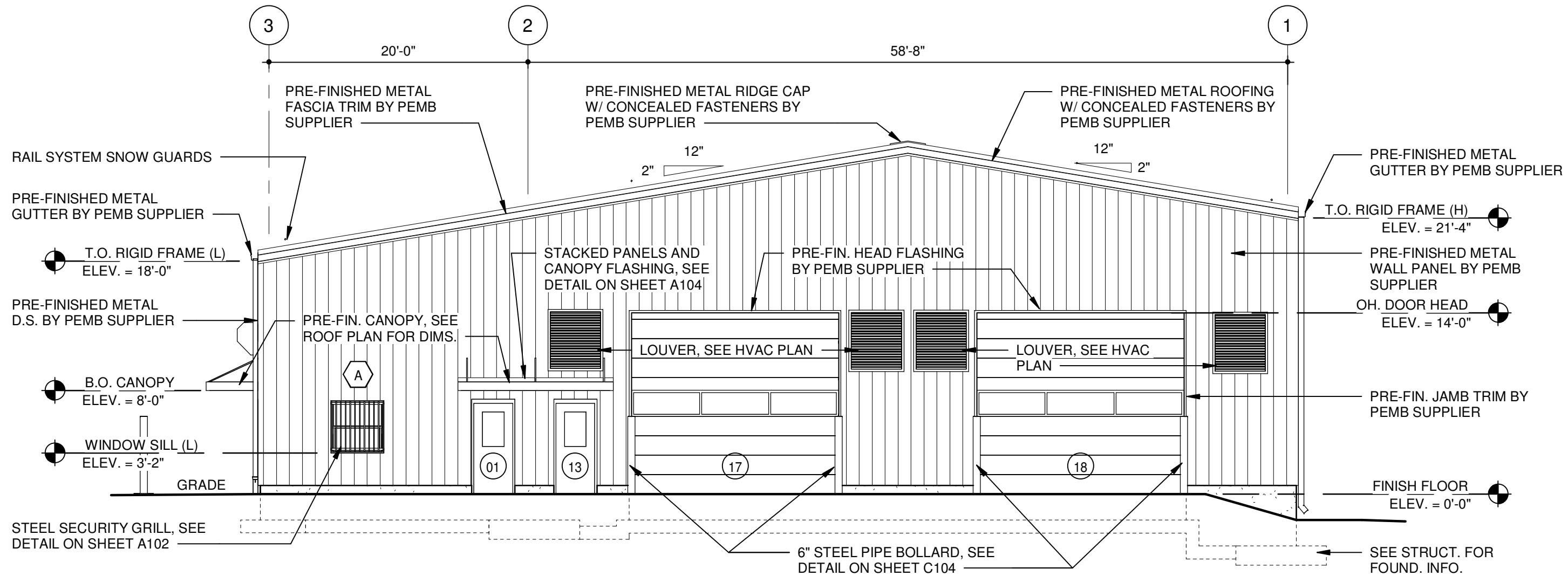
**ROOF PLAN**  
SCALE: 1/8" = 1'-0"



**B BUILDING ELEVATION**  
SCALE: 1/8" = 1'-0"



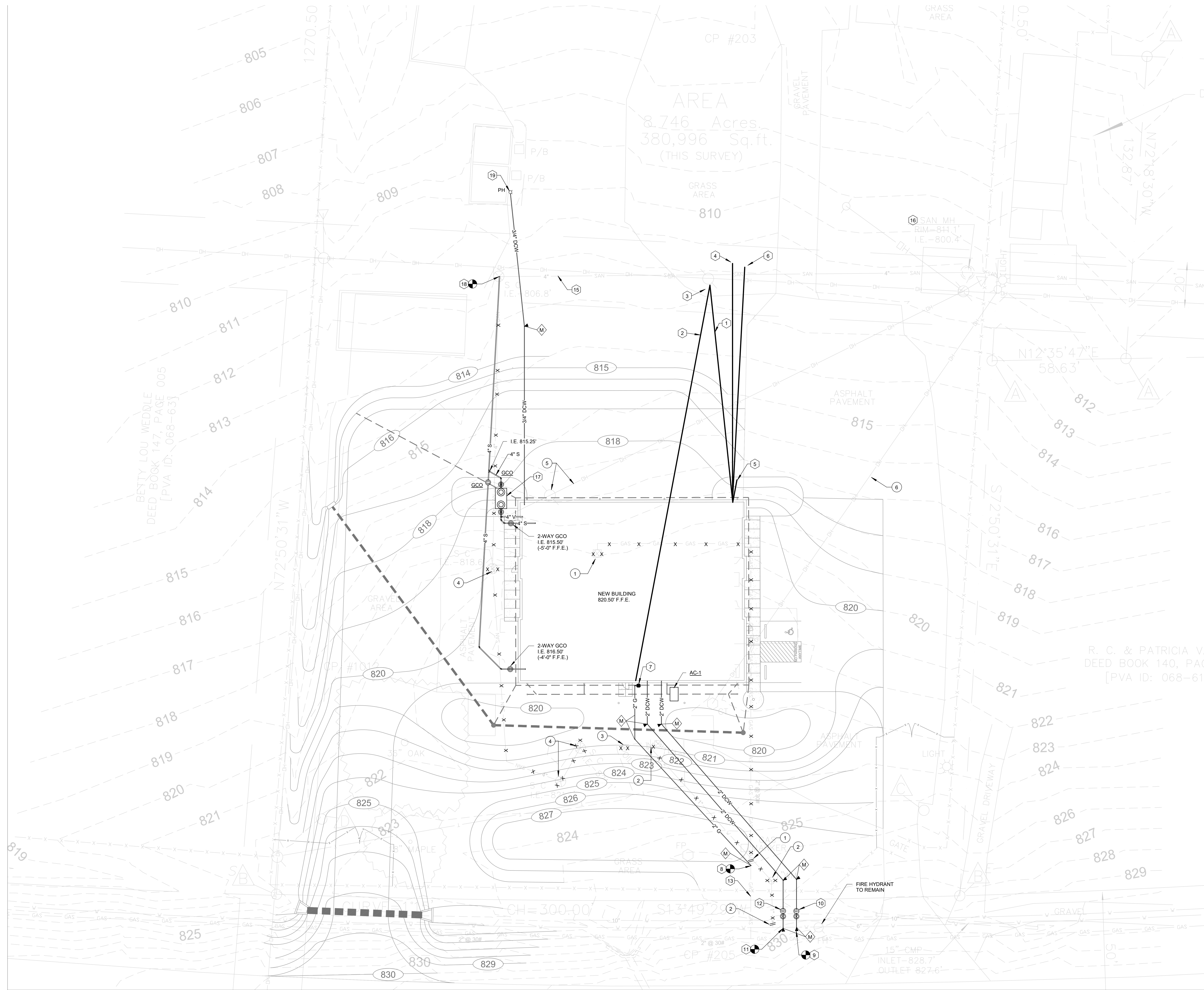
**C BUILDING ELEVATION**  
SCALE: 1/8" = 1'-0"



**D BUILDING ELEVATION**  
SCALE: 1/8" = 1'-0"

DRAWING INFORMATION		KYTC MAINTENANCE FACILITY CASEY COUNTY - LIBERTY, KENTUCKY	
A & E FILE NO.	2011	ROOF PLAN / BUILDING ELEVATIONS	
DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-Z001-A10
DRAWN BY	NICK	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
CHECKED BY	LSJ	A105	
PHASE	C	AS-BUILT DATE	
RTA DATE	12/16/2020	DECA LOG # A1C-8646	
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REVISION HISTORY OF THIS DRAWING		REVISION HISTORY OF THIS DRAWING	
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE
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2		6	
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4		8	





**SITE UTILITIES PLAN**  
SCALE: 1" = 20'-0"

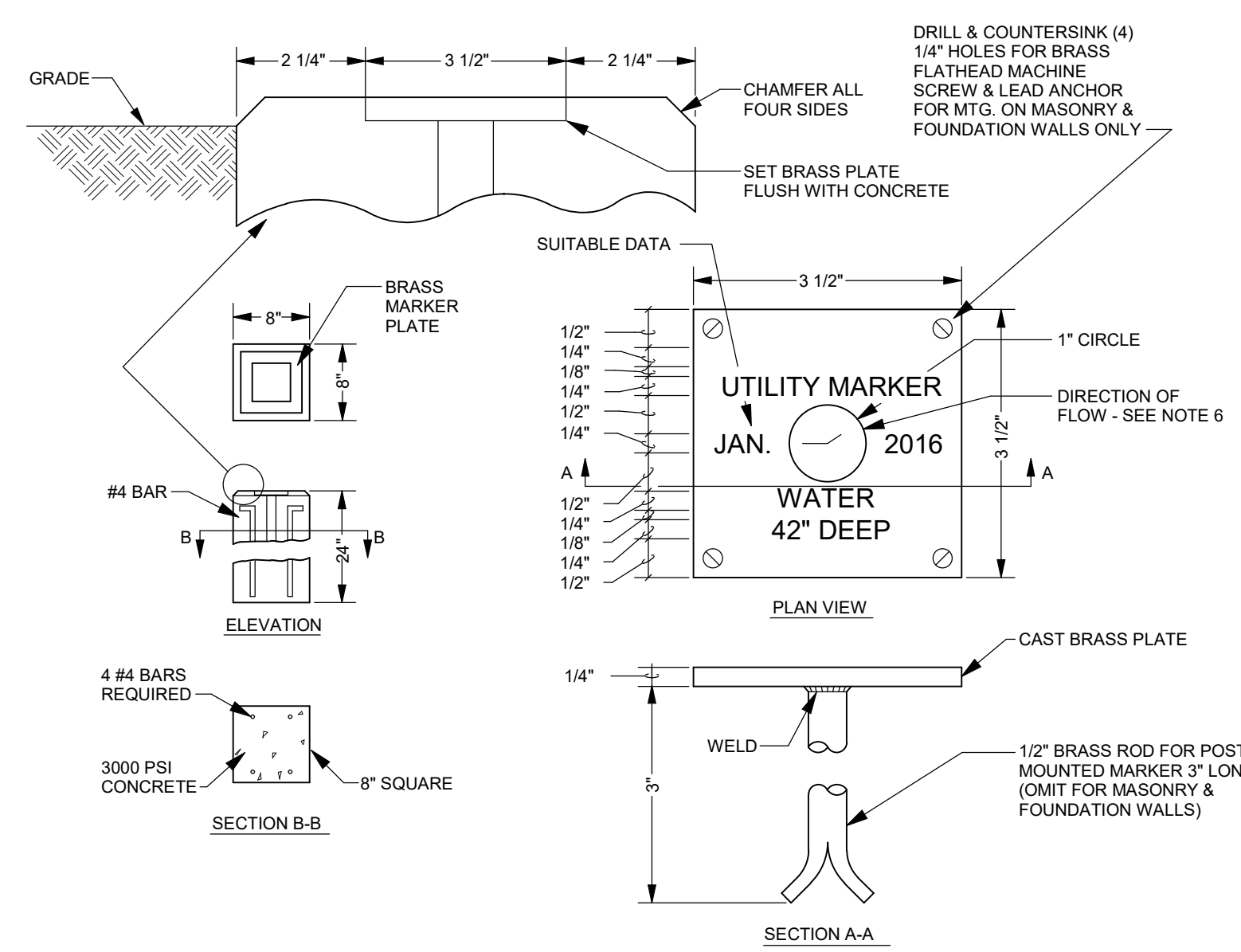
**NOTE:**  
IT IS NOT INTENDED THAT THE PLANS SHOW ALL OFFSETS IN PIPES, CONDUITS, AND DUCTS REQUIRED FOR INSTALLATION OF THE WORK. DETAILS AND SECTIONS ARE INCLUDED FOR SOME AREAS TO SHOW INTENDED RELATIONSHIP OF THE WORK OF VARIOUS TRADES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SUBCONTRACTORS TO COORDINATE INSTALLATION OF THE WORK AND TO PROVIDE THE NECESSARY OFFSETS, TRANSFORMATIONS, AND FITTINGS REQUIRED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR CORRECTION CONFLICTS BETWEEN THE WORK OF VARIOUS TRADES. DETAILS AND SECTIONS ARE SHOWN FOR THE CONTRACTORS CONVENIENCE AND SHALL NOT BE CONSIDERED COMPLETE IN EVERY DETAIL.

- GENERAL NOTES - SITE UTILITIES (DEMOLITION)**
- THE CONTRACT DOCUMENTS SHOW THE APPROXIMATE LOCATION OF THE EXISTING AND NEW SUBSURFACE UTILITY LINES. THESE LINES HAVE BEEN IDENTIFIED AND LOCATED AS ACCURATELY AS POSSIBLE USING AVAILABLE INFORMATION. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL ACTUAL LOCATIONS. IF ANY CHARTED, UNCHARTED OR MIS-LOCATED UTILITY SERVICE IS INTERRUPTED FOR ANY REASON, THE CONTRACTOR WILL WORK CONTINUOUSLY TO RESTORE SERVICE TO THE SATISFACTION OF THE OWNER.
  - SHOULD UTILITIES REQUIRE RELOCATION OR ROUTING NOT SHOWN OR INDICATED TO BE RELOCATED OR ROUTED, CONTACT AND COOPERATE WITH THE OWNER TO MAKE THE REQUIRED ADJUSTMENTS AT AN EQUITABLE CHANGE IN THE CONTRACT PRICE.
  - EXISTING UTILITIES SHOWN MAY ACTUALLY BE IN DIFFERENT LOCATIONS AND ADDITIONAL UTILITIES NOT SHOWN MAY EXIST AND MAY BE IN USE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROTECT ALL UTILITIES DURING CONSTRUCTION.
  - THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING UNDERGROUND UTILITIES PRIOR TO EXCAVATING. THE OWNER WILL NOT LOCATE THESE UTILITIES FOR THE CONTRACTOR. IF AN OUTSIDE SERVICE OR COMPANY IS REQUIRED TO ACCURATELY LOCATE BURIED UTILITIES THE CONTRACTOR IS RESPONSIBLE FOR SCHEDULING THIS WORK AND IS RESPONSIBLE FOR THE COSTS. THE CONTRACTOR SHOULD CONTACT APPROPRIATE UTILITY COMPANIES BEFORE DOING ANY EXCAVATING.
  - LOCATIONS OF UTILITIES ARE APPROXIMATE AND SUBJECT TO MINOR CHANGES IN THE FIELD. DO NOT SCALE THE DRAWINGS.
  - EXCAVATION: MATERIALS TO BE EXCAVATED SHALL INCLUDE EARTH AND ANY OTHER MATERIAL, INCLUDING ROCK, ENCOUNTERED IN THE TRENCH EXCAVATION.
  - CONTACT SANITARY, WATER AND GAS UTILITY SERVICE PROVIDER, PRIOR TO START OF ANY PLUMBING DEMOLITION, TO ENSURE PROPER TIMING FOR DISCONNECTION OF SERVICE.
  - IT IS INTENDED THAT ALL WATER LINES, VALVE BOXES, ETC., UNLESS OTHERWISE NOTED TO BE REMOVED AND REPLACED WITH NEW SERVICES, PIPING MAY BE ABANDONED IN PLACE WHERE NOT IN CONFLICT WITH NEW WORK ACCORDING TO DIVISION 31.
  - IT IS INTENDED THAT ALL GAS LINES, VALVES, ETC., UNLESS OTHERWISE NOTED TO BE REMOVED AND REPLACED WITH NEW SERVICES, PIPING MAY BE ABANDONED IN PLACE WHERE NOT IN CONFLICT WITH NEW WORK ACCORDING TO DIVISION 31.
  - IT IS INTENDED THAT ALL SANITARY CLEANOUTS AS NOTED TO BE REMOVED AND REPLACED WITH NEW SERVICES. PIPING MAY BE ABANDONED IN PLACE WHERE NOT IN CONFLICT WITH NEW WORK ACCORDING TO DIVISION 31.
  - EXISTING UTILITIES TO REMAIN SHALL BE PROTECTED ACCORDINGLY. ANY DAMAGE, THE CONTRACTOR WILL BE RESPONSIBLE TO REPAIR PER UTILITY COMPANY SPECIFICATIONS.
- GENERAL NOTES:**
- THIS CONTRACTOR SHALL COORDINATE ALL SITE UTILITY WORK REQUIRED WITH LOCAL UTILITY COMPANIES TO MEET PROJECT SCHEDULE. ALL REQUIRED SUBMITTALS AND ASSOCIATED FEES BY THIS CONTRACTOR.
  - LOCATION OF UTILITIES ARE APPROXIMATE AND SUBJECT TO MINOR CHANGES IN THE FIELD. DO NOT SCALE THE DRAWINGS.
  - THE CONTRACT DOCUMENTS SHOW THE APPROXIMATE LOCATION OF THE EXISTING AND NEW SUBSURFACE UTILITY LINES. THESE LINES HAVE BEEN IDENTIFIED AND LOCATED AS ACCURATELY AS POSSIBLE USING AVAILABLE INFORMATION. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL ACTUAL LOCATIONS. IF ANY CHARTED, UNCHARTED, OR MIS-LOCATED UTILITY SERVICE IS INTERRUPTED FOR ANY REASON, THE CONTRACTOR WILL WORK CONTINUOUSLY TO RESTORE SERVICE TO THE SATISFACTION OF THE OWNER.
  - SHOULD EXISTING UTILITIES REQUIRE RELOCATION OR ROUTING NOT SHOWN OR INDICATED TO BE RELOCATED OR ROUTED, CONTACT AND COOPERATE WITH THE OWNER TO MAKE THE REQUIRED ADJUSTMENTS AT AN EQUITABLE CHANGE IN THE CONTRACT PRICE.
  - EXISTING UTILITIES SHOWN MAY ACTUALLY BE IN DIFFERENT LOCATIONS AND ADDITIONAL UTILITIES NOT SHOWN MAY EXIST AND MAY BE IN USE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROTECT ALL UTILITIES DURING CONSTRUCTION.
  - THE CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING UNDERGROUND UTILITIES PRIOR TO EXCAVATING. THE OWNER WILL NOT LOCATE THE UTILITIES FOR THE CONTRACTOR. IF AN OUTSIDE SERVICE OR COMPANY IS REQUIRED TO ACCURATELY LOCATE BURIED UTILITIES THE CONTRACTOR IS RESPONSIBLE FOR SCHEDULING THIS WORK AND IS RESPONSIBLE FOR THE COSTS. THE CONTRACTOR SHOULD CONTACT APPROPRIATE UTILITY COMPANIES BEFORE DOING ANY EXCAVATING.
  - TOP ELEVATIONS OF NEW UNDERGROUND STRUCTURE ARE APPROXIMATE AND ARE FOR ESTIMATING PURPOSES ONLY. ACTUAL TOP ELEVATIONS MUST BE THE SAME AS FINISHED GRADE IN THE SAME AREA. SEE ARCHITECTURAL PLANS FOR FINISHED GRADES.
  - INSTALL DOMESTIC WATER PIPING WITH 3'-0" MINIMUM COVER.
  - INSTALL FIRE PROTECTION WITH 4'-0" MINIMUM COVER.
  - INSTALL NATURAL GAS PIPING WITH 2'-0" MINIMUM COVER.
  - INSTALL SITE SANITARY PIPING WITH 3'-0" MINIMUM COVER.
  - INSTALL UNDERGROUND FEEDERS WITH 2'-0" MINIMUM COVER.
  - EXCAVATION: MATERIALS TO BE EXCAVATED SHALL INCLUDE EARTH AND ANY OTHER MATERIAL, INCLUDING ROCK ENCOUNTERED IN TRENCH EXCAVATION.
  - SITE LIGHTING CIRCUITS SHALL BE #6 CONDUCTORS IN 1-1/4" CONDUITS.
  - TESTING OF EXTERIOR SEWER MANHOLES SHALL BE AS FOLLOWS:
    - EXTERIOR SANITARY SEWER SHALL BE PLUGGED BETWEEN MANHOLES AND SUBJECTED TO AN AIR PRESSURE TEST WITH ALL OPENINGS TIGHTLY CLOSED. AIR SHALL BE PUMPED IN UNTIL THE PRESSURE IS NOT LESS THAN 8 POUNDS PER SQUARE INCH. THE AIR PRESSURE GAGE SHALL REMAIN CONSTANT WITHOUT PUMPING ADDITIONAL AIR INTO THE SYSTEM.
    - MANHOLE SHALL BE PLUGGED AND FILLED WITH WATER AND A VISUAL INSPECTION MADE FOR LEAKS. ALL LEAKS SHALL BE CORRECTED.
    - ALL TESTS SHALL BE DONE PRIOR TO BACKFILLING.

- CODED NOTES - DEMOLITION**
- EXISTING GAS METER AND ASSOCIATED GAS LINE TO BE REMOVED TO POINT OF NEW CONNECTION. CUT AND CAP FOR NEW WORK AS REQUIRED. COORDINATE WORK WITH LOCAL UTILITY PRIOR TO CONSTRUCTION. RELOCATE EXISTING GAS METER AS REQUIRED.
  - EXISTING WATER METER, VALVES, BOXES AND ASSOCIATED WATER LINE TO BE REMOVED BACK TO MAIN. CUT AND CAP AT MAIN PER LOCAL UTILITY REQUIREMENTS.
  - EXISTING OIL SEPARATOR TO BE REMOVED.
  - EXISTING SANITARY CLEANOUTS AND ASSOCIATED PIPING TO BE REMOVED BACK TO POINT OF NEW CONNECTION.
  - COORDINATE REMOVAL OF OVERHEAD ELECTRIC AND UTILITY POLE WITH KENTUCKY UTILITIES COMPANY.
  - COORDINATE REMOVAL OF OVERHEAD TELECOMMUNICATIONS WITH UTILITY COMPANY.
- CODED NOTES:**
- UNDERGROUND ELECTRICAL SECONDARY.
  - UNDERGROUND TELECOMMUNICATION CONDUITS. RUN ONE 4" CONDUIT FOR TELEPHONE, ONE 3" CONDUIT FOR CABLE TELEVISION, AND ONE 3" CONDUIT FOR FIBER OPTIC CABLE. INSTALL FLUSH-TO-GRADE PULL BOX IN EACH CONDUIT AT EACH CHANGE OF DIRECTION OF ROUTING. USE LONG RADIUS SCHEDULE 80 PVC ELBOWS. CONDUITS ARE TO ORIGINATE AT THE TELECOMMUNICATION BACKBOARD AND RUN TO THE UTILITY POLE. SEE LOW VOLTAGE PLAN FOR ADDITIONAL INFORMATION.
  - MUST CONDUITS UP UTILITY POLE PER RESPECTIVE UTILITY COMPANY REQUIREMENTS.
  - AT THIS LOCATION, INSTALL A FLUSH-TO-GRADE WATER-TIGHT JUNCTION BOX WITH A 1" CONDUIT TO PANEL "A" FOR FUTURE SITE LIGHTING.
  - INSTALL TWO 2" CONDUITS, WITH PULL STRINGS, UNDER SLAB TO PANEL "B" FOR FUTURE USE.
  - CAP CONDUIT TO SHED AT THIS LOCATION IN A WATER-TIGHT FLUSH-TO-GRADE JUNCTION BOX. LEAVE 2" BLACK CONDUCTORS FOR FUTURE CIRCUIT CONNECTIONS. TERMINATE CONDUCTORS TO MAKE SAFE.
  - GAS METER AND REGULATOR, SEE DETAIL ON SHEET U201.
  - CONNECT TO EXISTING GAS LINE TO REMAIN PER LOCAL UTILITY REQUIREMENTS. FIELD VERIFY PRIOR TO CONSTRUCTION.
  - CONNECT TO EXISTING WATER LINE TO REMAIN PER LOCAL UTILITY REQUIREMENTS. FIELD VERIFY PRIOR TO CONSTRUCTION.
  - NEW WATER METER.
  - CONNECT TO EXISTING WATER LINE TO REMAIN PER LOCAL UTILITY REQUIREMENTS. FIELD VERIFY PRIOR TO CONSTRUCTION.
  - NEW WATER METER.
  - EXISTING 2" G. TO REMAIN.
  - EXISTING 4" SANITARY TO REMAIN.
  - EXISTING SANITARY MANHOLE TO REMAIN.
  - NEW OIL SEPARATOR, OWNER FURNISHED, OWNER SET. SEE DETAIL ON SHEET U102.
  - CONNECT TO EXISTING SANITARY CLEANOUT AS REQUIRED TO MATCH EXISTING INVERT. FIELD VERIFY INVERTS PRIOR TO CONSTRUCTION. ROUTING OF NEW LINE SHALL MAINTAIN OVER 12" ANGLE OF FLOW TO EXISTING CLEANOUT.
  - POST HYDRANT INSIDE GUARD RAIL. SEE DETAIL ON SHEET U102. COORDINATE FINAL LOCATION WITH OWNER PRIOR TO CONSTRUCTION.

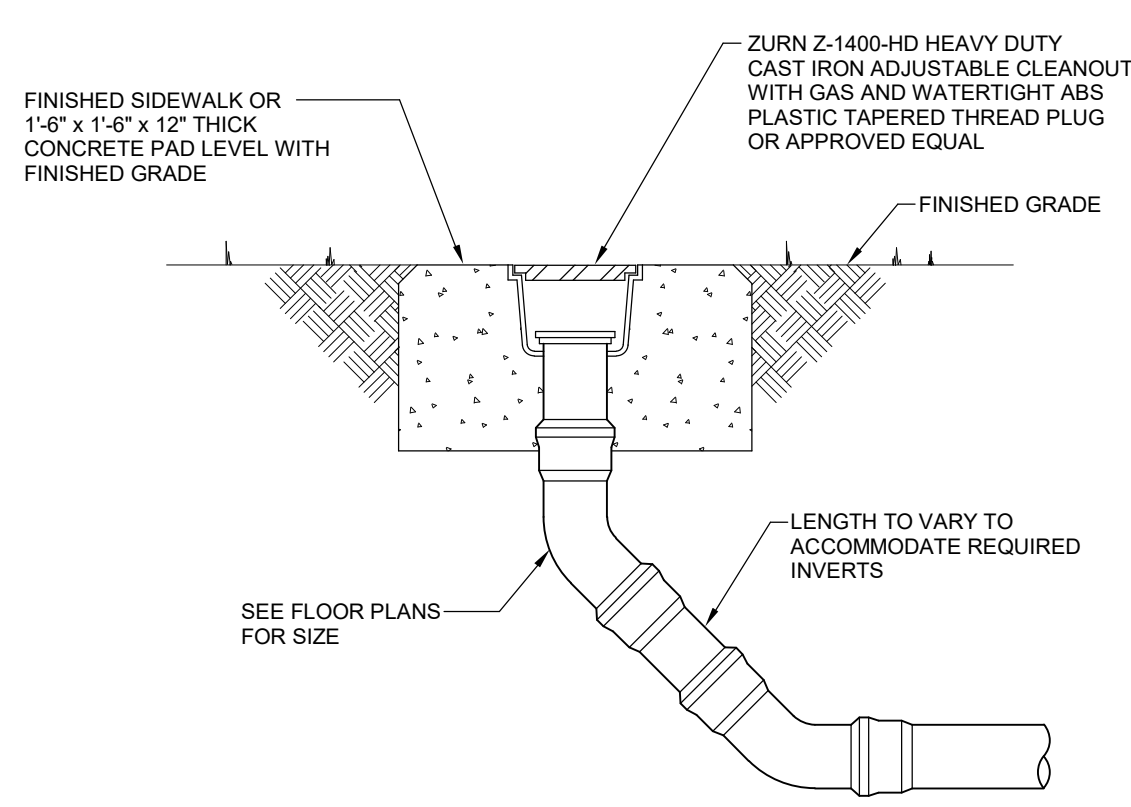
<p>STAGGS &amp; FISHER CONSULTING ENGINEERS, INC. 2504 Loch Ness Drive Lexington, KY 40517 606-271-3266</p>	<b>DRAWING INFORMATION</b> A & E FILE NO. 2011 DRAWING DATE 12/16/20 DRAWN BY CGSWT CHECKED BY CCKWT PHASE RTA RTA DATE 12/16/2020		<b>KYTC MAINTENANCE FACILITY</b> <b>CASEY COUNTY, KENTUCKY</b> <b>SITE UTILITIES PLAN</b>		DRAWING NO. <b>U101</b> AS-BUILT DATE DECA LOG # <b>A1C-8647</b>															
		ACCOUNT NO. <b>609-C9NW-Z001-A10</b>	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY																	
<p>Architecture   Interiors   Landscapes   Planning</p>		28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859-273-3700 / FAX 859-271-6605																		
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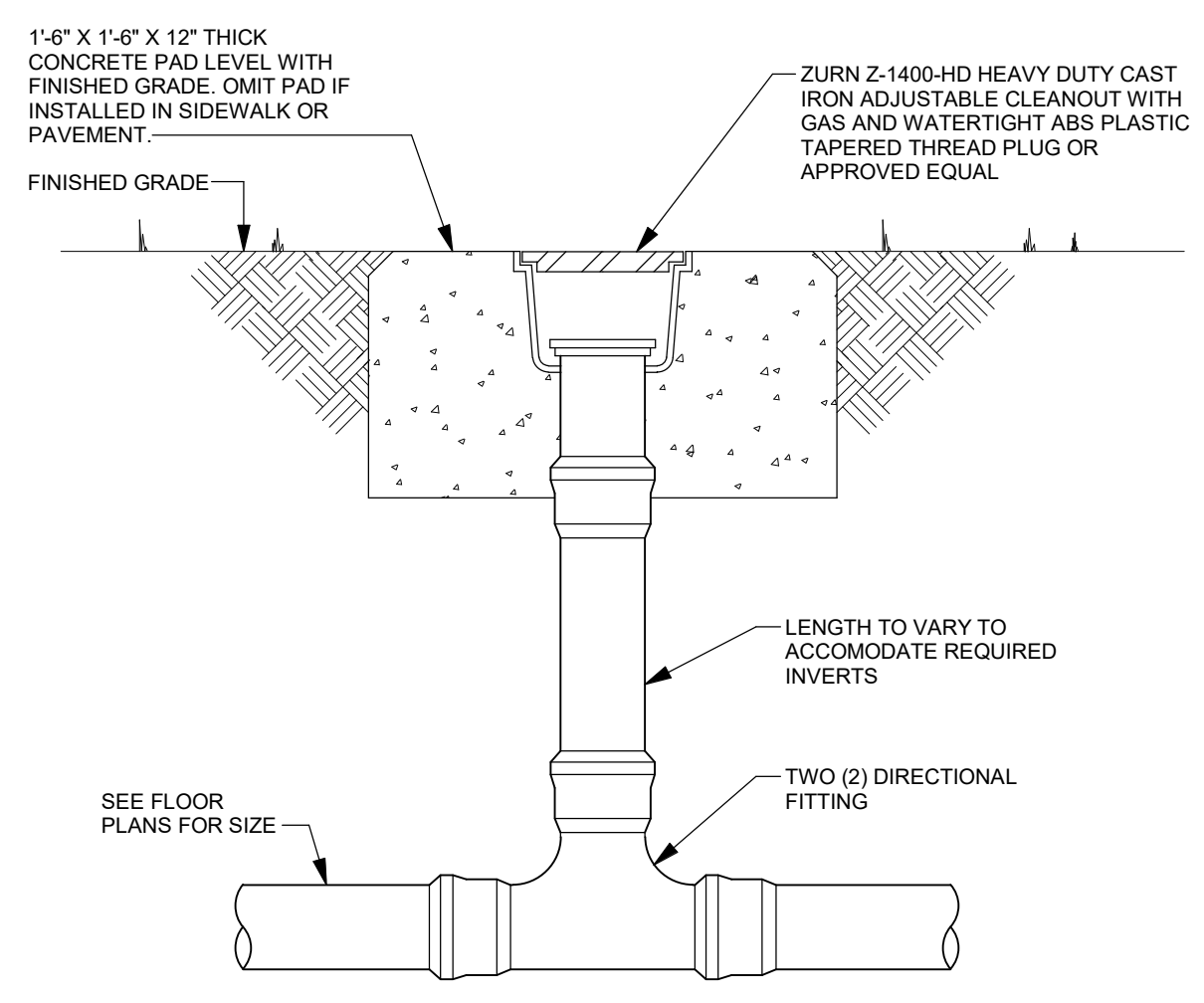


- NOTES:**
1. MARKERS SHALL BE LOCATED WHERE INDICATED ON DRAWINGS AND AT BUILDING/VAULT/TUNNEL ENTRANCE/EXIT AND EVERY CHANGE IN DIRECTION.
  2. BRASS MARKERS SHALL BE CAST BY BRUCE FOX COMPANY, NEW ALBANY, INDIANA (WWW.BRUCEFOX.COM), OR EQUAL.
  3. ALL LETTERING SHALL BE OF THE RAISED TYPE. LETTERING SHOWN ON MARKER IS FOR EXAMPLE ONLY. LETTERING TO BE RAISED 1/8\".
  4. AT THE CONTRACTOR'S OPTION, ONE MARKER MAY BE USED FOR COMPANION MAINS THAT ARE LOCATED CLOSE TOGETHER SUCH AS STEAM AND CONDENSATE PUMP DISCHARGE PIPING OR CHILLED WATER SUPPLY AND CHILLED WATER RETURN PIPING. PROVIDE ARROW FOR EACH MAIN.
  5. CONTRACTOR SHALL FURNISH A COMPLETE LIST FOR APPROVAL OF ALL MARKERS SHOWING NAMES, ARROWS, DEPTH AND DATE.
  6. WHEN UTILITY MARKERS ARE INSTALLED OVER LINES AT A POINT OF DIRECTION CHANGE, THE ARROW ON THE MARKERS SHALL BE "ANGLED" AS REQUIRED TO IMPLY THIS ROUTING.

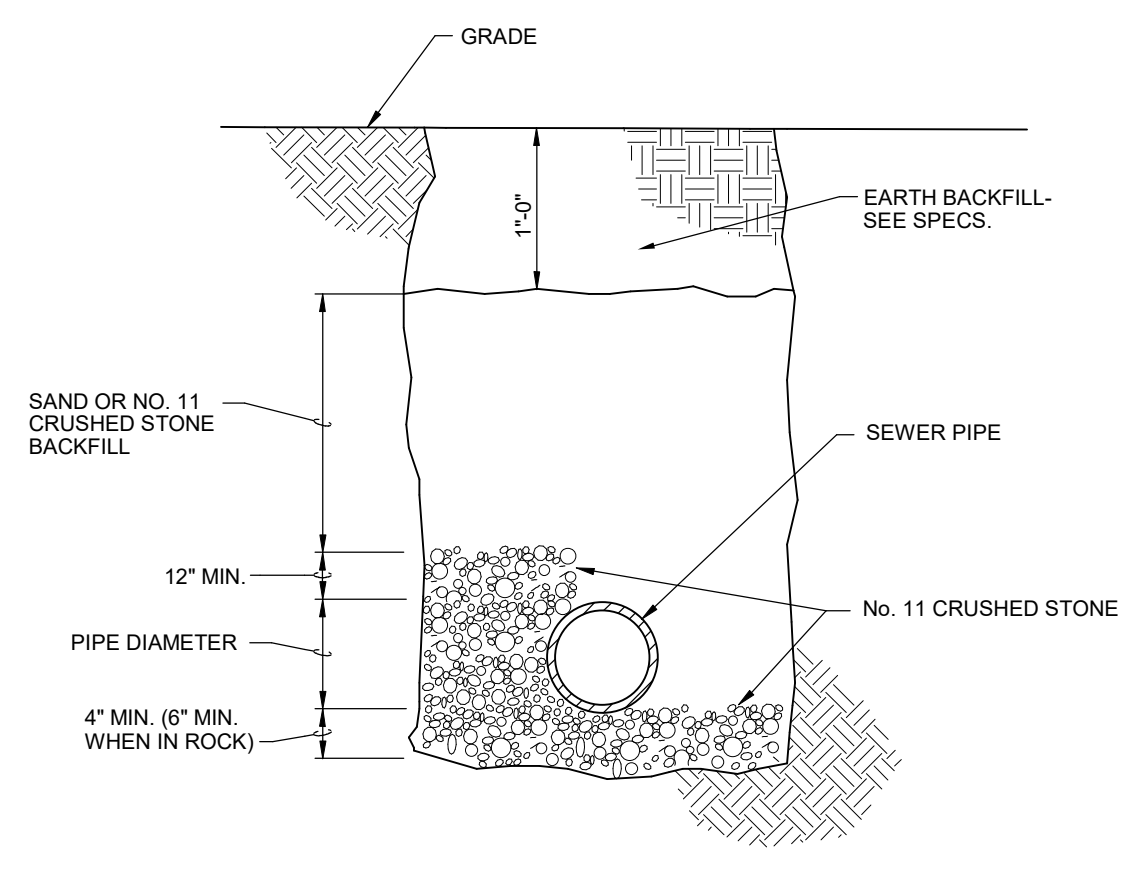
**UTILITY SERVICE MARKER DETAIL**  
NO SCALE



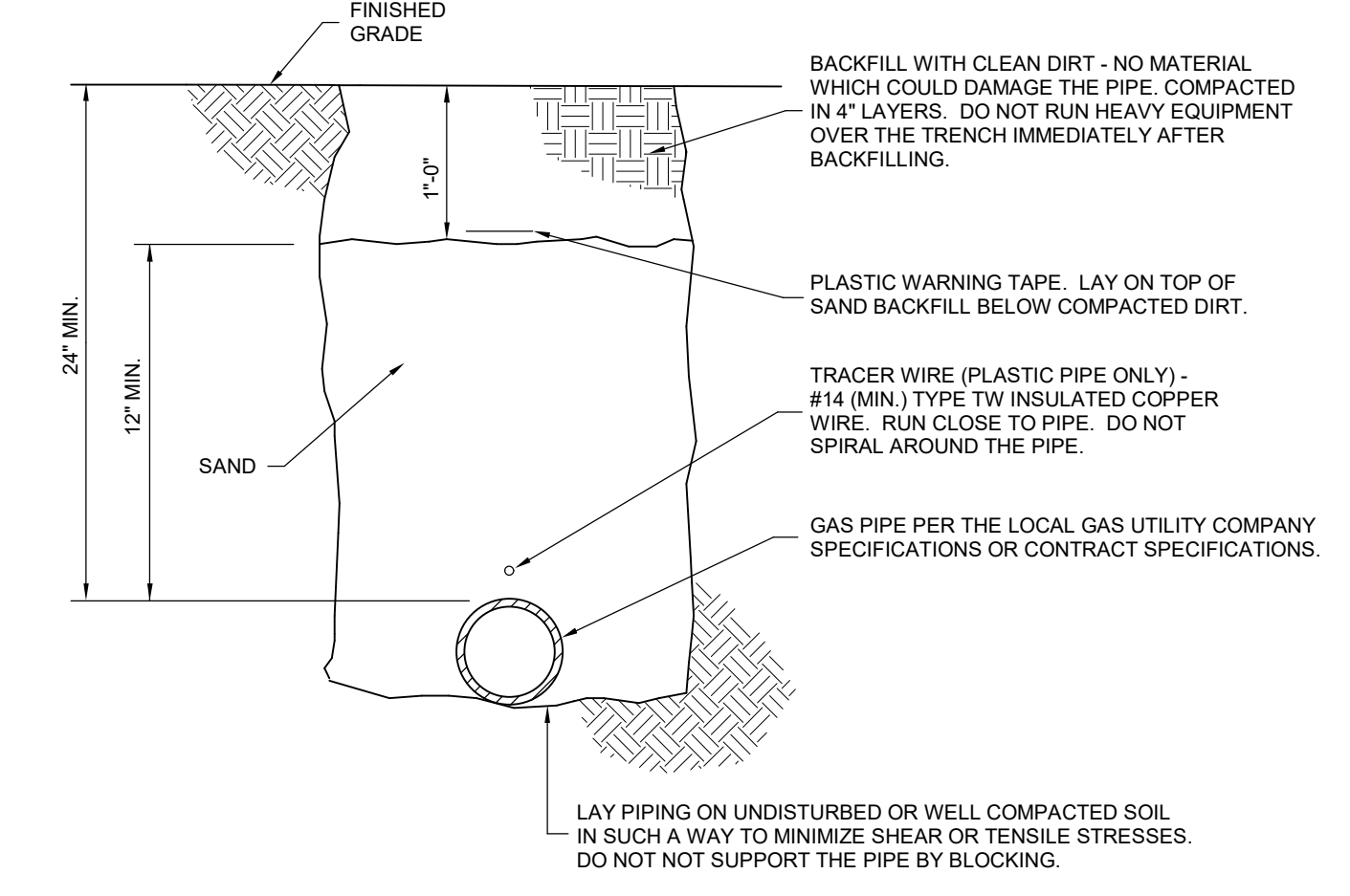
**EXTERIOR GRADE CLEANOUT DETAIL**  
NO SCALE



**EXTERIOR 2-WAY GRADE CLEANOUT DETAIL**  
NO SCALE

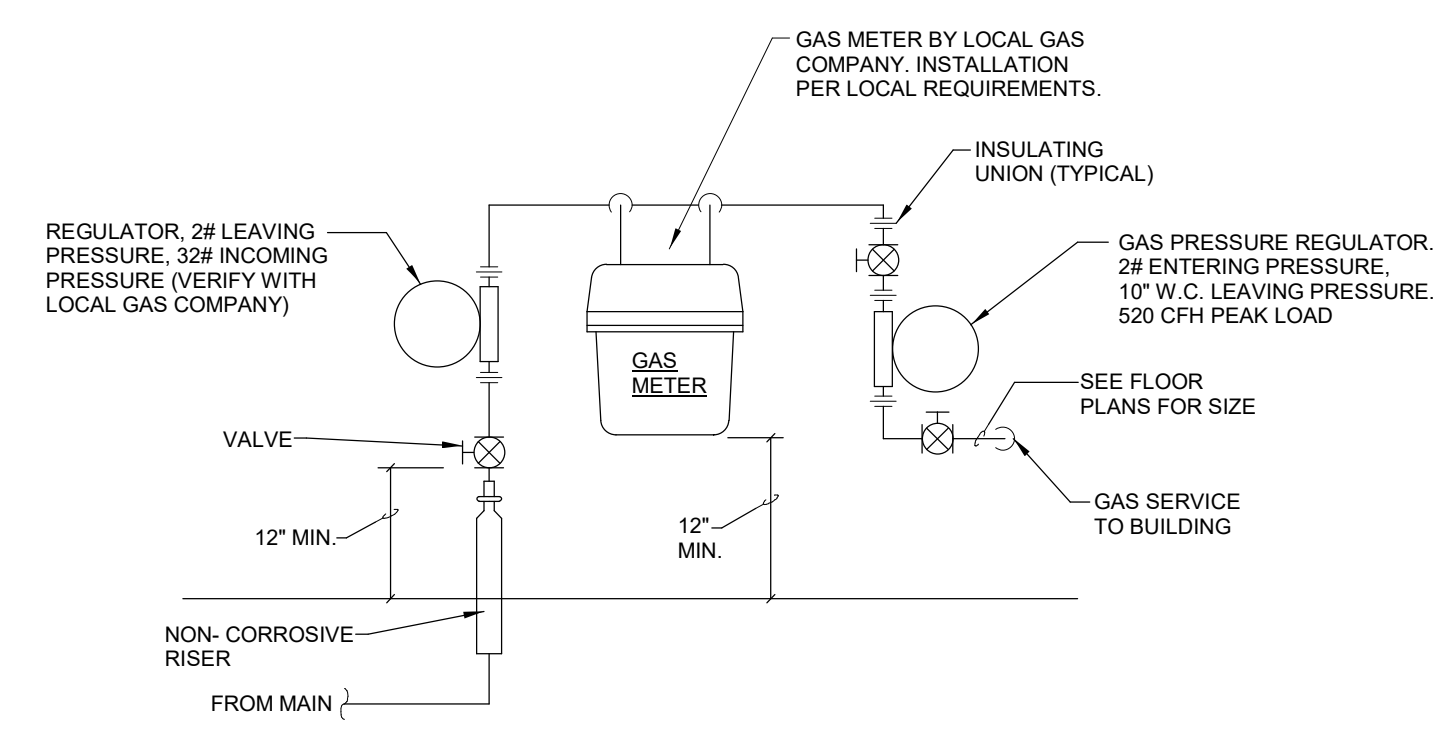


**EXTERIOR SEWER PIPING INSTALLATION DETAIL**  
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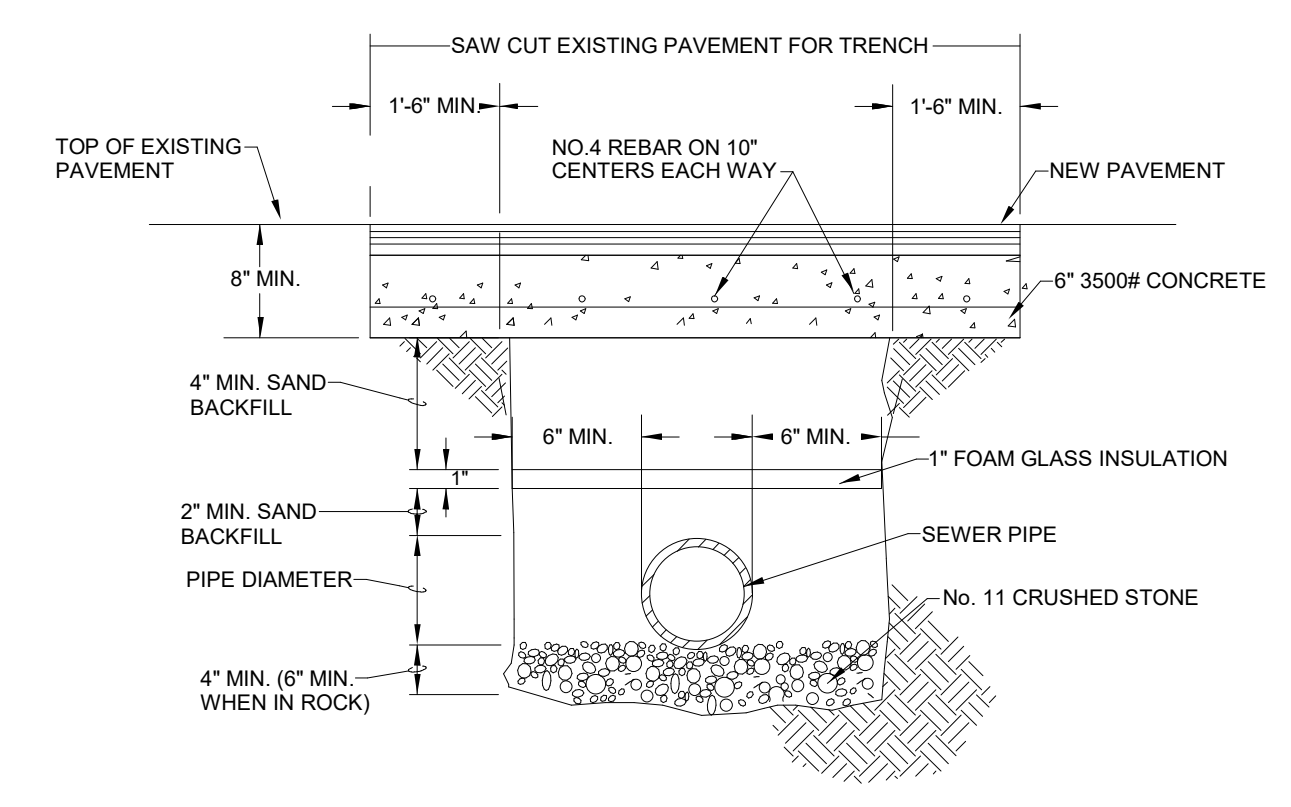


- NOTES:**
1. ALL GAS SUPPLY INSTALLATION WILL BE IN ACCORDANCE WITH THE REGULATIONS AND RECOMMENDATIONS OF THE LOCAL GAS UTILITY COMPANY.
  2. INSTALL PLASTIC PIPE WITH SUFFICIENT SLACK FOR CONTRACTION.

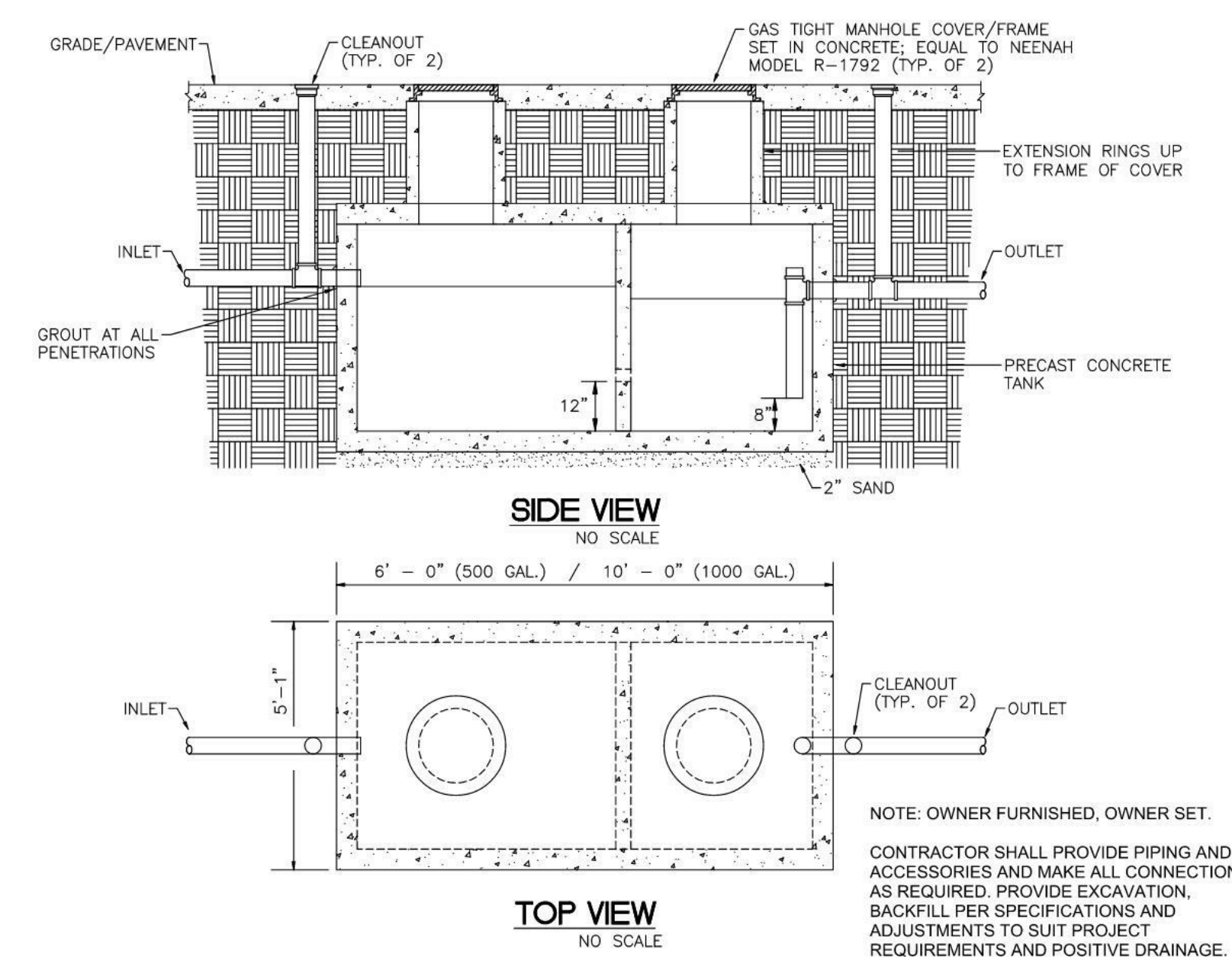
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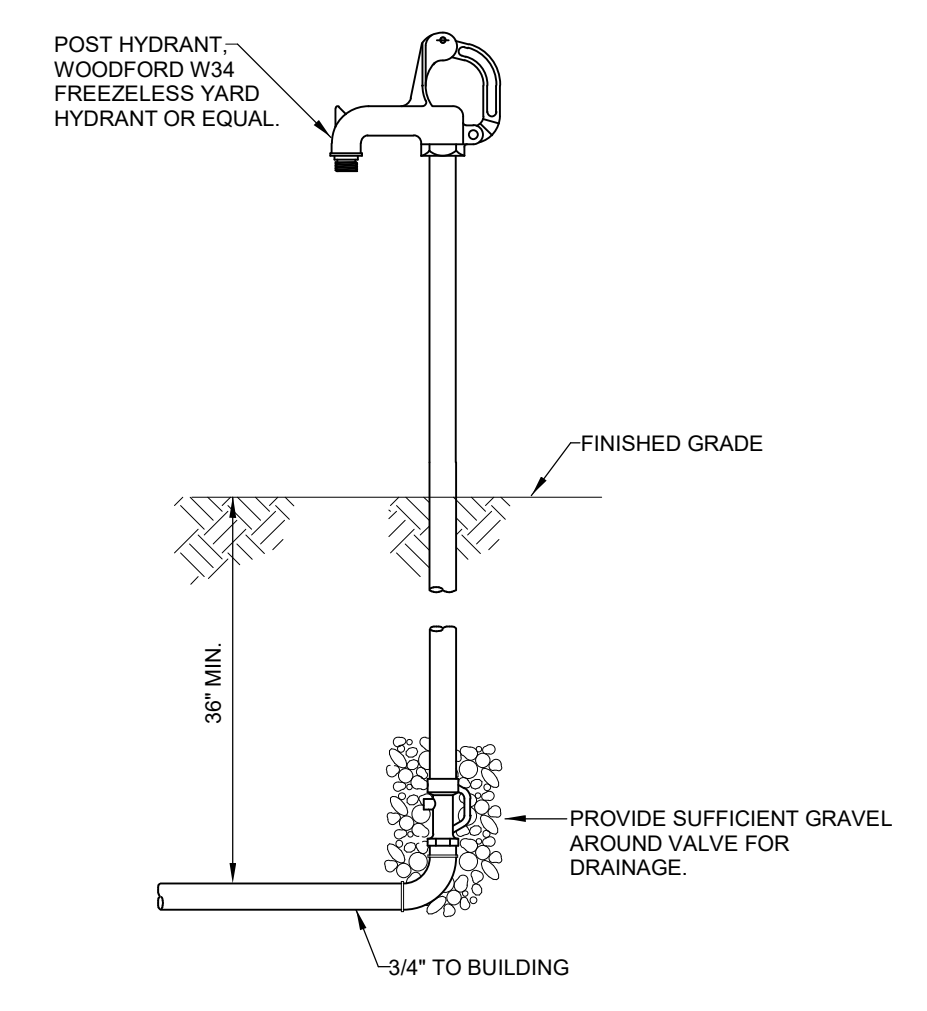
**GAS METER SCHEMATIC DETAIL**  
SCALE: NONE



**EXTERIOR SEWER OR WATER PIPING UNDER PAVED AREA**  
SCALE: NONE



**OIL SEPARATOR DETAIL**  
NOT TO SCALE



**POST HYDRANT DETAIL**  
NO SCALE

SITE UTILITIES LEGEND			
MECHANICAL		ELECTRICAL	
ES	EXISTING SANITARY SEWER	EOE	EXISTING OVERHEAD ELECTRIC
S	NEW SANITARY SEWER	OE	OVERHEAD ELECTRIC
ESS	EXISTING STORM SEWER	OET	OVERHEAD ELECTRIC/TELEPHONE
SS	NEW STORM SEWER	EE	EXISTING ELECTRIC UNDERGROUND
FP	FIRE PROTECTION LINE	BCU	BRANCH CIRCUIT UNDERGROUND
EW	EXISTING COLD WATER SERVICE	P	UNDERGROUND PRIMARY SERVICE
W	NEW COLD WATER SERVICE	UE	UNDERGROUND SECONDARY SERVICE
EHPG	EXISTING HIGH PRESSURE GAS	ET	EXISTING TELEPHONE UNDERGROUND
HPG	NEW HIGH PRESSURE GAS	T	UNDERGROUND TELEPHONE CONDUIT
EG	EXISTING GAS	TV	UNDERGROUND TELEVISION CONDUIT
G	NEW GAS	LS	LIGHTING STANDARD
VB	VALVE WITH VALVE BOX	EP	EXISTING POST LIGHT
UM	UTILITY MARKER	PL	POST LIGHT
TR	THRUST BLOCK	PC	PANELBOARD OR TERMINAL CABINET (REFER TO PLANS AND RISER FOR SIZE)
CI	CAST IRON	SC	SECTIONAL SWITCH GEAR (REFER TO PLANS AND RISER FOR NUMBER OF SECTIONS AND LAYOUT)
ELEV	ELEVATION	TR	TRANSFORMER (REFER TO PLANS AND RISER FOR SIZE)
EXIST.	EXISTING	FH	FIRE HYDRANT
F.H.	FIRE HYDRANT	JB	JUNCTION BOX
G.C.O.	GRADE CLEANOUT	ECB	ENCLOSED CIRCUIT BREAKER
I.E.	INVERT ELEVATION	DIS	DISCONNECT SWITCH
P.I.V.	POST INDICATOR VALVE	FUS	FUSED DISCONNECT
P.V.C.	POLYVINYL CHLORIDE PIPING	CM	COMBINATION MAGNETIC STARTER AND FUSED SWITCH
T.E.	TOP ELEVATION	M	MOTOR
		HOT	GROUND
		NEUTRAL	WIRE / CONDUIT
		12	BOTTOM OF DEVICE (IN INCHES A.F.F.)
		1	SEE NOTE 1 THIS SHEET
		HW	HEADWALL - FOR SERVICES, SEE DETAILS
		77	GROUND
		DU	DUPLEX CONVENIENCE OUTLET
		GR	QUADRAPLEX CONVENIENCE OUTLET
		GFI	GROUND FAULT INTERRUPTING OUTLET
		WP	WEATHERPROOF OUTLET
		SW	SWITCHED/CONTROLLED DUPLEX OUTLET
		E	DUPLEX RECEPTACLE ON EMERGENCY CIRCUIT
		CM	CEILING MOUNTED RECEPTACLE
		USB	USB DUPLEX RECEPTACLE
		SW	SIMPLEX WALL OUTLET (RATING AS NOTED)
		W	WALL OUTLET (240V, 1-PHASE) (RATING AS NOTED)
		W	WALL OUTLET (240V, 3-PHASE) (RATING AS NOTED)
		EC	EQUIPMENT CONNECTION

<p>STAGGS &amp; FISHER CONSULTING ENGINEERS, INC. 2504 LICHT TOWER DRIVE LEXINGTON, KY 40517 609-271-3200</p>	<b>DRAWING INFORMATION</b> A & E FILE NO. 2011 DRAWING DATE 12/16/20 DRAWN BY CGS CHECKED BY CCK/WT PHASE RTA RTA DATE 12/16/2020		<b>KYTC MAINTENANCE FACILITY CASEY COUNTY, KENTUCKY</b> <b>SITE DETAILS AND LEGENDS</b> ACCOUNT NO. 609-C9NW-Z001-A10 COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		DRAWING NO. U102 AS-BUILT DATE DECA LOG # A1C-8648
	<p>Architecture   Interiors   Landscapes   Planning</p> 28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859.273.3700 / FAX 859.271.6605				
	REVISION HISTORY OF THIS DRAWING		REVISION HISTORY OF THIS DRAWING		
	1 2 3 4	DESCRIPTION OF REVISIONS 5 6 7 8	DATE	DATE	

**NOTE:**  
IT IS NOT INTENDED THAT THE PLANS SHOW ALL OFFSETS IN PIPES, CONDUITS, AND DUCTS REQUIRED FOR INSTALLATION OF THE WORK. DETAILS AND SECTIONS ARE INCLUDED FOR SOME AREAS TO SHOW INTENDED RELATIONSHIP OF THE WORK OF VARIOUS TRADES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SUBCONTRACTORS TO COORDINATE INSTALLATION OF THE WORK AND TO PROVIDE THE NECESSARY OFFSETS, TRANSFORMATIONS, AND FITTINGS REQUIRED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR CORRECTION CONFLICTS BETWEEN THE WORK OF VARIOUS TRADES. DETAILS AND SECTIONS ARE SHOWN FOR THE CONTRACTORS CONVENIENCE AND SHALL NOT BE CONSIDERED COMPLETE IN EVERY DETAIL.



### MECHANICAL LEGEND

#### PLUMBING LEGEND

	SANITARY OR WASTE PIPING
	VENT PIPING
	KITCHEN WASTE PIPING
	ACID WASTE PIPING
	ACID WASTE VENT PIPING
	ROOF LEADER PIPING
	OVERFLOW ROOF LEADER PIPING
	STORM SEWER PIPING
	ELEVATOR SUMP PUMP DISCHARGE PIPING
	COLD WATER PIPING
	DOMESTIC HOT WATER PIPING
	DOMESTIC HOT WATER RECIRCULATING PIPING
	DOMESTIC HOT WATER SUPPLY PIPING (XXX) INDICATES TEMPERATURE
	DOMESTIC HOT WATER RECIRCULATING PIPING (XXX) INDICATES TEMPERATURE
	GAS PIPING
	AIR PIPING
	VACUUM PIPING
	SOFT COLD WATER
	REVERSE OSMOSIS WATER PIPING
	REVERSE OSMOSIS WATER RETURN PIPING
	LAB COLD WATER PIPING
	LAB HOT WATER PIPING
	LAB HOT WATER RECIRCULATING PIPING
	GATE VALVE
	BALL VALVE
	CHECK VALVE
	UNION
	PRESSURE GAUGE
	THERMOMETER
	WASTE AND VENT RISER DIAGRAM DESIGNATION
	DOMESTIC HOT/COLD WATER RISER DIAGRAM DESIGNATION

#### PLUMBING ABBREVIATIONS

CI	CAST IRON
PCO	PIPE CLEANOUT
FCO	FLOOR CLEANOUT
WCO	WALL CLEANOUT
GCO	GRADE CLEANOUT
DCW	DOMESTIC COLD WATER
FD	FLOOR DRAIN
DHW	DOMESTIC HOT WATER
OHD	OPEN HUB DRAIN
OR	OPEN RECEPTACLE
PVC	POLY-VINYL CHLORIDE
RD	ROOF DRAIN
SA	SHOCK ARRESTOR
VTR	VENT-THROUGH-ROOF
VCP	VITRIFIED CLAY PIPE
ORD	OVERFLOW ROOF DRAIN
WH	WALL HYDRANT
HB	HOUSE BIBB
IMB	ICE MAKER BOX

#### FIRE PROTECTION LEGEND

	FIRE PROTECTION MAIN (REFER TO PLANS FOR PIPE SIZE)
	SUPERVISED VALVE
	INSPECTOR'S TEST PIPING
	FLOW SWITCH
	PRESSURE GAUGE
	SPRINKLER HEAD (SEMI-RECESSED)
	SPRINKLER HEAD (CONCEALED)
	SPRINKLER HEAD (PENDENT)
	SPRINKLER HEAD (PENDENT - DRY TYPE)
	SPRINKLER HEAD (HIGH TEMPERATURE)
	SPRINKLER HEAD (UPRIGHT)
	SPRINKLER HEAD (SIDEWALL - EXISTING)
	SPRINKLER HEAD (SIDEWALL)
	SPRINKLER HEAD (SIDEWALL-EXTENDED COVERAGE)

#### HVAC LEGEND

	RECTANGULAR DUCT - WIDTH X DEPTH (REFER TO PLANS FOR DUCT SIZE)
	INTERNALLY LINED DUCT
	OVAL DUCT - WIDTH X DEPTH
	FLEXIBLE DUCT
	RISE IN DIRECTION OF ARROW
	RECTANGULAR TO ROUND TRANSITION
	SQUARE ELBOW WITH TURNING VANES
	MANUAL VOLUME/BALANCING DAMPER
	FIRE DAMPER
	ROUND DUCT - UP, DOWN
	SUPPLY DUCT - UP, DOWN
	RETURN DUCT - UP, DOWN
	EXHAUST DUCT - UP, DOWN
	FLEXIBLE CONNECTION
	MOTOR-OPERATED DAMPER
	CONTROL DAMPER
	SOUND TRAP
	ACCESS DOOR - PLAN, SIDE VIEW
	UNIT SYMBOL, WATER FLOW (GPM)
	STATIC PRESSURE SENSOR IN DUCT
	TEMPERATURE SENSOR
	CO2 SENSOR
	HUMIDITY SENSOR
	FREEZESTAT
	CURRENT SENSING SWITCH
	DIFFERENTIAL PRESSURE SWITCH
	VARIABLE FREQUENCY DRIVE
	STARTER
	SUPPLY DIFFUSER - TYPE, AIR QUANTITY
	SUPPLY DIFFUSER - ELEVATION
	RETURN INLET - TYPE, AIR QUANTITY
	SIDEWALL RETURN GRILLE - ELEVATION
	EXHAUST INLET - TYPE, AIR QUANTITY
	EXHAUST/RETURN INLET - ELEVATION

#### HVAC PIPING LEGEND

	HIGH PRESSURE STEAM (REFER TO PLANS FOR PIPE SIZE)
	HIGH PRESSURE CONDENSATE RETURN (REFER TO PLANS FOR PIPE SIZE)
	LOW PRESSURE STEAM (REFER TO PLANS FOR PIPE SIZE)
	LOW PRESSURE CONDENSATE RETURN (REFER TO PLANS FOR PIPE SIZE)
	STEAM VENT (REFER TO PLANS FOR PIPE SIZE)
	SAFETY RELIEF VALVE VENT (REFER TO PLANS FOR PIPE SIZE)
	CONDENSATE PUMP DISCHARGE (REFER TO PLANS FOR PIPE SIZE)
	FEEDWATER (REFER TO PLANS FOR PIPE SIZE)
	CHILLED WATER SUPPLY (REFER TO PLANS FOR PIPE SIZE)
	CHILLED WATER RETURN (REFER TO PLANS FOR PIPE SIZE)
	HOT WATER SUPPLY (REFER TO PLANS FOR PIPE SIZE)
	HOT WATER RETURN (REFER TO PLANS FOR PIPE SIZE)
	CONDENSER WATER SUPPLY (REFER TO PLANS FOR PIPE SIZE)
	CONDENSER WATER RETURN (REFER TO PLANS FOR PIPE SIZE)
	DOMESTIC COLD WATER (REFER TO PLANS FOR PIPE SIZE)
	SOFT WATER (REFER TO PLANS FOR PIPE SIZE)
	HOT WATER EXPANSION TANK PIPE (REFER TO PLANS FOR PIPE SIZE)
	CHILLED WATER EXPANSION TANK PIPE (REFER TO PLANS FOR PIPE SIZE)
	CONDENSATE DRAIN (REFER TO PLANS FOR PIPE SIZE)
	REFRIGERATE LINE (REFER TO PLANS FOR PIPE SIZE)
	GATE VALVE (SCREWED) - PLAN, END VIEW
	GATE VALVE (FLANGED) - PLAN, END VIEW
	TRIPLE OFFSET ROTARY VALVE - PLAN, END VIEW
	GLOBE VALVE (SCREWED) - PLAN, END VIEW
	GLOBE VALVE (FLANGED) - PLAN, END VIEW
	CHECK VALVE: SILENT CHECK VALVE
	CHECK VALVE
	BUTTERFLY VALVE - PLAN, END VIEW
	BUTTERFLY VALVE
	HIGH PERFORMANCE BUTTERFLY VALVE - PLAN, END VIEW
	3-WAY CONTROL VALVE: 2-WAY CONTROL VALVE
	COMB. BALANCING SHUT-OFF VALVE - PLAN, END VIEW
	0.5-2" BALANCING VALVE
	2.5-12" BALANCING VALVE
	BALL VALVE
	STEAM TRAP
	3/4" DRAIN VALVE WITH HOSE CONNECTION
	SAFETY RELIEF VALVE
	Y-TYPE STRAINER WITH DRAIN VALVE
	Y STRAINER
	FLEXIBLE CONNECTOR
	PRESSURE GAUGE
	TEMPERATURE GAUGE
	UNION
	MANUAL AIR VENT - PLAN, ELEVATION
	AUTOMATIC AIR VENT - PLAN, ELEVATION
	CONCENTRIC REDUCER - PLAN, ELEVATION
	ECCENTRIC REDUCER - PLAN, ELEVATION
	FLANGED CONNECTION
	NEEDLE VALVE IN GAUGE LINE
	FLOW METER
	FLOW SWITCH
	TEMPERATURE SENSOR
	PRESSURE SWITCH
	DIFFERENTIAL PRESSURE SWITCH
	BTU METER

#### VAV SYMBOL LEGEND

	VAV UNIT - 6" RD INLET SIZE MINIMUM AND MAXIMUM AIR FLOWS
	VAV UNIT - 7" RD INLET SIZE CONSTANT MINIMUM AND MAXIMUM AIR FLOWS
	VAV UNIT W/CO2 CONTROL - 8" RD INLET SIZE CONSTANT MINIMUM AND MAXIMUM AIR FLOWS
	VAV UNIT - 9" RD INLET SIZE MINIMUM AND MAXIMUM HEATING AIR FLOWS
	VAV UNIT - 10" RD INLET SIZE MINIMUM AND MAXIMUM HEATING AIR FLOWS
	VAV UNIT - 11" RD INLET SIZE MINIMUM AND MAXIMUM HEATING AIR FLOWS
	VAV UNIT W/CO2 CONTROL - 12" RD INLET SIZE MIN. AND MAX. COOLING & CO2 AIR FLOWS MINIMUM AND MAXIMUM HEATING AIR FLOWS
	VAV UNIT - 13" RD INLET SIZE MIN HEATING CFM, MIN COOLING CFM
	VAV UNIT - 14" RD INLET SIZE MIN HEATING CFM, MIN COOLING CFM

VARIABLE AIR VOLUME AIR TERMINAL UNIT SOUND TRAP AND DUCT SIZING UNLESS OTHERWISE NOTED		
UNIT SIZE	INLET DUCT SIZE	SOUND TRAP SIZE
VAV OR VAV-5	6" RD	ST-1
VAV OR VAV-6	6" RD	ST-1
VAV OR VAV-8	8" RD	ST-2
VAV OR VAV-10	10" RD	ST-3
VAV OR VAV-12	12" RD	ST-4
VAV OR VAV-14	14" RD	ST-5

#### HVAC ABBREVIATIONS

A.A.V.	AUTOMATIC AIR VENT
A.D.	ACCESS DOOR
A.F.	ABOVE FLOOR
B.E.	BELLMOUTH ENTRANCE
C.	COMMON
D.P.	DIFFUSER PLATE
E.A.	EXHAUST AIR
E.M.D.	END OF MAIN DRIP
F.D.	FIRE DAMPER
F.M.S.	FLOW MEASURING STATION
F.S.D.	FIRE/SMOKE DAMPER
I.B.	INLET BELL
I.S.	INLET SCREEN
M.A.V.	MANUAL AIR VENT
M.D.	MOTOR OPERATED DAMPER
M.E.	MOISTURE ELIMINATORS
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
O.A.	OUTSIDE AIR
P.A.	PRIMARY AIR
R.A.	RETURN AIR
S.A.	SUPPLY AIR
R.H.	RANGE HOOD
S.D.	SUCTION DIFFUSER
S.M.D.	SMOKE DAMPER
T.A.V.	THERMOSTATIC AIR VENT
T.C.P.	TEMPERATURE CONTROL PANEL
V.B.	VACUUM BREAKER
V.D.	VOLUME DAMPER

**NOTE:**  
THE SYMBOLS LISTED ON THIS SHEET MAY NOT ALL BE USED ON THIS SET OF CONTRACT DRAWINGS, HOWEVER, WHEREVER A SYMBOL IS USED THE ITEM SHALL BE FURNISHED AND INSTALLED.

#### PLUMBING DEMOLITION GENERAL NOTES:

- DEMOLITION DRAWINGS DEPICT THE MAJOR COMPONENTS TO BE REMOVED, BUT DO NOT NECESSARILY REFLECT EXACT ROUTES, AND MAY NOT SHOW ALL SYSTEMS, ADDITIONS, AND REVISIONS THERE TO. THE CONTRACTOR SHALL EXAMINE THE FACILITIES AND PROVIDE COMPLETE SYSTEMS DEMOLITION EXCEPTING THOSE SYSTEMS TO REMAIN IN SERVICE.
- PRIOR TO BEGINNING DEMOLITION CONFIRM ALL PIPING BRANCHES FROM AREA TO BE RENOVATED INTO AREAS AND SYSTEMS NOT BEING RENOVATED. BRING TO ATTENTION OF ARCHITECT/ENGINEER OF SYSTEMS THAT MAY BE AFFECTED.
- REMOVE ALL PIPING, HANGERS, SLEEVES, AND ANY ITEMS RELATED TO PLUMBING DEMOLITION. REMOVE ALL SUCH ITEMS WHETHER REMOVED BY THIS PROJECT OR PREVIOUSLY ABANDONED.
- CAP AND RE-INSULATE ALL ACTIVE PIPING LEFT UN-INSULATED DURING THE PROJECT DEMOLITION.
- IDENTIFY ALL PLUMBING AND PIPING ITEMS, ACCORDING TO THE PROJECT SPECIFICATIONS, AT EACH CAPPED LOCATION.
- ALL EXISTING SYSTEMS MUST REMAIN IN OPERATION IN EXISTING AREAS OF THE BUILDING THAT REMAIN OCCUPIED DURING CONSTRUCTION.
- PROVIDE ADEQUATE TEMPORARY PLUMBING CONNECTIONS TO MAINTAIN SERVICES FOR ALL SPACES AFFECTED WHEN PERMANENT SYSTEMS ARE NOT AVAILABLE OR CAPABLE.
- PATCH AND RESTORE SURFACES OF WALLS, FLOORS, AND CEILINGS TO REMAIN WHERE AFFECTED BY DEMOLITION PER THE ARCHITECTURAL SPECIFICATIONS.
- FIRE-STOP AND CAULK ALL OPENINGS LEFT FROM DEMOLITION AND WHERE REQUIRED BY THE NFPA.
- COORDINATE ALL SHUT-DOWNS WITH OWNER PRIOR TO DEMOLITION.
- CUT AND CAP ALL SANITARY TO BE REMOVED BACK TO BELOW FLOOR. SANITARY PIPING BELOW EXISTING FLOOR SLAB TO REMAIN MAY BE CUT AND CAPPED BACK AT MAIN AND ABANDONED IN PLACE. REFER TO ARCHITECTURAL PLANS.
- COORDINATE WITH OWNER PRIOR TO CONSTRUCTION FOR DEMOLITION OR NEW WORK REQUIRED OUTSIDE DEFINED LIMITS OF RENOVATION. SEE ARCHITECTURAL, PATCH AND REPAIR TO MATCH EXISTING ALL AFFECTED FINISHES PER ARCHITECTURAL SPECIFICATIONS.

#### PLUMBING GENERAL NOTES:

- CONTRACTOR SHALL REFERENCE ARCHITECTURAL PLANS FOR REQUIRED CEILING HEIGHTS. PIPING IN ROOMS WITH SUSPENDED CEILINGS SHALL BE ABOVE CEILINGS UNLESS OTHERWISE NOTED.
- THE CONTRACTOR SHALL INSTALL FULL SIZE INDIRECT WASTES FROM EQUIPMENT REQUIRING SAME TO NEAREST FLOOR DRAIN, UNLESS OTHERWISE NOTED.
- LOCATIONS OF PIPING AND EQUIPMENT ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENT IN THE FIELD. DO NOT SCALE THE DRAWINGS.
- ALL OFFSETS IN PIPING ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL OFFSETS WHERE NECESSARY.
- COORDINATE WITH MECHANICAL, FIRE PROTECTION, AND ELECTRICAL CONTRACTORS TO AVOID INTERFERENCES WITH PIPING, DUCTS, AND CONDUIT.
- INSTALL PIPING AND EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- SEAL AIRTIGHT AROUND ALL PIPING PENETRATIONS THROUGH WALLS, FLOOR, AND ROOF.
- VERIFY EXACT LOCATIONS OF ALL PLUMBING ROUGH-INS WITH ARCHITECT.
- SLEEVES IN FLOORS SHALL EXTEND 1" ABOVE FINISHED FLOOR AND BE CAULKED FOR WATERTIGHT INSTALLATION. SEE SPECIFICATIONS.
- SEE H.V.A.C. DRAWINGS FOR ADDITIONAL DETAILS APPLICABLE TO PLUMBING SYSTEM INSTALLATION.
- SET EQUIPMENT PRESSURE REGULATING VALVE OUTLET PRESSURE WHERE NOTED ON DRAWINGS AT EQUIPMENT MANUFACTURER'S REQUIREMENTS.
- COORDINATE WITH OWNER AND PROVIDE ADDITIONAL PIPING, DRAIN, VALVES, AND CONNECTIONS AS REQUIRED FOR OWNER FURNISHED EQUIPMENT. FINAL CONNECTIONS BY PLUMBING CONTRACTOR.
- CAP ALL PIPING 6" ABOVE FLOOR SLAB UNLESS OTHERWISE NOTED FOR FUTURE CONNECTION.
- CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COORDINATION WITH SITE AND STRUCTURAL FIELD VERIFY ALL INVERTS PRIOR TO CONSTRUCTION.
- MECHANICAL CONTRACTOR TO DESIGN AND INSTALL EXPANSION LOOPS IN DOMESTIC WATER IF REQUIRED BY MATERIAL USED.

#### FIRE PROTECTION GENERAL NOTES:

- PIPING IN ROOMS WITH SUSPENDED CEILINGS SHALL BE ABOVE CEILING UNLESS OTHERWISE NOTED.
- LOCATIONS OF PIPING AND EQUIPMENT ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENTS IN THE FIELD. DO NOT SCALE THE DRAWINGS.
- ALL OFFSETS IN PIPING ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL OFFSETS WHERE NECESSARY.
- COORDINATE WITH HVAC, PLUMBING, AND ELECTRICAL EQUIPMENT TO AVOID INTERFERENCE WITH PIPING, DUCT AND CONDUIT.
- INSTALL PIPING AND EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- SEAL AIRTIGHT AROUND ALL PIPING PENETRATIONS THROUGH WALLS, FLOORS, AND ROOF.
- CENTER SPRINKLER HEADS IN SUSPENDED ACOUSTICAL CEILING TILES. SEE DETAIL ON THIS DRAWING.
- PROVIDE DRAINS AT LOW POINTS PER NFPA-13.
- PITCH ALL SPRINKLER PIPING TO MAIN. IF PIPING CANNOT BE PITCHED TO MAIN, PROVIDE AUXILIARY DRAINS AT LOW POINTS.
- PROVIDE GUARDS ON ALL HEADS INSTALLED 8'-0" OR LESS ABOVE THE FLOOR UNLESS DIRECTED OTHERWISE BY ENGINEER.
- IN MECHANICAL ROOMS OR SIMILAR AREAS WHERE INTERFERENCE OCCURS WITH SPRINKLER DISCHARGE, PROVIDE ADDITIONAL SPRINKLER HEADS AS REQUIRED PER NFPA-13.
- INDIVIDUAL BRANCH LINE SIZE TO A SPRINKLER HEAD SHALL BE 1".
- ALL PIPING SHALL BE INSTALLED PARALLEL AND PERPENDICULAR TO WALLS, FLOORS, AND CEILING AND HORIZONTAL UNLESS SPECIFICALLY SHOWN OTHERWISE ON DRAWINGS OR UNABLE DUE TO INTERFERENCES.
- PROVIDE SEISMIC BRACING FOR PIPING AND EQUIPMENT AS REQUIRED BY KENTUCKY BUILDING CODE. SEE SPECIFICATIONS.
- DO NOT SUPPORT ANY PIPING FROM THE RAISED ACCESS FLOOR.

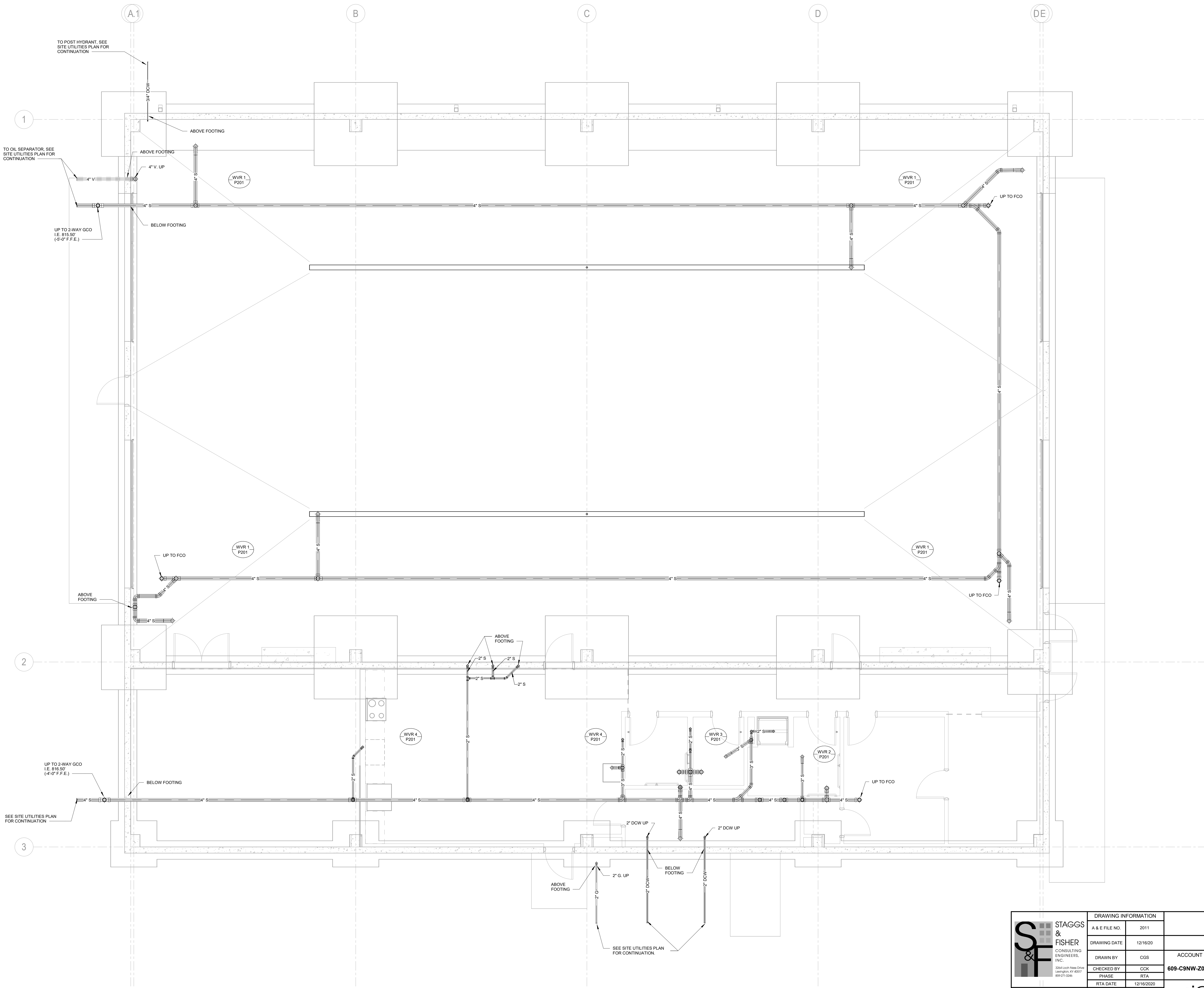
#### HVAC GENERAL NOTES:

- DUCTWORK AND PIPING IN ROOMS WITH SUSPENDED CEILINGS SHALL BE ABOVE CEILING EXCEPT IN EQUIPMENT ROOMS.
- INSTALL AIR VENTS AT HIGH POINTS IN PIPING AND DRAINS IN LOW POINTS.
- LOCATIONS OF PIPING, DUCT, AND EQUIPMENT ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENTS IN THE FIELD. DO NOT SCALE THE DRAWINGS.
- ALL OFFSETS IN DUCTS AND PIPING ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL OFFSETS WHERE NECESSARY.
- ALL INCREASERS AND REDUCERS IN PIPING SYSTEM ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL INCREASERS AND REDUCERS WHERE REQUIRED.
- COORDINATE WITH PLUMBING, SHEET METAL, FIRE PROTECTION, AND ELECTRICAL CONTRACTORS TO AVOID INTERFERENCE WITH PIPING, DUCTS, AND CONDUIT.
- INSTALL ALL PIPING, DUCTWORK, AND EQUIPMENT IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- SEAL AIRTIGHT AROUND ALL DUCT AND PIPING PENETRATIONS THROUGH WALLS AND FLOORS.
- SEAL ALL DUCTWORK WITH DUCT SEALANT AND/OR DUCT CEMENT IN ACCORDANCE WITH SPECIFICATIONS SECTION "METAL DUCTWORK".
- DIMENSIONS FOR DUCTS ARE INSIDE DIMENSIONS.
- SEE ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF GRILLES AND DIFFUSERS IN CEILINGS.
- DO NOT RUN ANY PIPING OR DUCTWORK OVER ANY ELECTRICAL OR ELEVATOR EQUIPMENT.
- INSTALL ACCESS DOOR IN DUCT ADJACENT TO EACH MOTOR OPERATED DAMPER.
- ROLL FITTINGS IN ROUND DUCT AS REQUIRED FOR PROPER CONNECTIONS TO BRANCH DUCTS.
- WHERE SIZE OF DUCT PENETRATING A FIRE WALL OR PARTITION IS LESS THAN THE MINIMUM SIZE OF FACTORY-MADE FIRE DAMPER OR DUCT ACCESS DOOR, PROVIDE THE MINIMUM SIZE FACTORY MADE DAMPER AND/OR ACCESS DOOR AVAILABLE. INCREASE DUCT SIZE AS REQUIRED TO ACCOMMODATE TRANSITIONS UPSTREAM AND DOWN STREAM OF SIZE INCREASE.
- ALL TRANSITIONS IN DUCTWORK ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL TRANSITIONS WHERE REQUIRED.
- FIELD VERIFY EXISTING CONDITIONS AND ALL REQUIRED MEASUREMENTS BEFORE FABRICATING ANY PIPING, DUCTWORK, OR EQUIPMENT.
- INSTALL CONTROL DEVICES (SUCH AS SENSORS, SENSING WELLS, VALVES, DAMPERS, ETC.), FURNISHED BY CONTROLS SUPPLIER, IN DUCT AND PIPING SYSTEMS.
- PROVIDE SEISMIC BRACING FOR PIPING, DUCTWORK, AND EQUIPMENT AS REQUIRED BY KENTUCKY BUILDING CODE. SEE SPECIFICATIONS.

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	DRAWING INFORMATION		KYTC MAINTENANCE FACILITY CASEY COUNTY, KENTUCKY		DRAWING NO. <b>M000</b>	
	A & E FILE NO.	2011	MECHANICAL LEGEND AND GENERAL NOTES			AS-BUILT DATE DECA LOG # <b>A1C-8649</b>
	DRAWING DATE	12/16/20	ACCOUNT NO.	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		
	DRAWN BY	Author	CHECKED BY	Checker		
PHASE	RTA	RTA DATE	12/16/2020			
		28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517   PH. 859.273.3700   FAX 859.271.9605		REVISION HISTORY OF THIS DRAWING		
DESCRIPTION OF REVISIONS		DATE	DESCRIPTION OF REVISIONS	DATE		
1		5				
2		6				
3		7				
4		8				



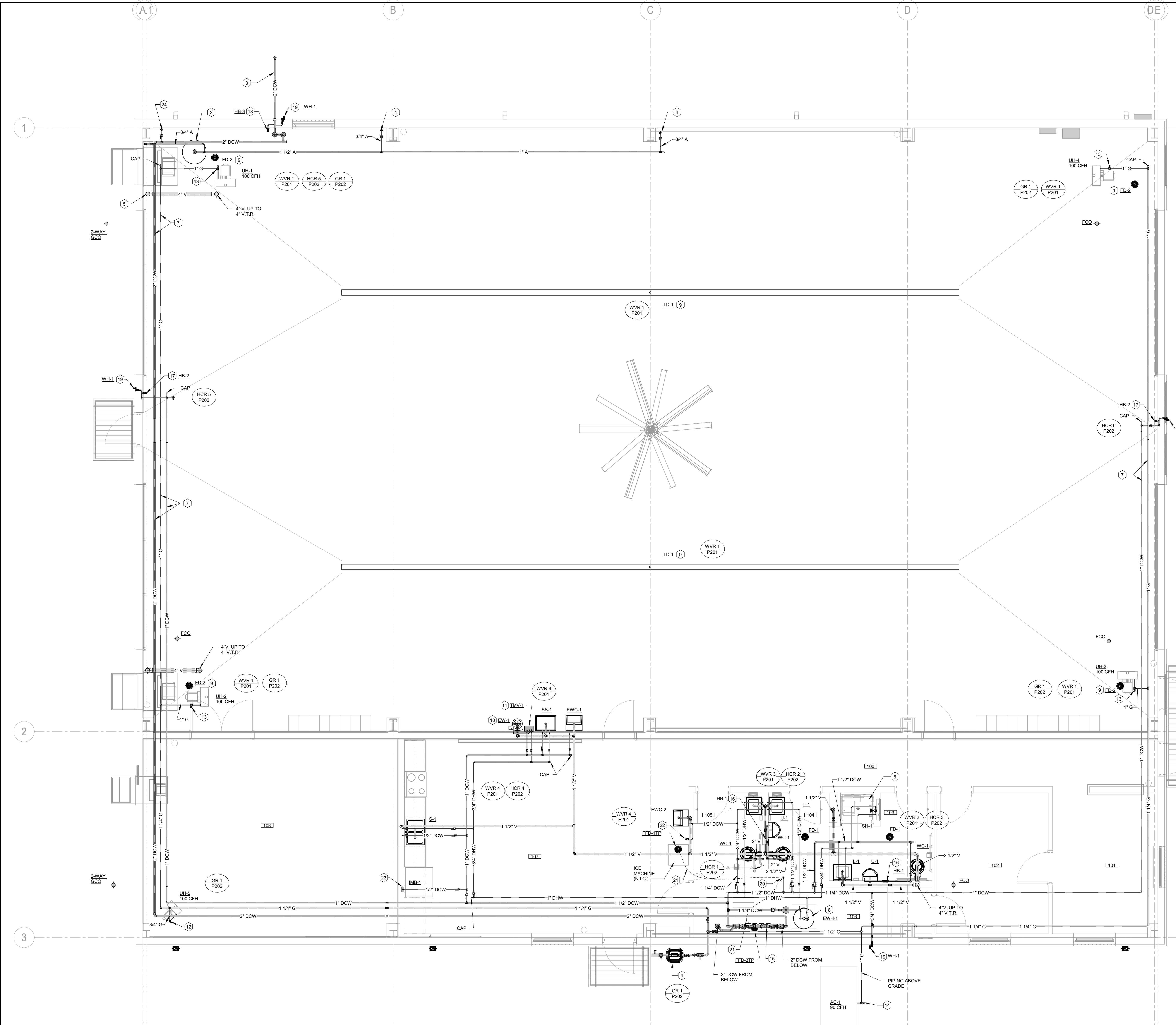


**PLUMBING UNDERFLOOR PLAN**  
 SCALE: 1/4" = 1'-0"

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<p><b>STAGGS &amp; FISHER</b>        CONSULTING ENGINEERS, INC.  <small>3354 Loch Tree Drive        Lexington, KY 40517        606-271-3266</small></p>	<b>DRAWING INFORMATION</b>		<b>KYTC MAINTENANCE FACILITY        CASEY COUNTY, KENTUCKY</b>		<b>DRAWING NO.</b>  <b>P100</b>  <b>AS-BUILT DATE</b>  <b>DECA LOG #</b> <b>A1C-8650</b>
	A & E FILE NO. 2011	DRAWING DATE 12/16/20	ACCOUNT NO. 609-C9NW-Z001-A10	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
	DRAWN BY CGS	CHECKED BY CCK	PHASE RTA	RTA DATE 12/16/2020	
	<p>Architecture   Interiors   Landscapes   Planning</p> <p>28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 606-273-3700 / FAX 606-271-6605</p>				
<b>REVISION HISTORY OF THIS DRAWING</b>		<b>REVISION HISTORY OF THIS DRAWING</b>		<b>REVISION HISTORY OF THIS DRAWING</b>	
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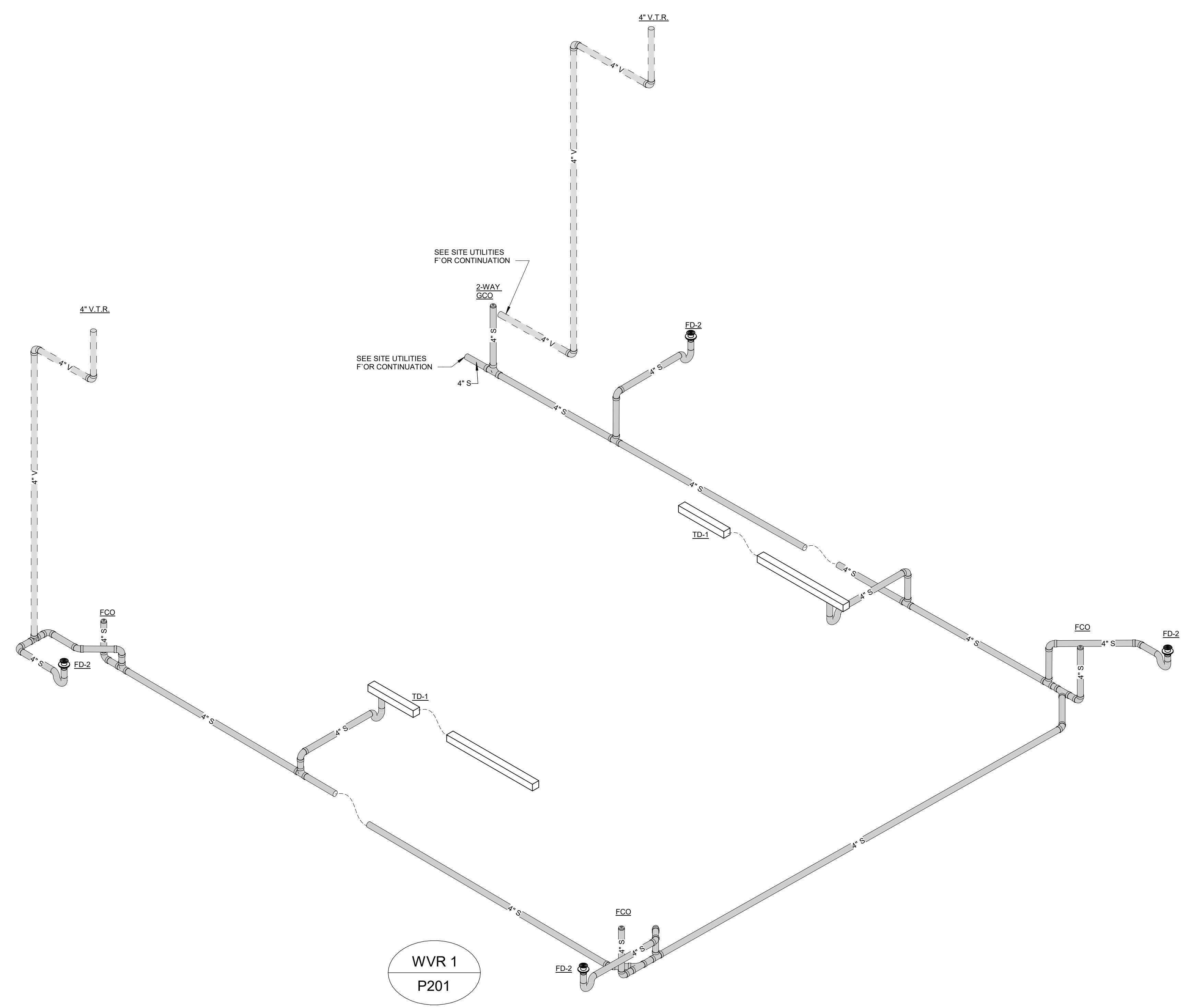


- CODED NOTES:**
- 1 GAS METER AND REGULATOR, PEAK LOAD 520 CFH. SEE DETAIL ON SHEET U102.
  - 2 AIR COMPRESSOR, OWNER FURNISHED, CONTRACTOR INSTALLED ON 4' CONCRETE MAINTENANCE PAD. CONTRACTOR SHALL MAKE ALL REQUIRED CONNECTIONS. SECURE COMPRESSOR TO PAD.
  - 3 TRUCK WATER FILL. SEE DETAIL ON SHEET P300.
  - 4 COMPRESSED AIR DROP. SEE DETAIL ON SHEET P300.
  - 5 4" VENT FROM OIL SEPARATOR.
  - 6 COORDINATE FLOOR RECESS FOR ADA-ACCESSIBILITY WITH GENERAL CONTRACTOR PRIOR TO FLOOR POUR.
  - 7 ROUTE PIPING AS HIGH AS POSSIBLE. SLOPE WITH ROOF. COORDINATE WITH ALL TRADES.
  - 8 ELECTRIC WATER HEATER (EWH-1), SEE PIPING DETAIL ON SHEET P300.
  - 9 ALL CLEANOUTS, FLOOR DRAINS AND TRENCH DRAINS IN MAINTENANCE BAY SHALL BE SUITABLE FOR VEHICLE TRAFFIC.
  - 10 EYEFACE WASH (EW-1). INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
  - 11 THERMOSTATIC MIXING VALVE (TMV-1) FOR EYEFACE WASH (EW-1). INSTALL PER MANUFACTURER'S RECOMMENDATIONS. SURFACE MOUTH BOTTOM OF BOX 54" COORDINATE WITH ARCHITECTURAL PANEL.
  - 12 3/4" GAS LINE DOWN TO UNIT HEATER, 30 MBH. CONNECT IN ACCORDANCE WITH SHOP DRAWINGS. PROVIDE GAS COCK AND DRIP LEG ON VERTICAL. SEE H.V.A.C. DRAWINGS.
  - 13 1" GAS LINE DOWN TO UNIT HEATER, 100 MBH. CONNECT IN ACCORDANCE WITH SHOP DRAWINGS. PROVIDE GAS COCK AND DRIP LEG ON VERTICAL. SEE H.V.A.C. DRAWINGS.
  - 14 1" GAS LINE DOWN TO AC-1, 90 MBH. CONNECT IN ACCORDANCE WITH SHOP DRAWINGS. PROVIDE GAS COCK AND DRIP LEG ON VERTICAL. SEE H.V.A.C. DRAWINGS.
  - 15 STACKED DOMESTIC WATER SERVICE ENTRANCES. SEE SCHEMATIC DETAIL ON SHEET P300.
  - 16 HOSE BIBB (HB-1): WOODFORD MODEL #824 WALL FAUCET WITH METAL WHEEL HANDLE WITH BRASS FINISH AND BOX. INSTALL 18" A.F.F.
  - 17 HOSE BIBB (HB-2): WOODFORD MODEL #24 WALL FAUCET WITH METAL WHEEL HANDLE AND BRASS FINISH. INSTALL 24" A.F.F.
  - 18 HOSE BIBB (HB-3) FOR DRAIN DOWN ONLY. WOODFORD MODEL #24 WALL FAUCET WITH LOOSE KEY HANDLE AND BRASS FINISH. INSTALL 24" A.F.F.
  - 19 FREEZE-PROOF WALL HYDRANT (WH-1). WOODFORD MODEL #87 AUTOMATIC DRAINING WALL HYDRANT WITH LOOSE KEY OPERATION AND CHROME FINISH. MOUNT 68" A.F.F.
  - 20 TRAP PRIMER, PRECISION PLUMBING PRODUCTS MODEL MPR-500 PRIME RITE TRAP PRIMER WITH DL-4 (DISTRIBUTION UNIT). ROUTE PIPING DOWN ON NEAREST WALL. BRACKET AS REQUIRED. SEE TRAP PRIMER DETAIL ON SHEET P500.
  - 21 EXTEND 1/2" SOFT COPPER LINES FROM TRAP PRIMER UNIT TO EACH FLOOR DRAIN BELOW SLAB AND CONNECT TO TRAP PRIMER CONNECTION ADPTOR ON FLOOR DRAIN. NO UNDERSLAB JOINTS ALLOWED EXCEPT FOR CONNECTION TO FLOOR DRAIN CONNECTOR.
  - 22 1/2" DCW. VALVE AND CAP FOR FUTURE CONNECTION FOR ICE MACHINE (N.I.C.).
  - 23 PROVIDE ICE MAKER SUPPLY BOX (IMB-1) SOLOX CHIEF 696 SERIES WITH LEAD FREE BALL VALVE AND FRAME. MOUNT BOTTOM OF BOX 47" A.F.F.
  - 24 3/4" DCW DOWN TO EXTERIOR POST HYDRANT. BRACKET PIPING TO WALL AS REQUIRED. PROVIDE SHUT-OFF VALVE IN VERTICAL, 18" A.F.F.

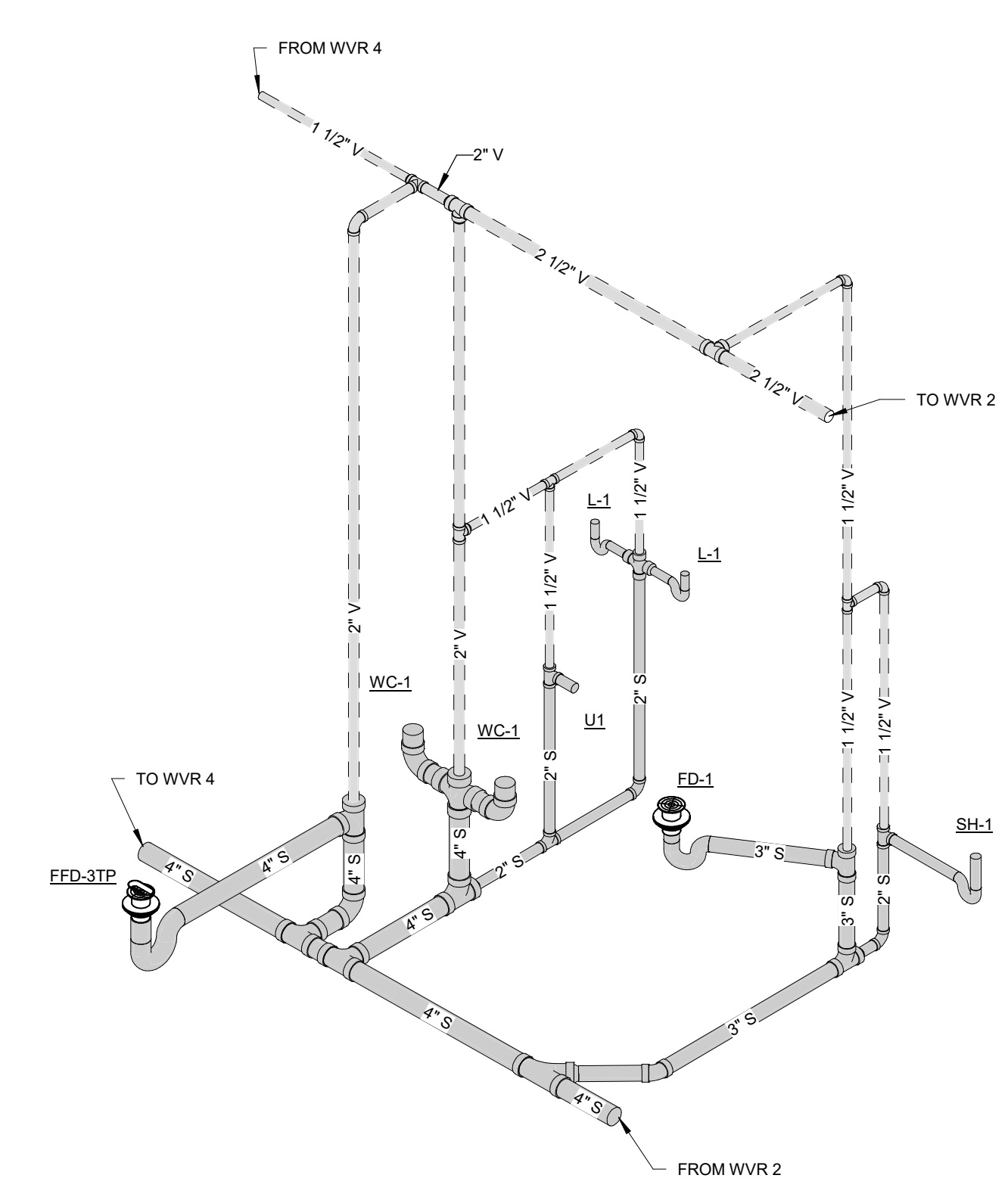
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<p><b>STAGGS &amp; FISHER</b>          CONSULTING ENGINEERS, INC.          2504 Loch Ness Drive          Lexington, KY 40517          606-271-3266</p>	<b>DRAWING INFORMATION</b>		<b>KYTC MAINTENANCE FACILITY          CASEY COUNTY, KENTUCKY</b>	
	A & E FILE NO. 2011	DRAWING DATE 12/16/20	<b>PLUMBING PLAN</b>	
	DRAWN BY CGS	ACCOUNT NO. 609-C9NW-Z001-A10	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
	CHECKED BY RTA	PHASE RTA	RTA DATE 12/16/2020	DRAWING NO. <b>P101</b>
AS-BUILT DATE		DECA LOG # <b>A1C-8651</b>		
28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859.273.3700 / FAX 859.271.6605		<p>Architecture   Interiors   Landscapes   Planning</p>		
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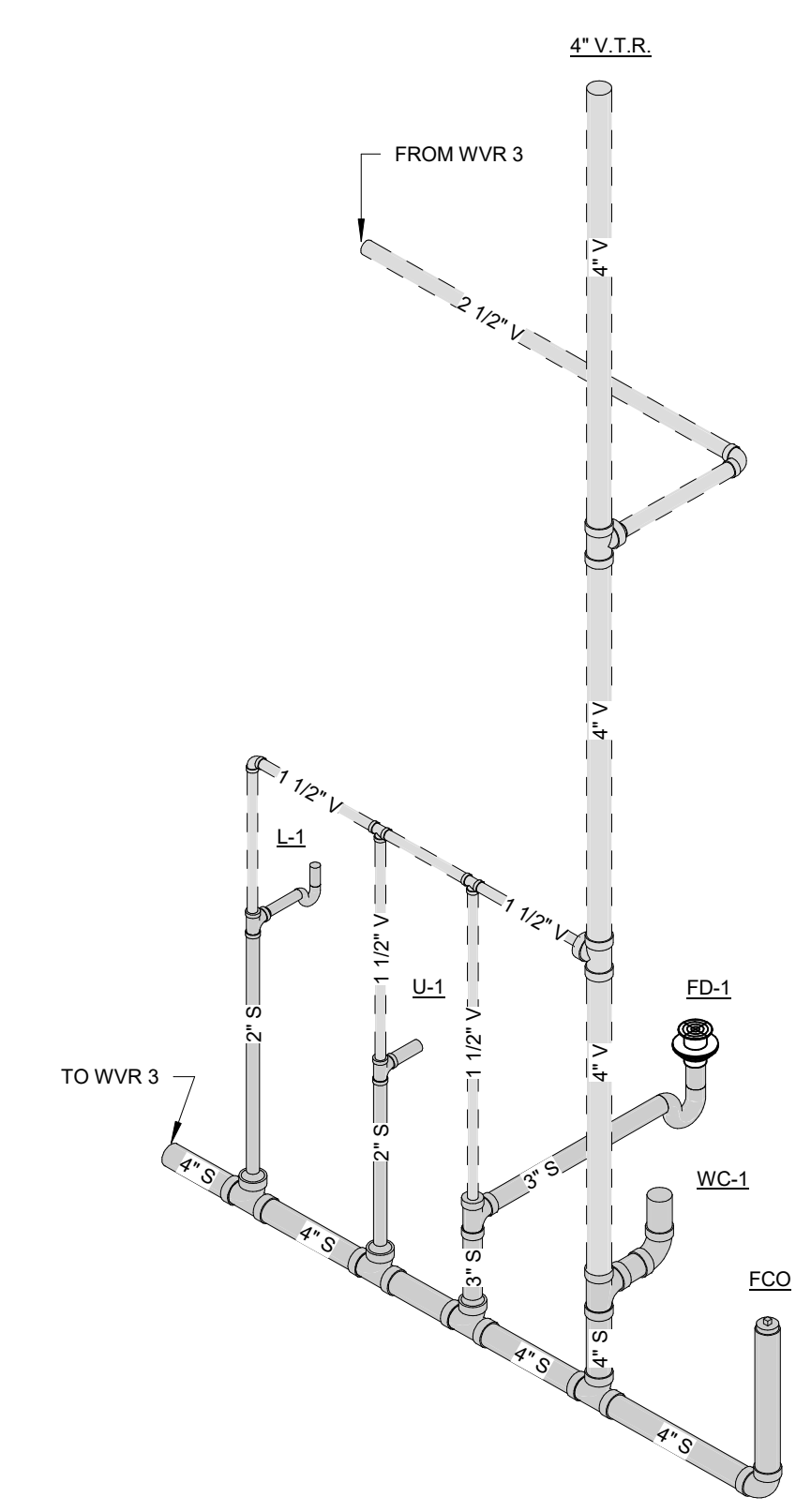




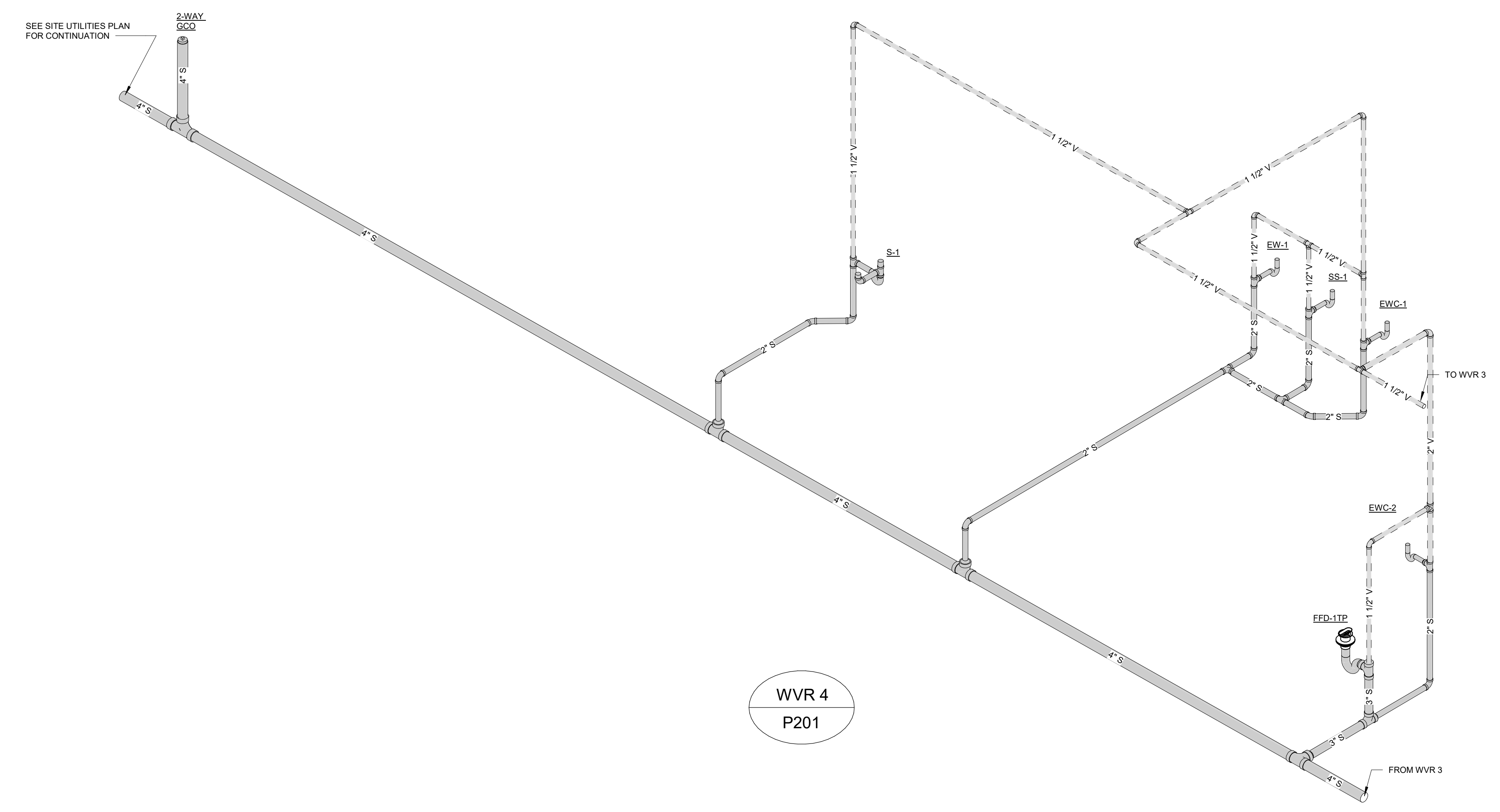
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P201



WVR 3  
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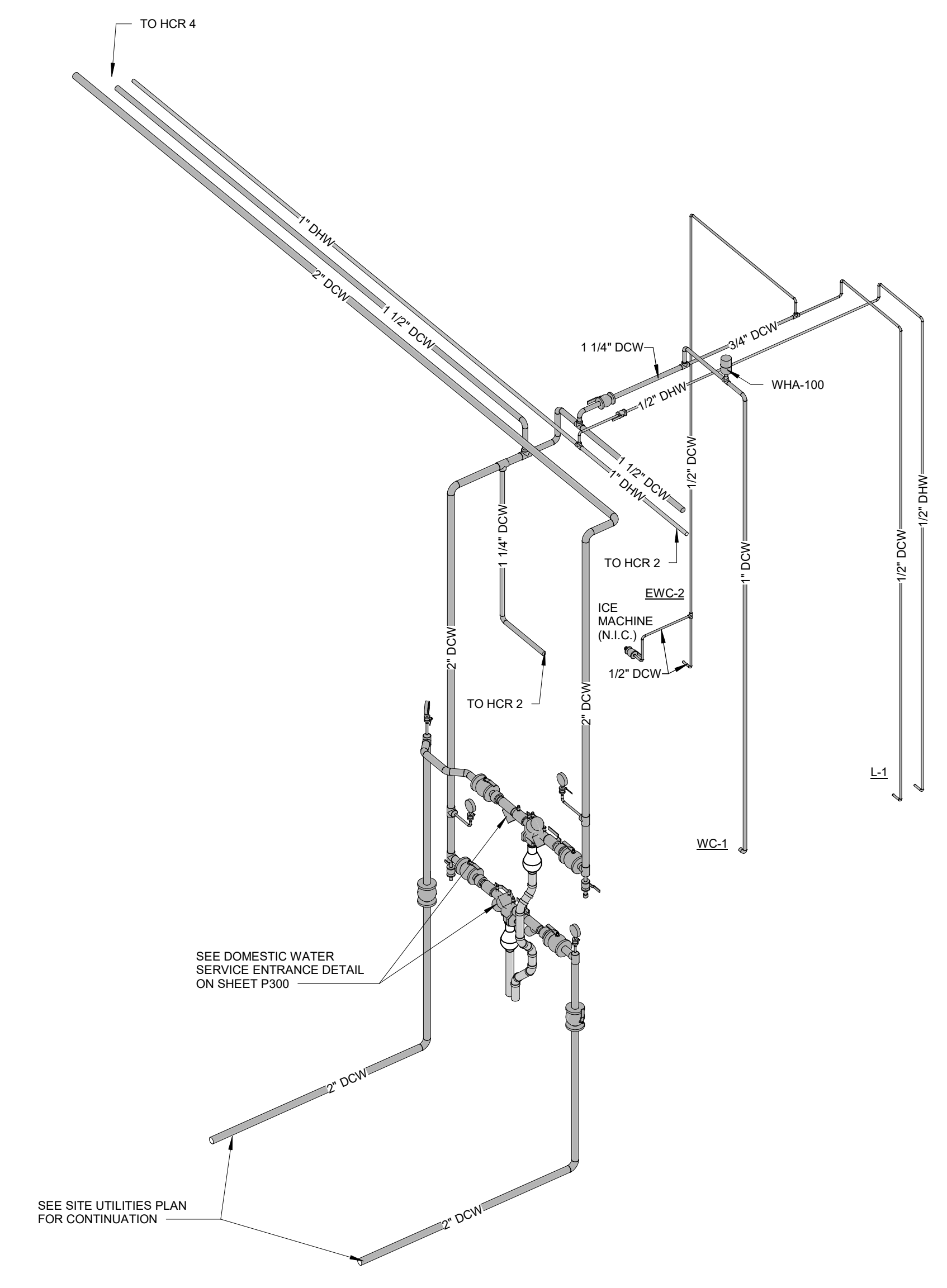
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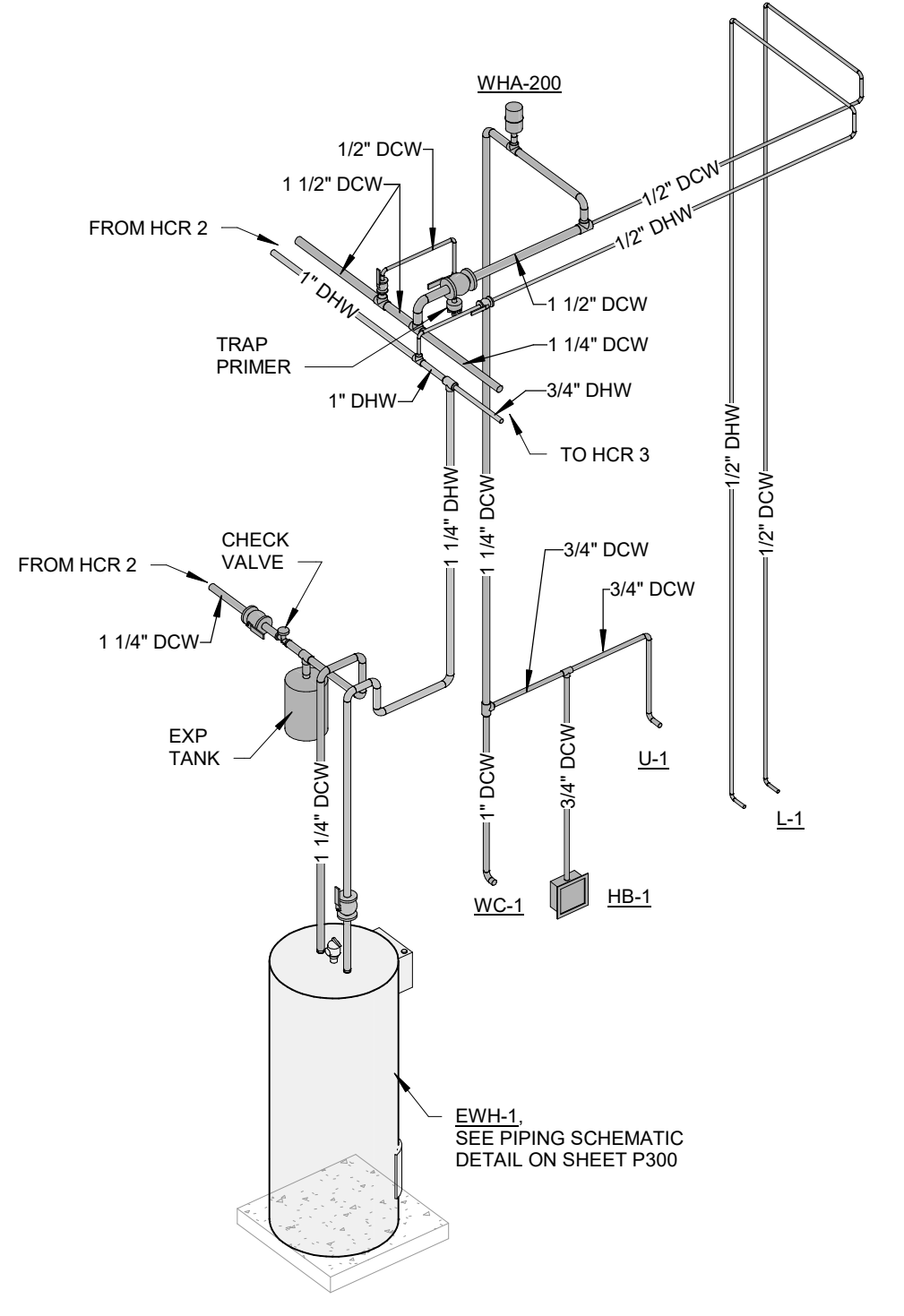
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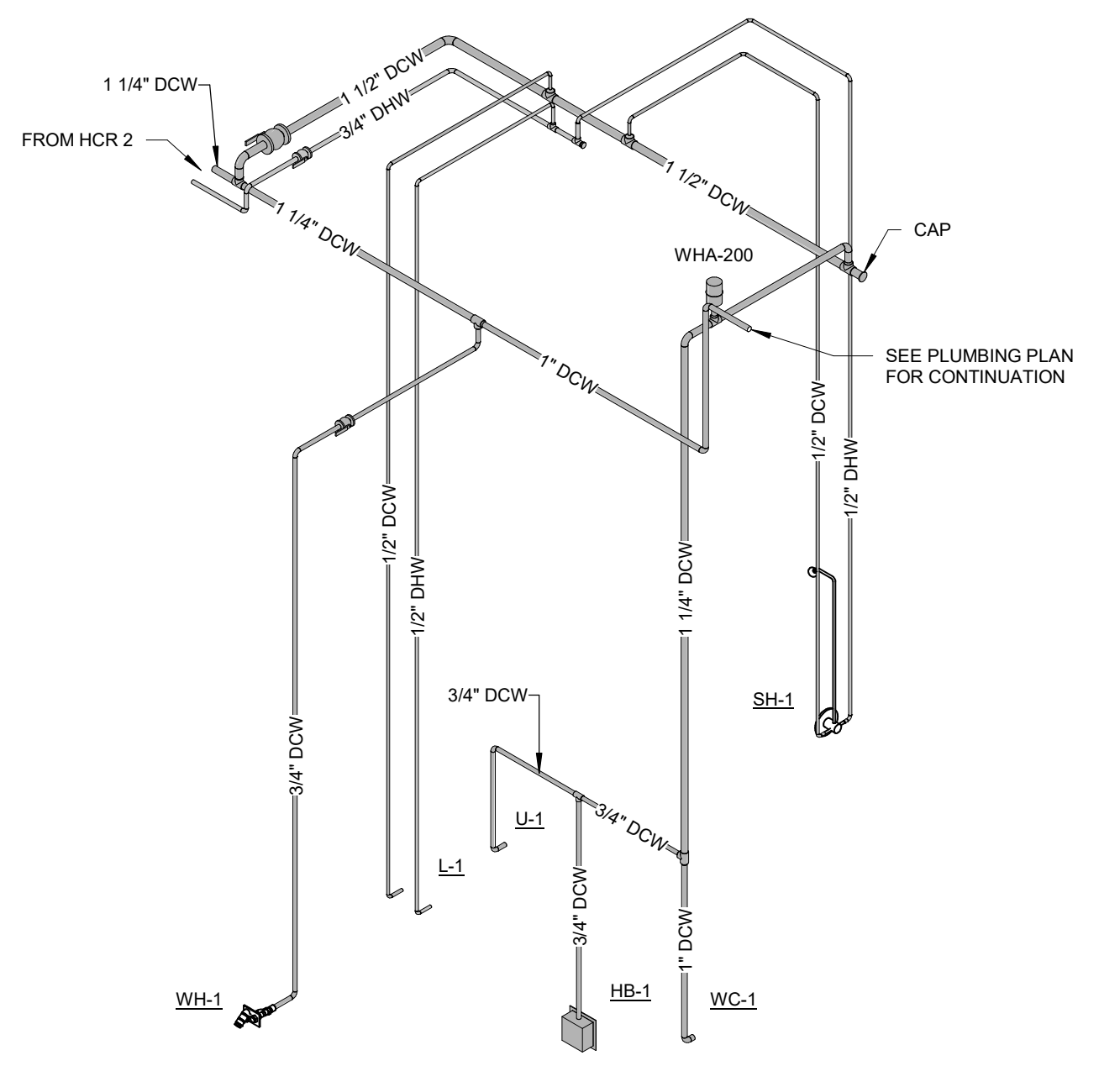
<p>STAGGS &amp; FISHER CONSULTING ENGINEERS, INC. 2354 Loch Three Drive Lexington, KY 40517 606-271-3266</p>	DRAWING INFORMATION		KYTC MAINTENANCE FACILITY CASEY COUNTY, KENTUCKY		DRAWING NO. <b>P201</b>
	A & E FILE NO.	2011	PLUMBING RISER DIAGRAMS		
	DRAWING DATE	12/16/20	ACCOUNT NO.	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	DECA LOG # <b>A1C-8652</b>
	DRAWN BY	CGS	609-C9NW-Z001-A10	REVISION HISTORY OF THIS DRAWING	
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RTA DATE	12/16/2020	<p>Architecture   Interiors   Landscapes   Planning</p> <p>28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859.273.3700 / FAX 859.271.6605</p>			
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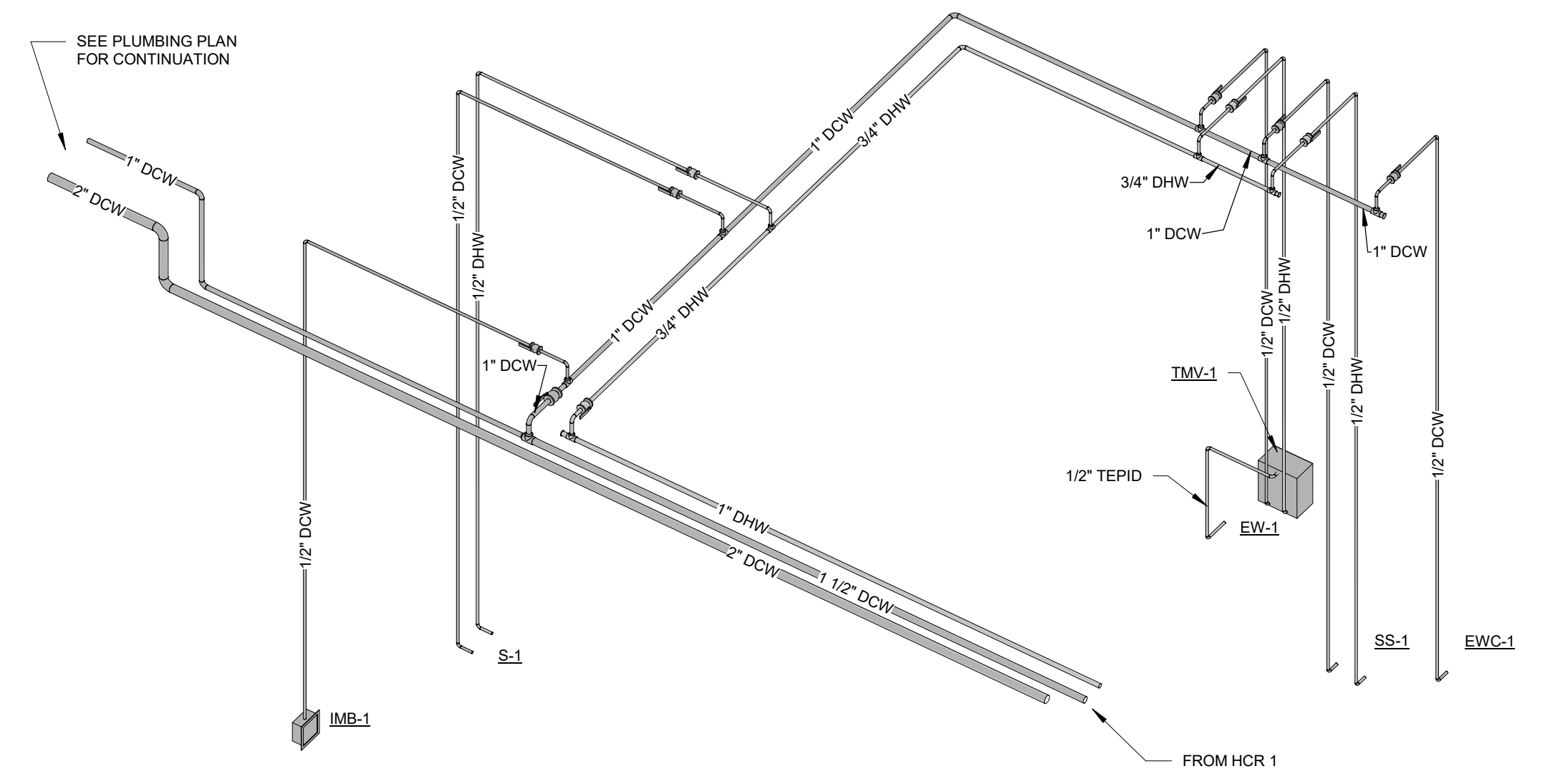
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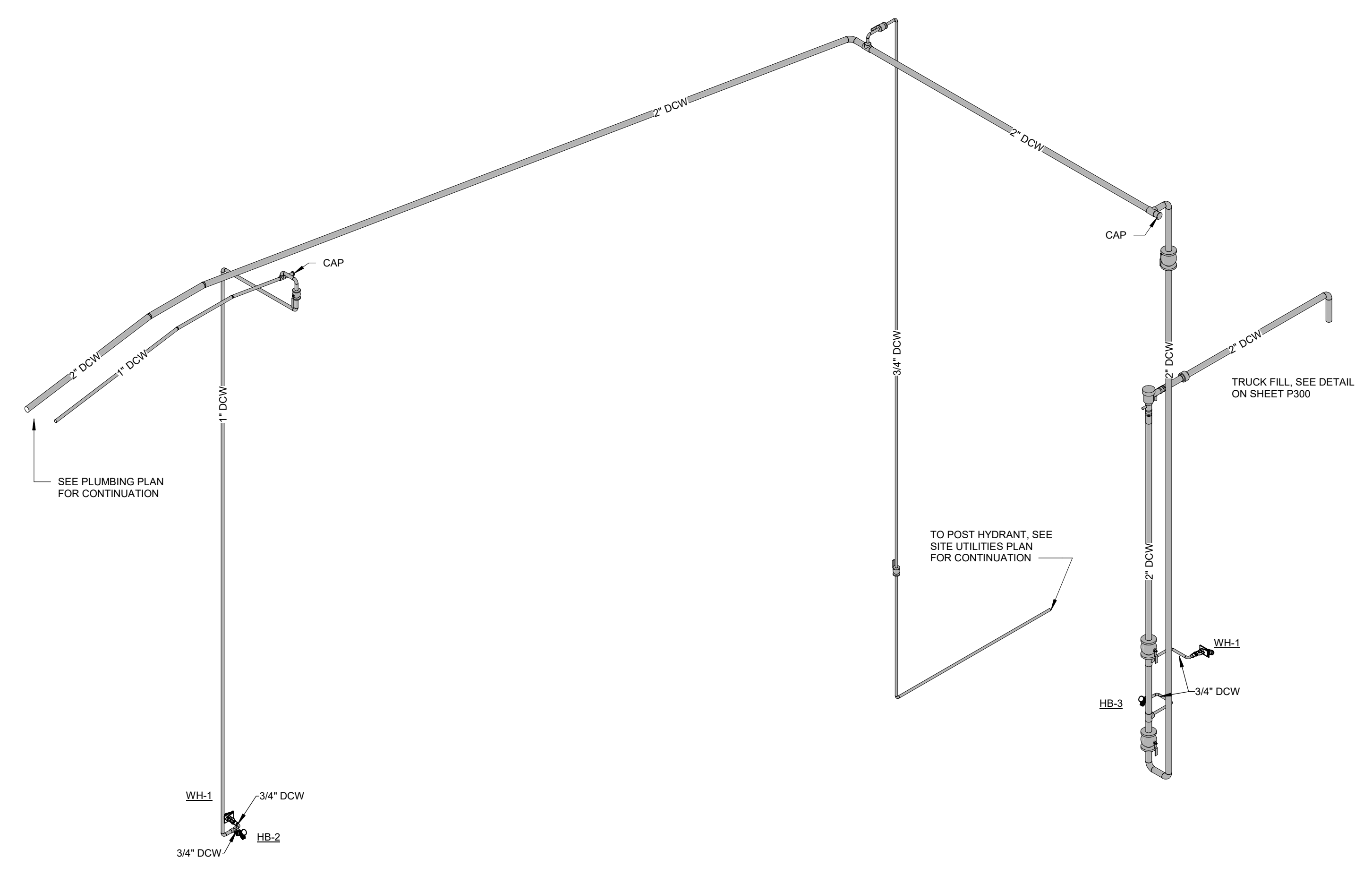
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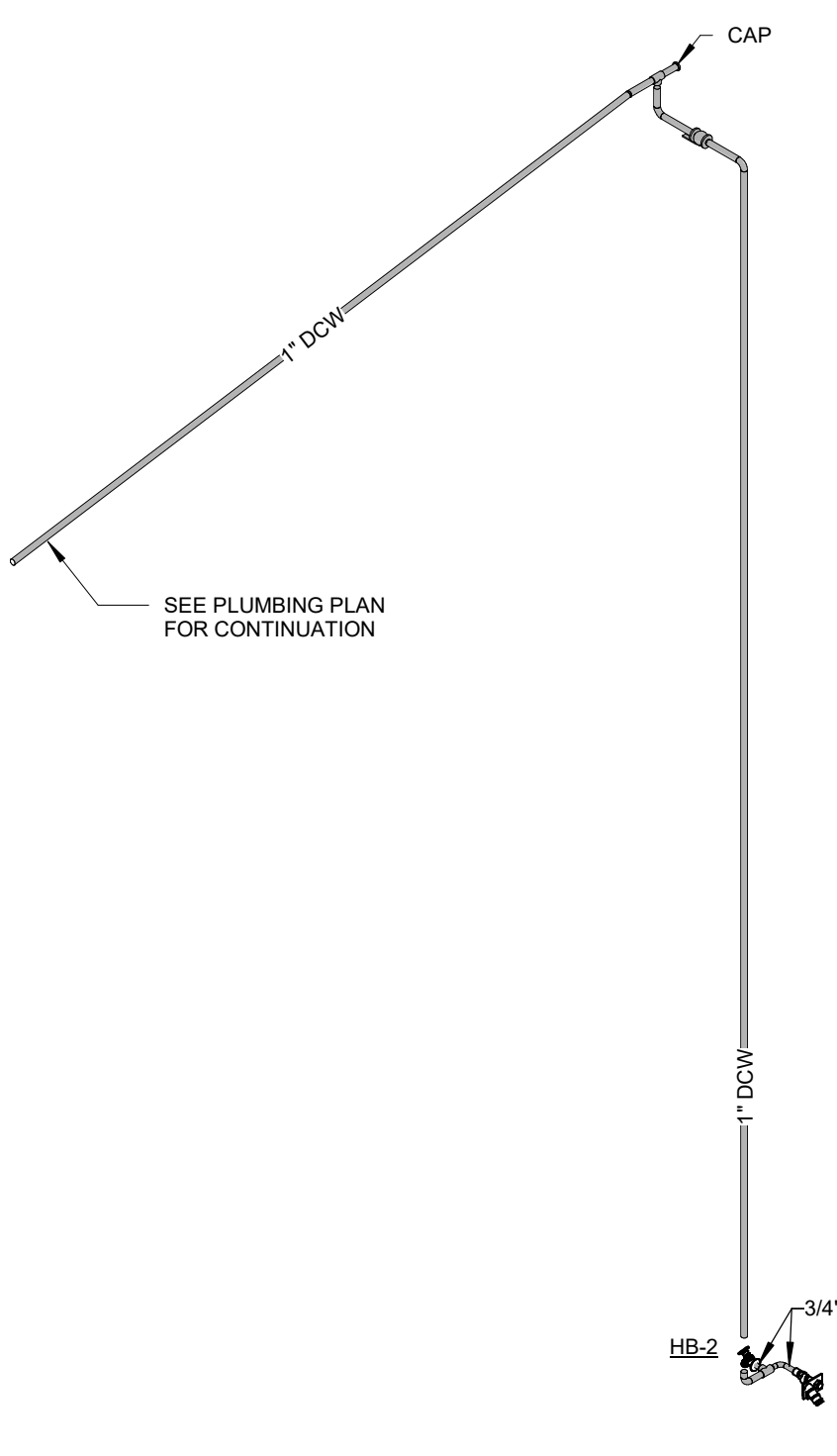
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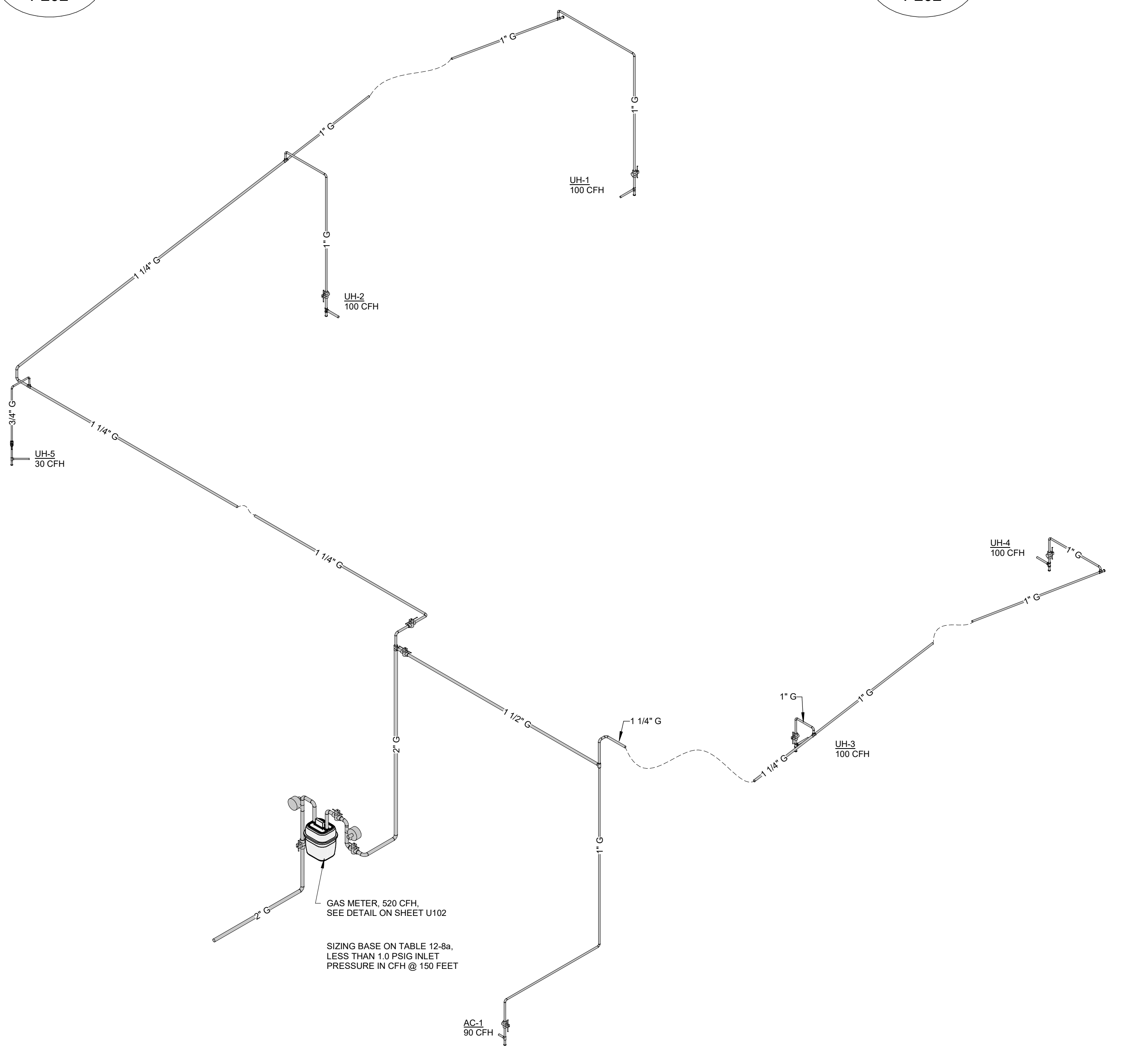
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HCR 6  
P202

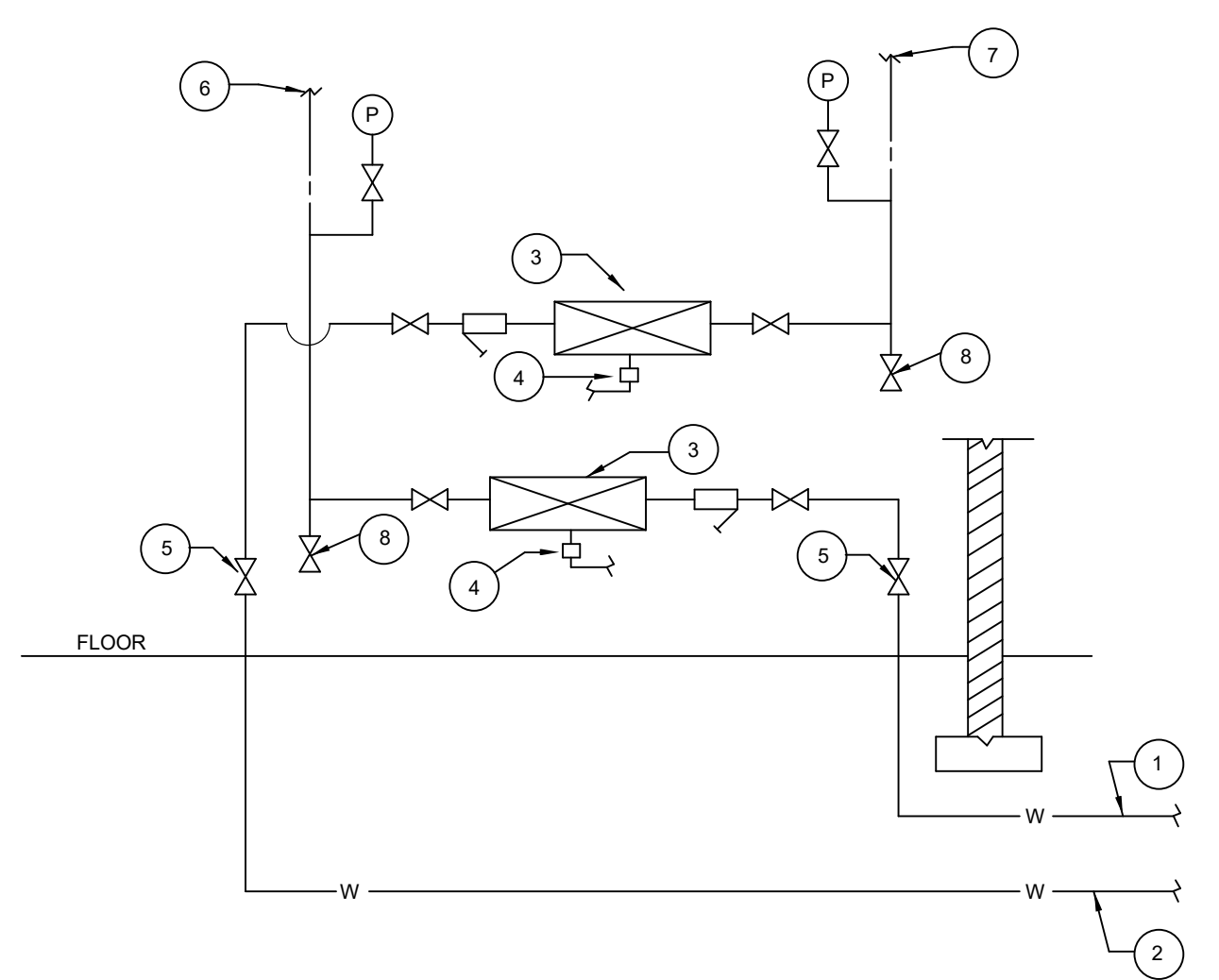


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	A & E FILE NO.	2011	PLUMBING RISER DIAGRAMS		
	DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-Z001-A10	
	DRAWN BY	CGS	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		
CHECKED BY	CCK	REVISION HISTORY OF THIS DRAWING		DATE	
PHASE	RTA	DESCRIPTION OF REVISIONS		DATE	
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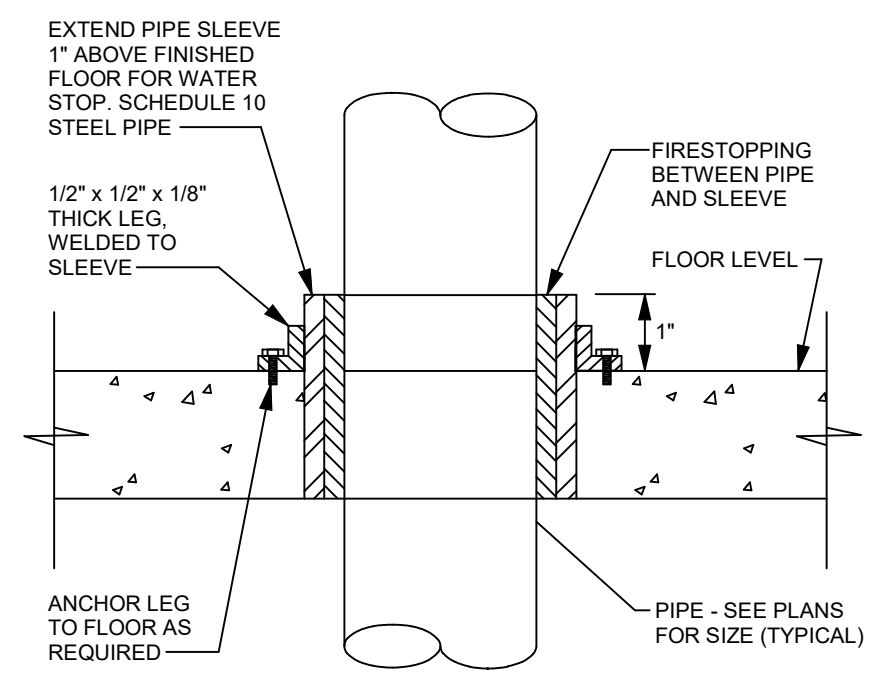




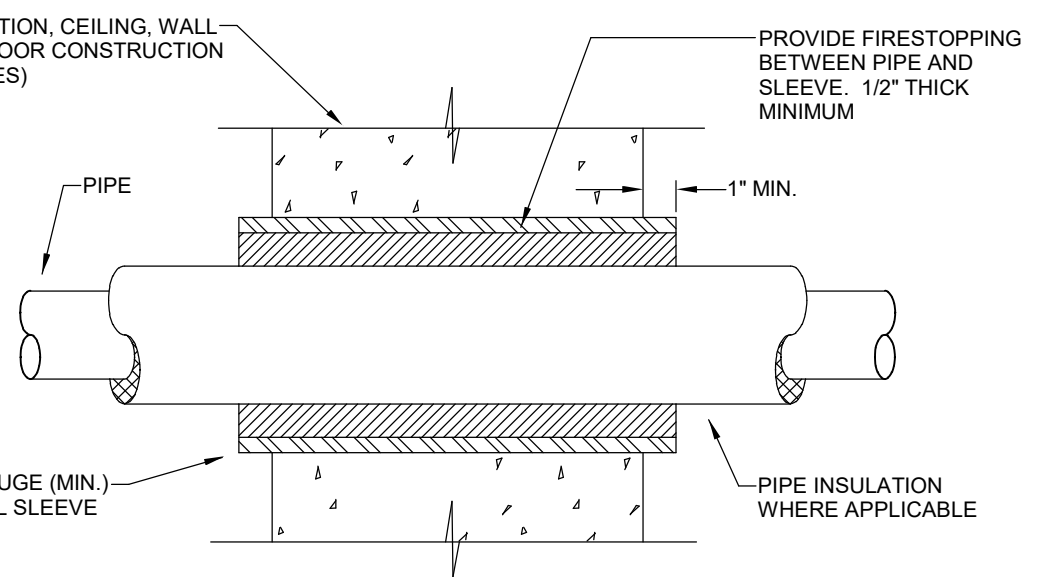
- CODED NOTES - DOMESTIC WATER ENTRANCE**
- 2" DOMESTIC COLD WATER MAIN FROM METER. SEE SITE UTILITIES PLAN DRAWING FOR CONTINUATION.
  - 2" DOMESTIC COLD WATER MAIN FROM "AG" METER. SEE SITE UTILITIES PLAN DRAWING FOR CONTINUATION.
  - 2" REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER WITH STRAINER AND O.S.&Y. GATE VALVES. PROVIDE SUPPORTS UNDER EACH VALVE. INSTALL WITH CENTERLINE OF PIPING AT 30" ABOVE FINISHED FLOOR AND 12" ABOVE FINISHED FLOOR. VERIFY MINIMUM AND MAXIMUM CLEARANCES WITH LOCAL WATER COMPANY.
  - AIR GAP FITTING. PIPE DRAIN LINE FULL SIZE TO FLOOR DRAIN.
  - MAIN SHUT-OFF VALVE.
  - TO BUILDING SYSTEM. SEE FLOOR PLANS FOR CONTINUATION.
  - TO TRUCK FILL. SEE FLOOR PLANS FOR CONTINUATION.
  - 3/4" DRAIN VALVE.

**DOMESTIC WATER ENTRANCE SCHEMATIC**  
SCALE: NONE

- NOTES:**
- COORDINATE WITH FIRE STOPPING MANUFACTURER TO INSURE UL LISTED ASSEMBLY.
  - CAULK ALL AROUND PIPE SLEEVE AT FLOOR PENETRATION.



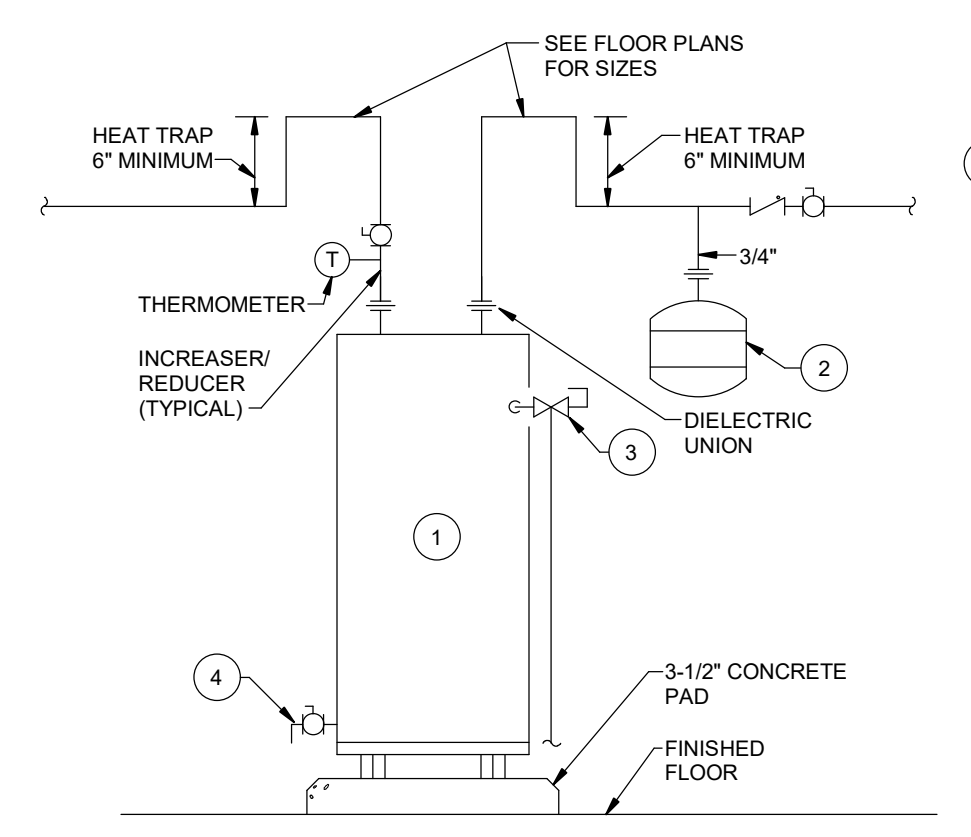
**SLEEVE DETAIL FOR PIPING PASSING THRU CONCRETE FLOOR SLAB**  
SCALE: NONE



- NOTES:**
- SPACE BETWEEN PIPE AND SLEEVE SHALL BE FREE OF ANY FOREIGN MATERIAL.
  - PIPE SHALL BE APPROXIMATELY CENTERED IN OPENING.

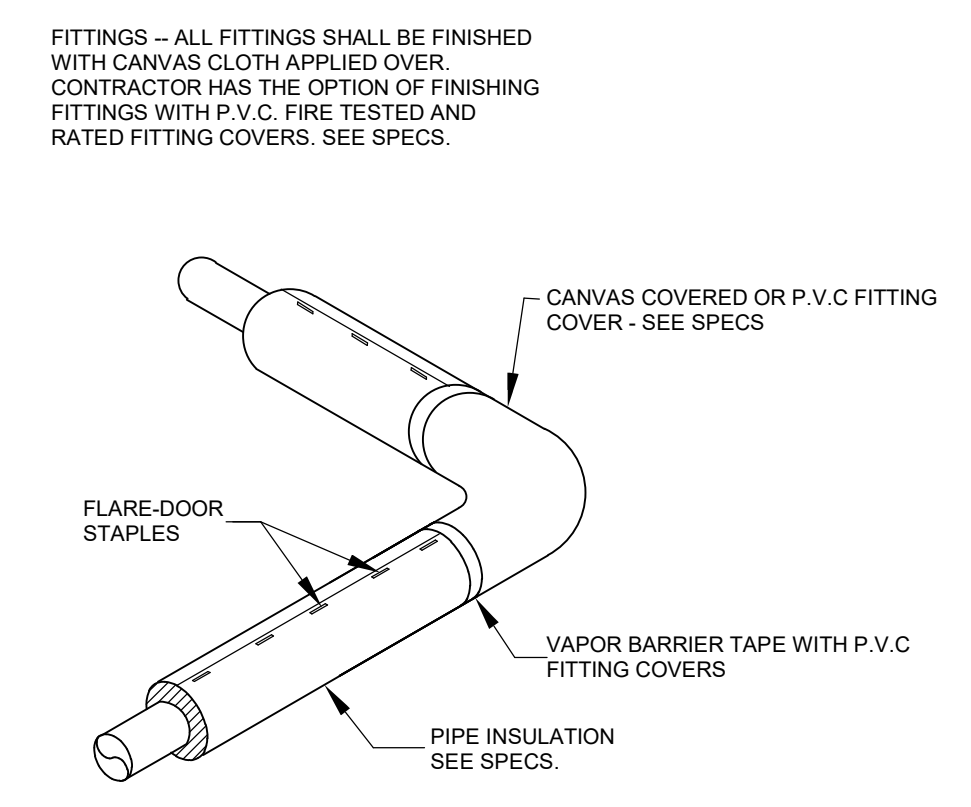
**TYPICAL FIRESTOPPING DETAIL**  
SCALE: NONE

FIXTURE SCHEDULE AND ROUGHING-IN REQUIREMENTS													
FIXTURE NUMBER	FIXTURE	MFR.	MODEL NO.	FLUSH VALVE, FAUCET	ACCESSORIES	MOUNTING	WALL HUNG, FLOOR MOUNTED, COUNTERTOP	MOUNTING HEIGHT (SEE REMARKS)	HOT	COLD	WASTE (MIN.)	VENT (MIN.)	REMARKS
WC-1	WATER CLOSET	ZURN	Z5665-BWL-1, VITREOUS CHINA	ZURN Z5600AV, 1.6 GPF, MANUAL	ZURN Z5950, ELONGATED SEAT WHITE	ADA	FLOOR	---	---	1'	4"	1'-1/2'	
U-1	URINAL	ZURN	Z3755-U, VITREOUS CHINA	ZURN Z5903AV, 1.0 GPF, MANUAL	---	ADA	WALL HUNG	---	---	3/4"	2"	1'-1/2'	SEE ARCHITECTURAL DETAILS FOR MOUNTING HEIGHTS.
L-1	LAVATORY	ZURN	Z5344 20"x18", VITREOUS CHINA	ZURN Z81000-XL SINGLE LEVER	GRID STRAINER, P-TRAP, STOPS & SUPPLIES	ADA	WALL HUNG	---	1/2"	1/2"	1'-1/4" P-TRAP	1'-1/2'	SEE ARCHITECTURAL DETAILS FOR MOUNTING HEIGHTS.
S-1	2 COMPARTMENT SINK	JUST	DLN-ADA-1033-A-GR, 17"x33"x8 STAINLESS STEEL	ZURN Z87105-XL, 2.2 GPM, WRIST BLADE HANDLES, GOOSE NECK SPOUT	CUP STRAINER, P-TRAP, STOPS & SUPPLIES	SEE ARCH. DWGS	COUNTER SELF RIMMING	---	1/2"	1/2"	1'-1/2" P-TRAP	1'-1/2'	
SS-1	SERVICE SINK	FIAT	TAT1 - SINGLE COMPARTMENT WITH LEGS	SWING SPOUT FAUCET PROVIDED WITH SINK	CUP STRAINER, P-TRAP, STOPS & SUPPLIES	STANDARD	FLOOR MOUNTED	---	1/2"	1/2"	1'-1/2" P-TRAP	1'-1/2'	
SH-1	SHOWER STALL	CLARION	3837BF, 38"x38"x78-3/4" BARRIER FREE	AMERICAN STANDARD 1602SC 223 COMMERCIAL SHOWER SYSTEM	PRESSURE BALANCING VALVE, FIXED HEAD & HAND HELD SHOWER & DIVERTER	ADA	RECESSED FLOOR MOUNTED	---	1/2"	1/2"	2"	1'-1/2'	FOLD UP SEAT, SHOWER CURTAIN, VACUUM BREAKER, IN-LINE BACKFLOW PREVENTER, QUICK DISCONNECT FOR FLEXIBLE HOSE.
EW-1	WATER COOLER	ELKAY	LZSG8	---	P-TRAP, SHUT-OFF VALVE, FRONT ACCESS PANEL	STANDARD	WALL HUNG	---	---	1/2"	1'-1/2"	1'-1/2'	VANDAL RESISTANT, WATER FILTER
EW-2	WATER COOLER WITH BOTTLE FILLER	ELKAY	LZSGRWSK	---	P-TRAP, SHUT-OFF VALVE, FRONT ACCESS PANEL	ADA	WALL HUNG	---	---	1/2"	1'-1/2"	1'-1/2'	MOUNT ADA BUBBLER WITH SPOUT 30" FROM FLOOR, VANDAL RESISTANT, WATER FILTER
EW-1	EYEFACE WASH	GUARDIAN	G1750BC	GUARDIAN G3000 THERMOSTATIC MIXING VALVE (TMV-1)	WALL BRACKET	SEE ARCH. DWGS	WALL HUNG	---	1/2"	1/2"	1'-1/2" P-TRAP	1'-1/2'	

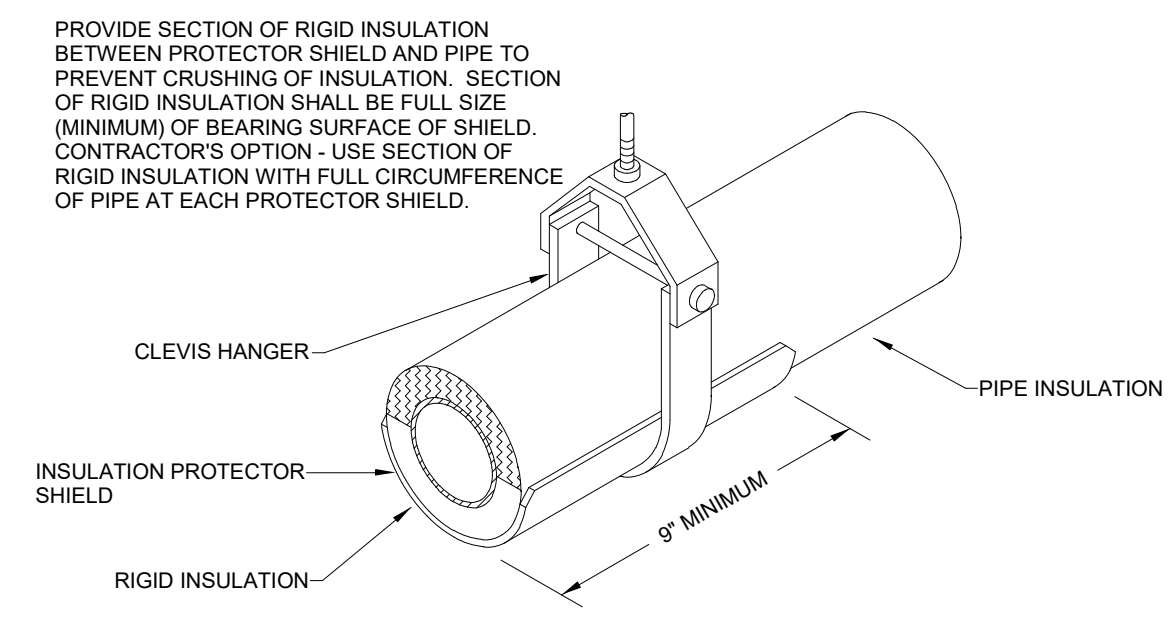


- CODED NOTES - WATER HEATER DETAIL**
- ELECTRIC WATER HEATER - LOCHINVAR MODEL NO. KTA052, 50 GALLON STORAGE, 9 KW (2 AT 4.5 KW EACH ELEMENT, 240 VOLT, 1-PHASE).
  - EXPANSION TANK - AMTROL THERMOTROL MODEL NO. ST-62, 2.0 GALLON TANK VOLUME, 0.9 GALLON ACCEPTANCE VOLUME, PRECHARGED AT 55 PSIG, ASME TANK.
  - TEMPERATURE-PRESSURE RELIEF VALVE. PIPE DISCHARGE LINE FULL SIZE DOWN TO FLOOR DRAIN.
  - INSTALL DRAIN LINE WITH SHUT-OFF VALVE. ROUTE FULL SIZE TO FLOOR DRAIN.

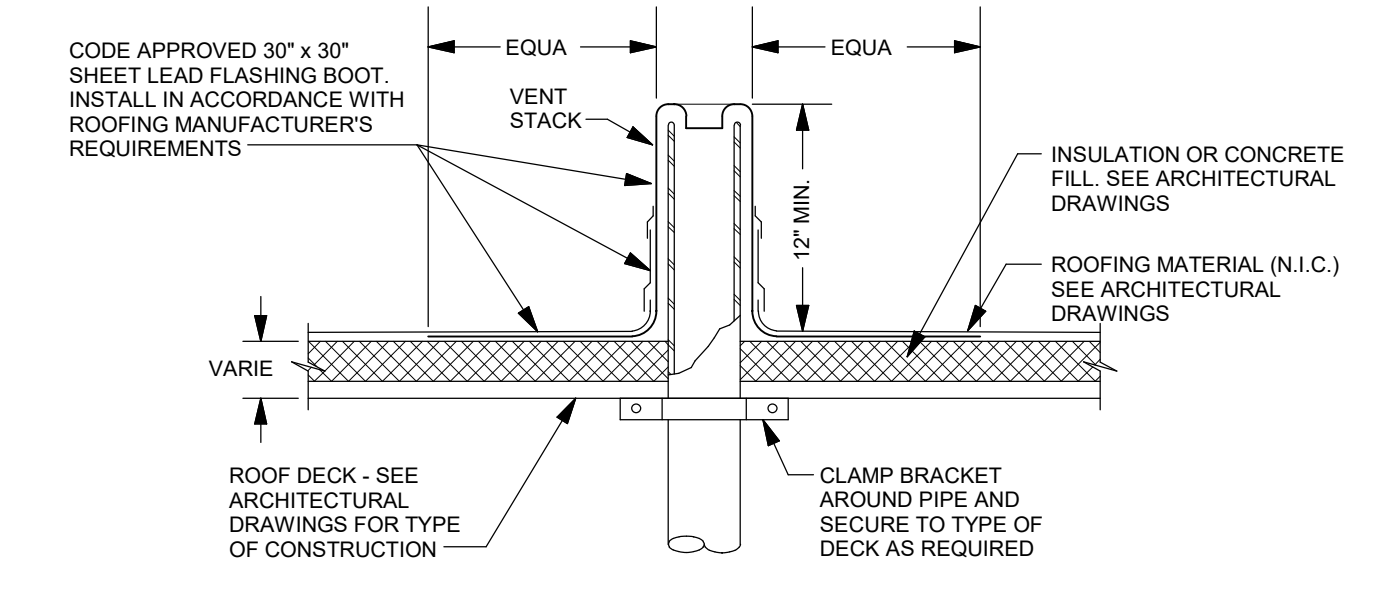
**ELECTRIC WATER HEATER SCHEMATIC PIPING DETAIL**  
SCALE: NONE



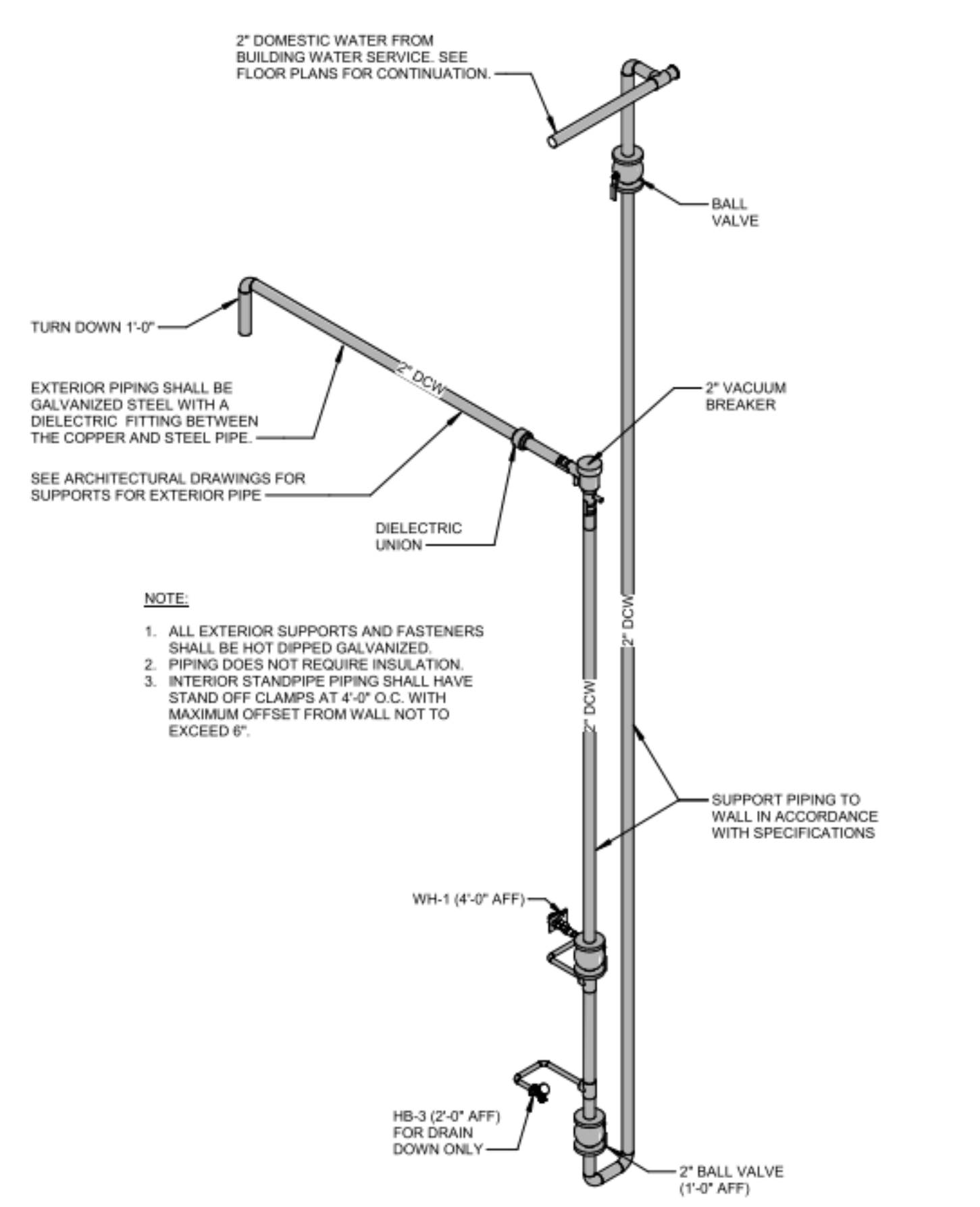
**TYPICAL DETAIL OF INSULATION AT PIPE FITTING**  
SCALE: NONE



**TYPICAL PIPE SUPPORT DETAIL WITH SHIELD**  
SCALE: NONE



**VENT-THRU-ROOF DETAIL**  
SCALE: NONE



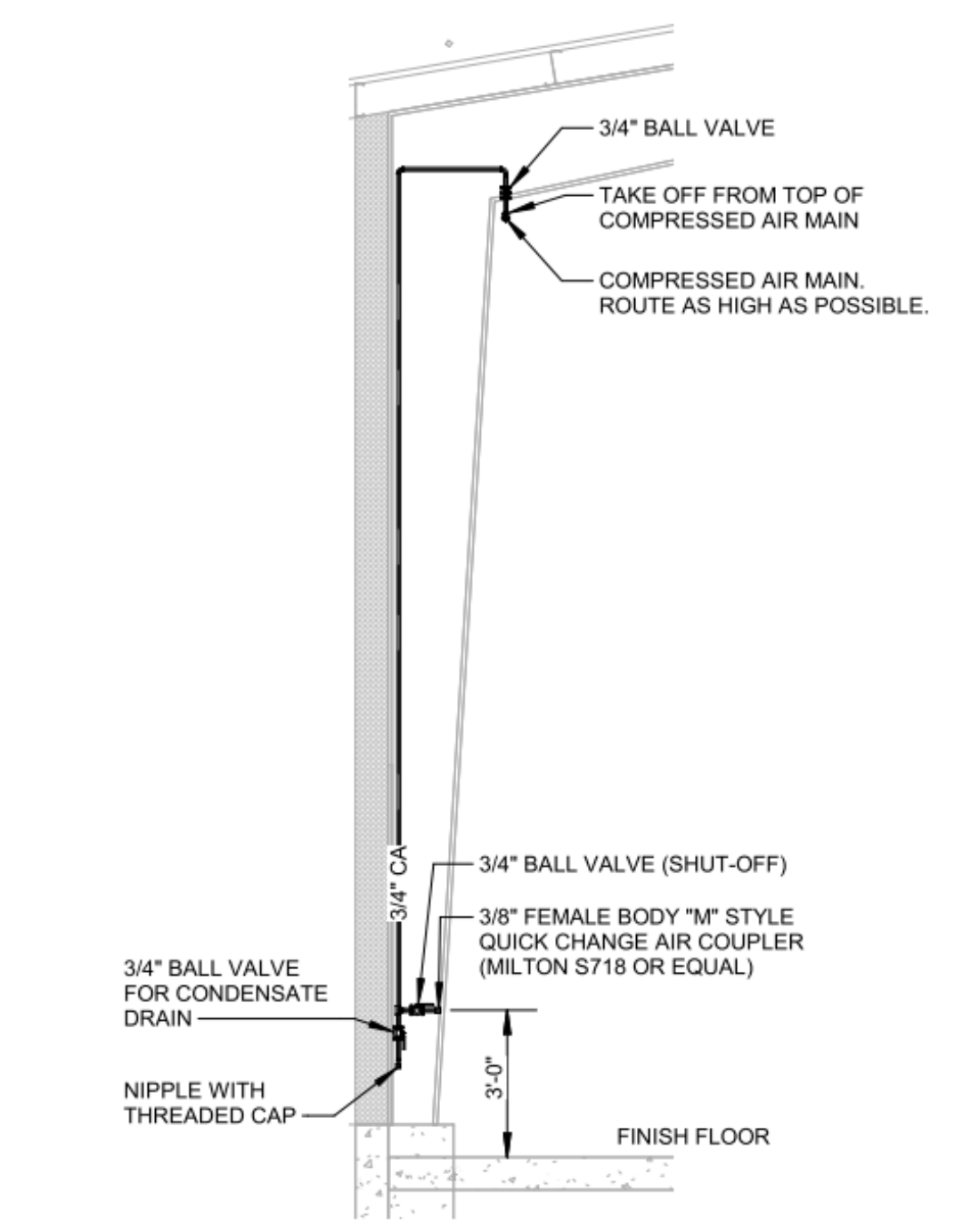
**TRUCK WATER FILL DETAIL**  
SCALE: NONE

**GENERAL NOTES - PLUMBING**

- PIPING IN ROOMS WITH SUSPENDED CEILINGS SHALL BE ABOVE CEILINGS UNLESS OTHERWISE NOTED.
- THE CONTRACTOR SHALL INSTALL FULL SIZE INDIRECT WASTES FROM EQUIPMENT REQUIRING SAME TO NEAREST FLOOR DRAIN UNLESS OTHERWISE NOTED.
- LOCATIONS OF PIPING AND EQUIPMENT ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENT IN THE FIELD. DO NOT SCALE THE DRAWINGS.
- ALL OFFSETS IN PIPING ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL OFFSETS WHERE NECESSARY.
- COORDINATE WITH MECHANICAL AND ELECTRICAL CONTRACTORS TO AVOID INTERFERENCES WITH PIPING, DUCTS AND CONDUIT.
- INSTALL PIPING AND EQUIPMENT IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- SEAL AIRTIGHT AROUND ALL PIPING PENETRATIONS THROUGH WALLS, FLOOR AND ROOF.
- VERIFY EXACT LOCATIONS OF ALL PLUMBING ROUGH-INS WITH ARCHITECT.
- SLEEVES IN FLOORS SHALL EXTEND 1" ABOVE FINISHED FLOOR AND BE CAULKED FOR WATERTIGHT INSTALLATION. SEE SPECIFICATIONS.
- SEE H.V.A.C. DRAWINGS FOR ADDITIONAL DETAILS APPLICABLE TO PLUMBING SYSTEM INSTALLATION.
- SET EQUIPMENT PRESSURE REGULATING VALVE OUTLET PRESSURE WHERE NOTED ON DRAWINGS AT EQUIPMENT MANUFACTURER'S REQUIREMENTS.
- COORDINATE WITH OWNER AND PROVIDE ADDITIONAL PIPING, DRAINS, VALVES, AND CONNECTIONS AS REQUIRED FOR OWNER FURNISHED EQUIPMENT. FINAL CONNECTIONS BY PLUMBING CONTRACTOR.

FLOOR DRAIN SCHEDULE					
TYPE	MANUFACTURER	MODEL NO.	BODY	TOP	REMARKS
FD-1	JAY R. SMITH	2005Y	DUCA CAST IRON	NICKEL BRONZE	1 5 6
FD-2	JAY R. SMITH	2005Y	DUCA CAST IRON	NICKEL BRONZE	3
FD-3	JAY R. SMITH	2005Y	DUCA CAST IRON	NICKEL BRONZE	4 5 6
TD-1	ZURN	Z-886-E-1J4-VP-JDGDG-USA-08	FIBER REINFORCED POLYMER	DUCTILE IRON SLOTTED	2

- REMARKS:**
- 3" ADJUSTABLE FLOOR DRAIN, 6" DIAMETER TOP, NICKEL BRONZE STRAINER.
  - 4" NO-HUB BOTTOM OUTLET, CLOSED END CAPS, BOTTOM DOME STRAINER, JOINT CONNECTORS AND ALL REQUIRED ACCESSORIES 60 FEET IN LENGTH, SEE ARCHITECTURAL PLANS.
  - 4" HEAVY DUTY ADJUSTABLE FLOOR DRAIN, 8" DIAMETER TOP, NICKEL BRONZE STRAINER.
  - 4" ADJUSTABLE FLOOR DRAIN, 6" DIAMETER TOP, NICKEL BRONZE STRAINER.
  - DRAINS INDICATED ON THE DRAWINGS WITH A PREFIX "F" SHALL BE PROVIDED WITH A X-3591 8-1/4"X 3-1/4" OVAL FUNNEL, 4-1/2" HIGH WITH NICKEL BRONZE FINISH.
  - FLOOR DRAINS INDICATED ON THE DRAWINGS WITH A SUFFIX "TP" SHALL BE PROVIDED WITH A TRAP PRIMER ADAPTOR FITTINGS.



**COMPRESSED AIR DROP DETAIL**  
SCALE: NONE

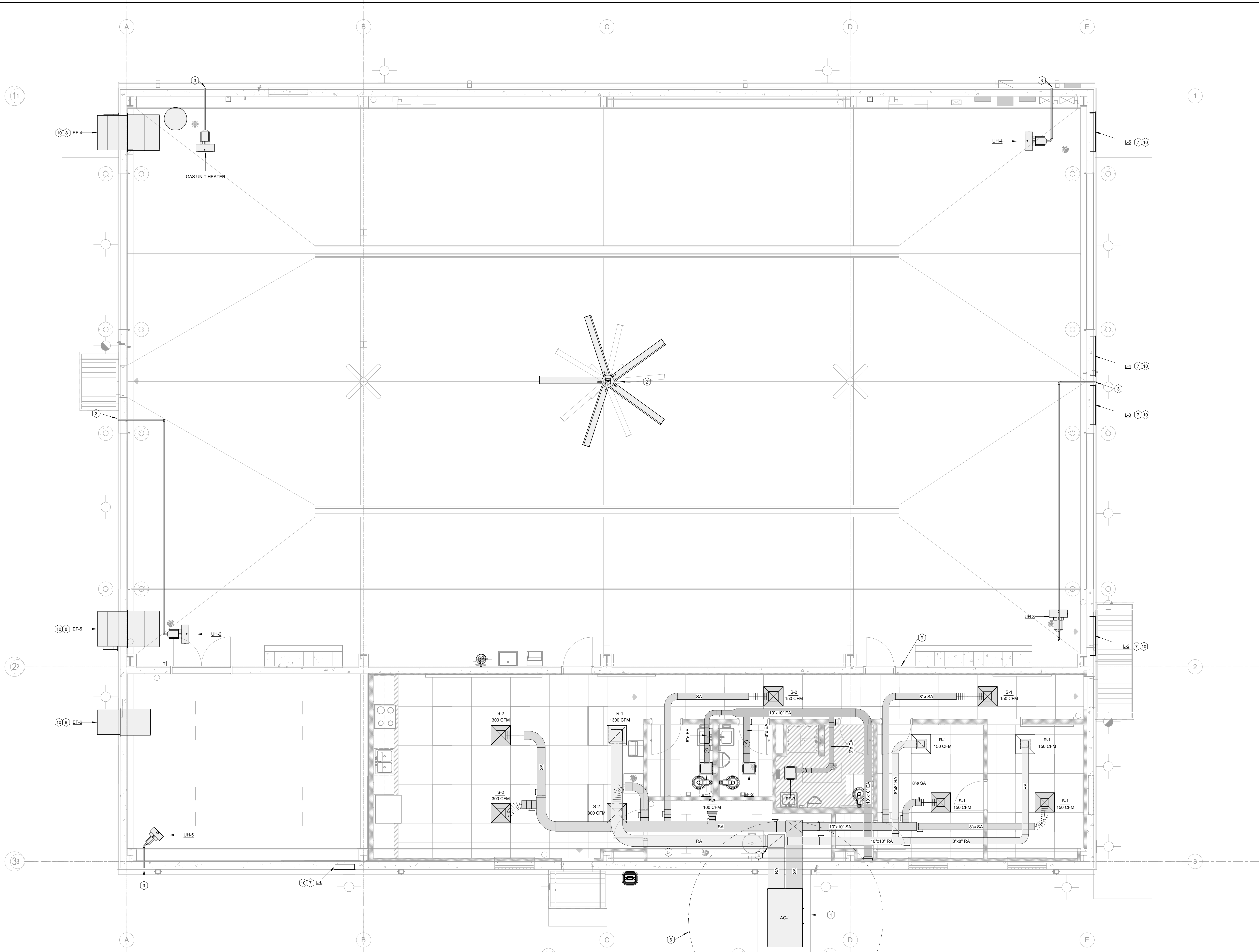
	DRAWING INFORMATION		KYTC MAINTENANCE FACILITY CASEY COUNTY, KENTUCKY		DRAWING NO. P300
	A & E FILE NO.	2011	PLUMBING DETAILS AND SCHEDULES		
	DRAWING DATE	12/16/2020	ACCOUNT NO.	609-C9NW-Z001-A10	
	DRAWN BY	CGS	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		
CHECKED BY	CKK	PHASE	RTA	AS-BUILT DATE	DECA LOG # A1C-8654
RTA DATE	12/16/2020				28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859.273.3700 / FAX 859.271.6605 REVISION HISTORY OF THIS DRAWING
DESCRIPTION OF REVISIONS		DATE	DESCRIPTION OF REVISIONS		DATE
1		5			
2		6			
3		7			
4		8			

NOTE: IT IS NOT INTENDED THAT THE PLANS SHOW ALL OFFSETS IN PIPES, CONDUITS, AND DUCTS REQUIRED FOR INSTALLATION OF THE WORK. DETAILS AND SECTIONS ARE INCLUDED FOR SOME AREAS TO SHOW INTENDED RELATIONSHIP OF THE WORK OF VARIOUS TRADES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SUBCONTRACTORS TO COORDINATE INSTALLATION OF THE WORK AND TO PROVIDE THE NECESSARY OFFSETS, TRANSFORMATIONS, AND FITTINGS REQUIRED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR CORRECTION CONFLICTS BETWEEN THE WORK OF VARIOUS TRADES. DETAILS AND SECTIONS ARE SHOWN FOR THE CONTRACTORS CONVENIENCE AND SHALL NOT BE CONSIDERED COMPLETE IN EVERY DETAIL.



- GENERAL NOTES - H.V.A.C.
- A. DUCTWORK AND PIPING IN ROOMS WITH SUSPENDED CEILINGS SHALL BE ABOVE CEILING EXCEPT IN EQUIPMENT ROOMS.
  - B. INSTALL AIR VENTS AT HIGH POINTS IN PIPING AND DRAINS IN LOW POINTS.
  - C. LOCATIONS OF PIPING, DUCT AND EQUIPMENT ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENTS IN THE FIELD. DO NOT SCALE THE DRAWINGS.
  - D. ALL OFFSETS IN DUCTS AND PIPING ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL OFFSETS WHERE NECESSARY.
  - E. ALL INCREASERS AND REDUCERS IN PIPING SYSTEMS ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL INCREASERS AND REDUCERS WHERE REQUIRED.
  - F. COORDINATE WITH PLUMBING, SHEET METAL AND ELECTRICAL CONTRACTORS TO AVOID INTERFERENCE WITH PIPING, DUCTS AND CONDUIT.
  - G. INSTALL ALL PIPING, DUCTWORK AND EQUIPMENT IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS.
  - H. SEAL AIRTIGHT AROUND ALL DUCT AND PIPING PENETRATIONS THROUGH WALLS AND FLOORS.
  - J. SEAL ALL DUCTWORK WITH DUCT SEALANT AND/OR DUCT CEMENT IN ACCORDANCE WITH SPECIFICATIONS SECTION "METAL DUCTWORK".
  - K. DIMENSIONS FOR DUCTS ARE INSIDE DIMENSIONS.
  - L. SEE ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF GRILLES AND DIFFUSERS IN CEILINGS.
  - M. DO NOT RUN ANY PIPING OR DUCTWORK OVER ANY ELECTRICAL OR ELEVATOR EQUIPMENT.
  - N. INSTALL ACCESS DOOR IN DUCT ADJACENT TO EACH MOTOR OPERATED DAMPER.
  - P. ROLL FITTINGS IN ROUND DUCT AS REQUIRED FOR PROPER CONNECTIONS TO BRANCH DUCTS.
  - Q. WHERE SIZE OF DUCT PENETRATING A FIRE WALL OR PARTITION IS LESS THAN THE MINIMUM SIZE OF FACTORY MADE FIRE DAMPER OR DUCT ACCESS DOOR, THEN PROVIDE THE MINIMUM SIZE FACTORY MADE DAMPER AND/OR ACCESS DOOR AVAILABLE. INCREASE DUCT SIZE AS REQUIRED TO ACCOMMODATE TRANSITIONS UPSTREAM AND DOWN STREAM OF SIZE INCREASE.
  - R. ALL TRANSITIONS IN DUCTWORK ARE NOT NECESSARILY SHOWN. PROVIDE ADDITIONAL TRANSITIONS WHERE REQUIRED.
  - S. FIELD VERIFY EXISTING CONDITIONS AND ALL REQUIRED MEASUREMENTS BEFORE FABRICATING ANY PIPING, DUCTWORK OR EQUIPMENT.
  - T. INSTALL CONTROL DEVICES (SUCH AS SENSORS, SENSING WELLS, VALVES, DAMPERS, ETC.) FURNISHED BY CONTROLS SUPPLIER, IN DUCT AND PIPING SYSTEMS.

- CODED NOTES:
- 1. OUTDOOR PACKAGED UNIT. INSTALL ON 8" CONCRETE HOUSEKEEPING PAD.
  - 2. GREENHECK MODEL DC-S-14-13.1 V HIGH VOLUME LOW SPEED AMCA CERTIFIED 14 FT DIAMETER CEILING FAN. PERFORMANCE: 48,707 CFM, 186 FT/MIN AVERAGE AIR SPEED, 207 FT/MIN MAX AVERAGE AIR SPEED, 68 FAN RPM, 76 MAX FAN RPM. ELECTRICAL: 180W INPUT POWER, 240 VOLT, 1 PHASE, IP54 ENCLOSURE, 76 MAX MOTOR RPM, 5.5 SYSTEM FLA. PROVIDE WITH VFD (VFD), EXTRUDED ALUMINUM AIRFOILS, ALUMINUM WINGLET, NEMA-1 DISCONNECT SWITCH, AND 10 YR MECHANICAL WARRANTY.
  - 3. SIDEWALL CONCENTRIC VENT KIT FOR UNIT HEATER.
  - 4. DUCTWORK TO RISE CONCEALED IN THE BUILDING.
  - 5. ROUTE DUCT AS HIGH AS POSSIBLE IN SPACE.
  - 6. MAINTAIN AT MINIMUM 10'-0" RADIUS FROM OUTSIDE AIR INTAKE AND EXHAUST AIR STREAMS, GAS VENTS, DRIVEWAYS, ETC.
  - 7. COORDINATE LOUVER LOCATIONS WITH PRE-ENGINEERED METAL BUILDING FRAMING AND CROSS BRACING AND ARCHITECTURAL ELEVATIONS. (TYP.)
  - 8. COORDINATE EXHAUST FAN LOCATIONS WITH PRE-ENGINEERED METAL BUILDING FRAMING AND CROSS BRACING AND ARCHITECTURAL DRAWINGS.
  - 9. HIGH VOLUME LOW SPEED FAN VFD CONTROLLER FROM MANUFACTURER. PROVIDE INTERCONNECTION BETWEEN FAN AND CONTROLLER AS REQUIRED BY MANUFACTURER.
  - 10. PROVIDE MOTORIZED SHUT-OFF DAMPER ON LOUVER (COORDINATE VOLTAGE AND REQUIRED ELECTRICAL CONNECTION WITH ELECTRICAL CONTRACTOR). INTERLOCK DAMPER WITH ASSOCIATED EXHAUST FAN TO OPEN WHEN EXHAUST FAN IS IN OPERATION.



HVAC PLAN  
SCALE: 1/4" = 1'-0"

<p>STAGGS &amp; FISHER CONSULTING ENGINEERS, INC. 3564 Loch Tree Drive Lexington, KY 40517 609-271-3266</p>	DRAWING INFORMATION		KYTC MAINTENANCE FACILITY CASEY COUNTY, KENTUCKY		DRAWING NO. <b>H101</b> AS-BUILT DATE DECA LOG # <b>A1C-8655</b>
	A & E FILE NO.	2011	HVAC PLAN		
	DRAWING DATE	12/16/20	ACCOUNT NO.	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
	DRAWN BY	CKK	609-C9NW-Z001-A10		
CHECKED BY	CKK	RTA	RTA DATE	12/16/2020	
<p>Architecture   Interiors   Landscapes   Planning</p>		<p>STATE OF KENTUCKY CHRISTOPHER KEITH GOVERNOR</p>		<p>28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859-273-3700 / FAX 859-271-6605</p>	
REVISION HISTORY OF THIS DRAWING		REVISION HISTORY OF THIS DRAWING		REVISION HISTORY OF THIS DRAWING	
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE
1		5			
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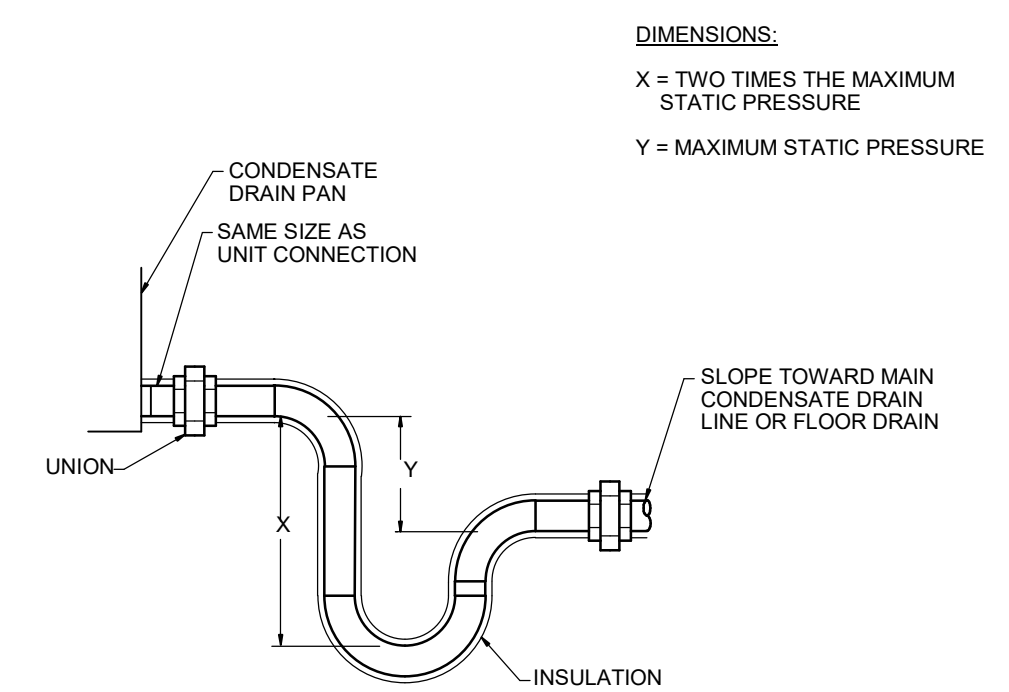
NOTE:  
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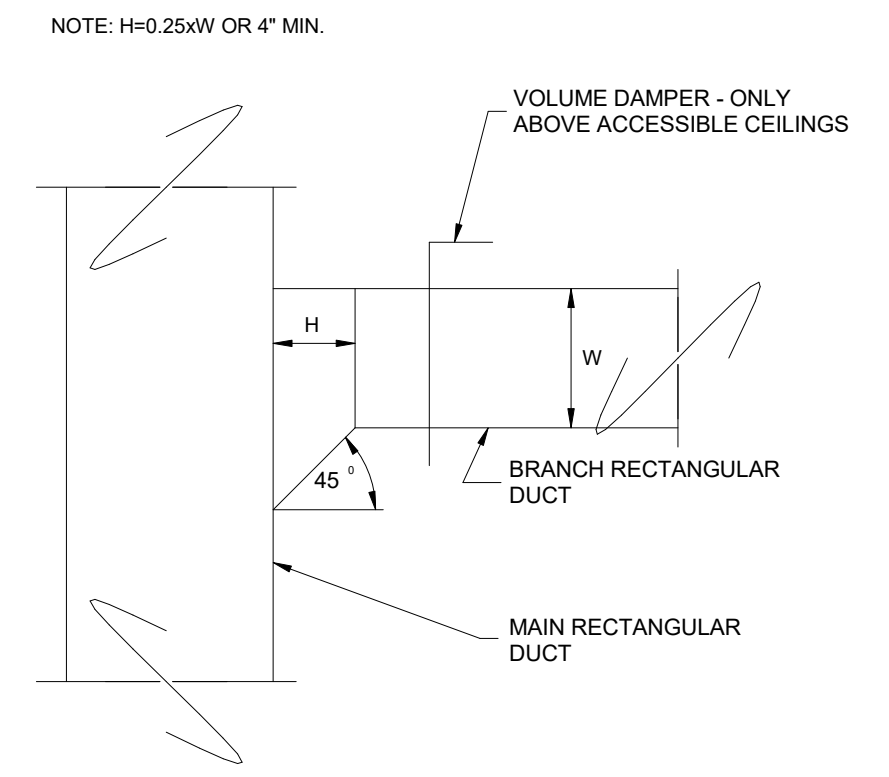
VENTILATING FANS

Table with columns: SYMBOL, MANUFACTURER, MODEL, SIZE, APPROX. UNIT WEIGHT (LBS.), MOUNTING, RATED CFM, E.S.P. IN. H2O, DRIVE, FAN RPM, MOTOR TYPE, MOTOR RPM, SONES, dBA, UNIT CONTROL, TOGGLE SWITCH, T-STAT, LIGHT SWITCH, WATTS, HP, VOLTAGE/PHASE, REMARKS.

- REMARKS: 1. PROVIDE UNIT WITH ALUMINUM INTAKE GRILLE WITH WHITE ENAMEL FINISH. 2. PROVIDE UNIT WITH FACTORY WIRE, PLUG-TYPE DISCONNECT. 3. PROVIDE UNIT WITH SOLID-STATE FAN SPEED CONTROL. COORDINATE INSTALLATION OF FIELD INSTALLED SPEED CONTROLLERS WITH ELECTRICAL CONTRACTOR.



CONDENSATE DRAIN TRAP DETAIL NO SCALE

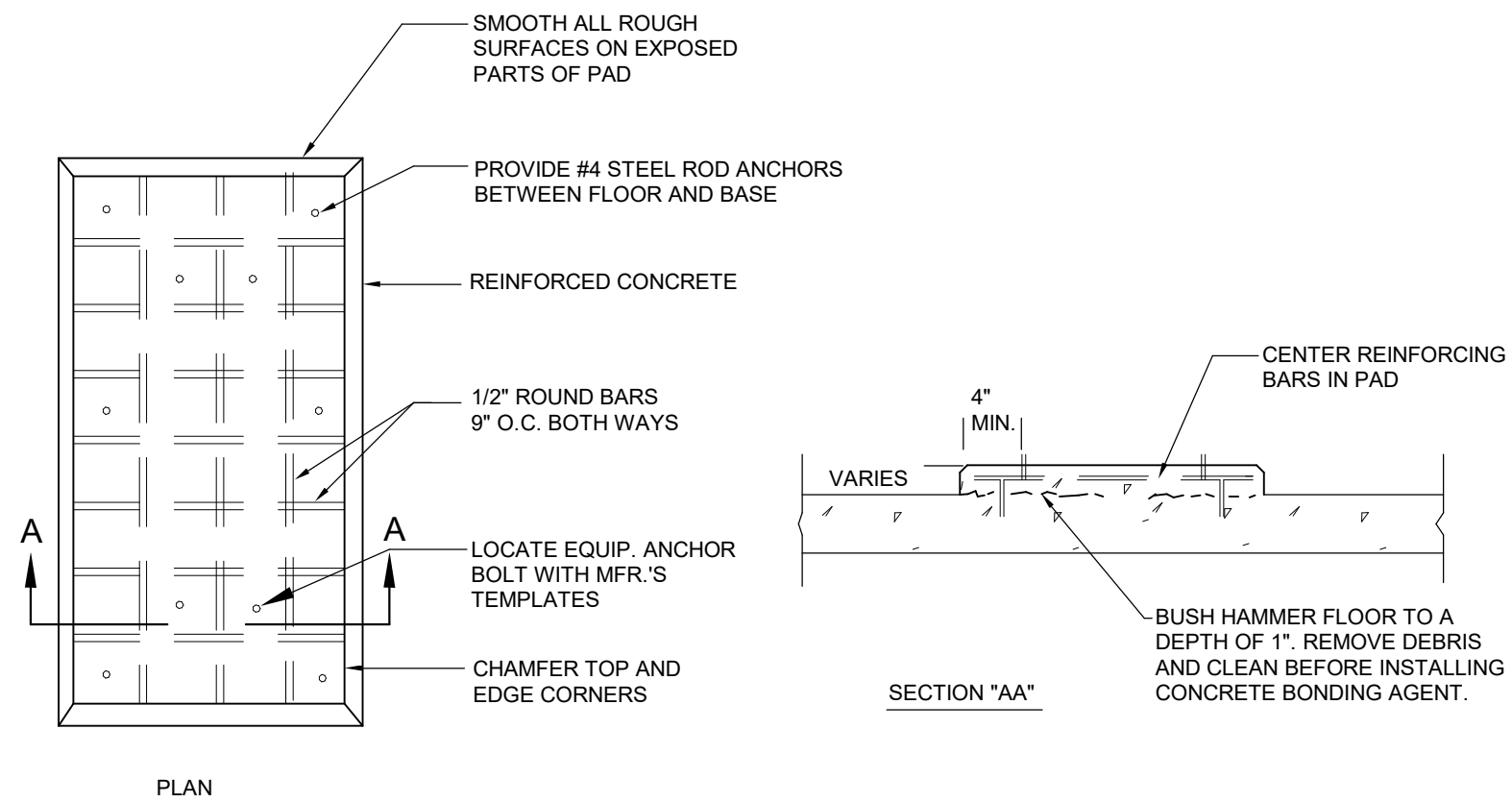


TYPICAL LOW PRESSURE RECTANGULAR DUCT TAKE-OFF NO SCALE

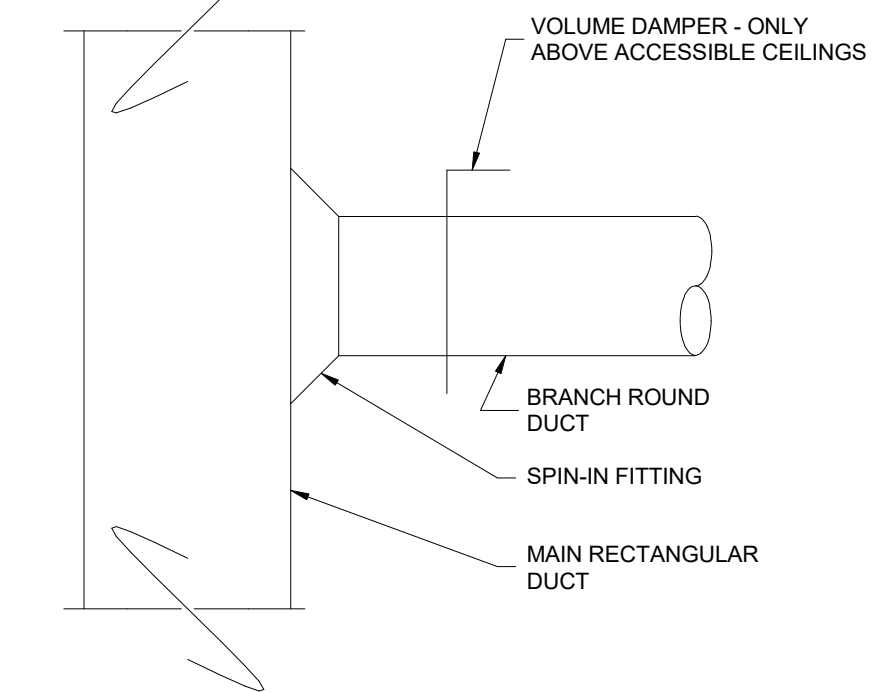
PACKAGED AIR CONDITIONING UNIT WITH NATURAL GAS HEAT

Table with columns: SYMBOL, MANUFACTURER, MODEL, SIZE, CONFIG., REFRIG., APPROX. UNIT WEIGHT (LBS.), OUTSIDE AIR CFM, SUPPLY FAN DATA, COOLING CAP, HEAT PERFORMANCE, ELECTRICAL CHAR., REMARKS.

- REMARKS: 1. COOLING PERFORMANCE IS BASED ON A 96 DEGREE F DB / 78 DEGREE F WB AMBIENT AIR TEMPERATURE AND 78 DEGREE F DB AND 65 DEGREE F WB RETURN AIR TEMPERATURE. HEATING PERFORMANCE IS BASED ON A 0 DEGREE F DB AMBIENT AIR TEMPERATURE AND A 70 DEGREE F DB RETURN AIR TEMPERATURE.



CONCRETE PAD DETAIL NO SCALE

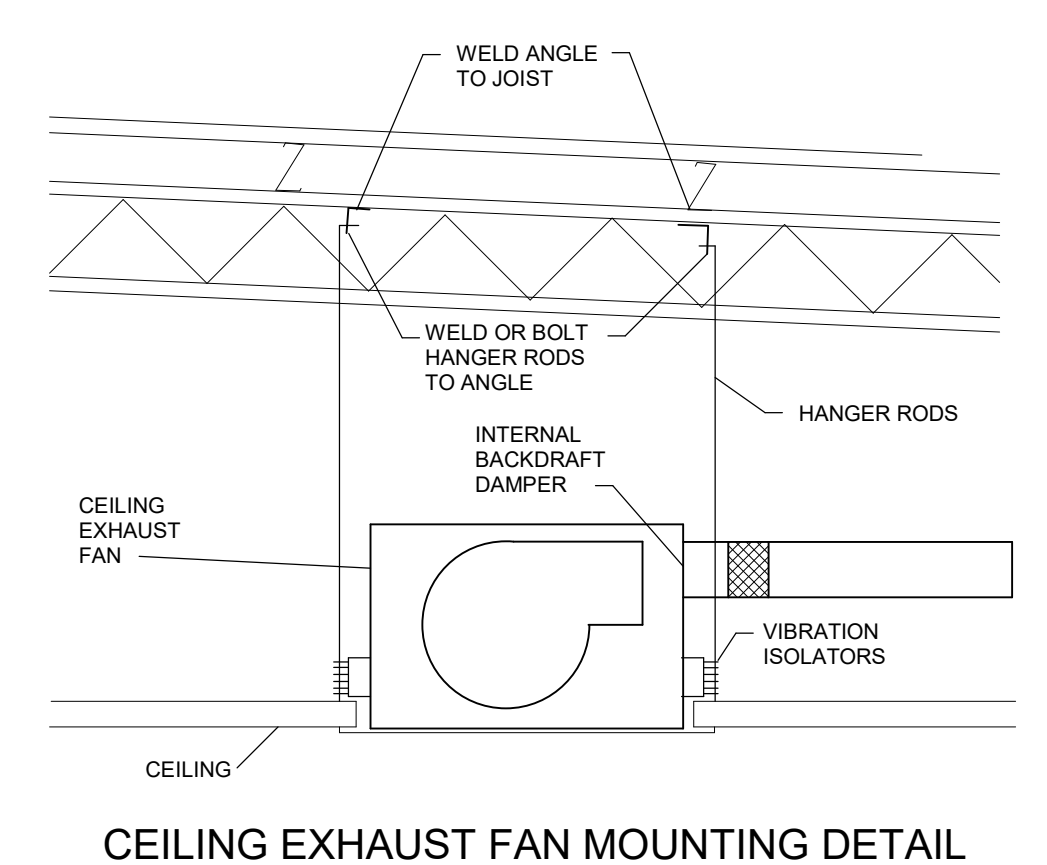


TYPICAL LOW PRESSURE ROUND DUCT TAKE-OFF NO SCALE

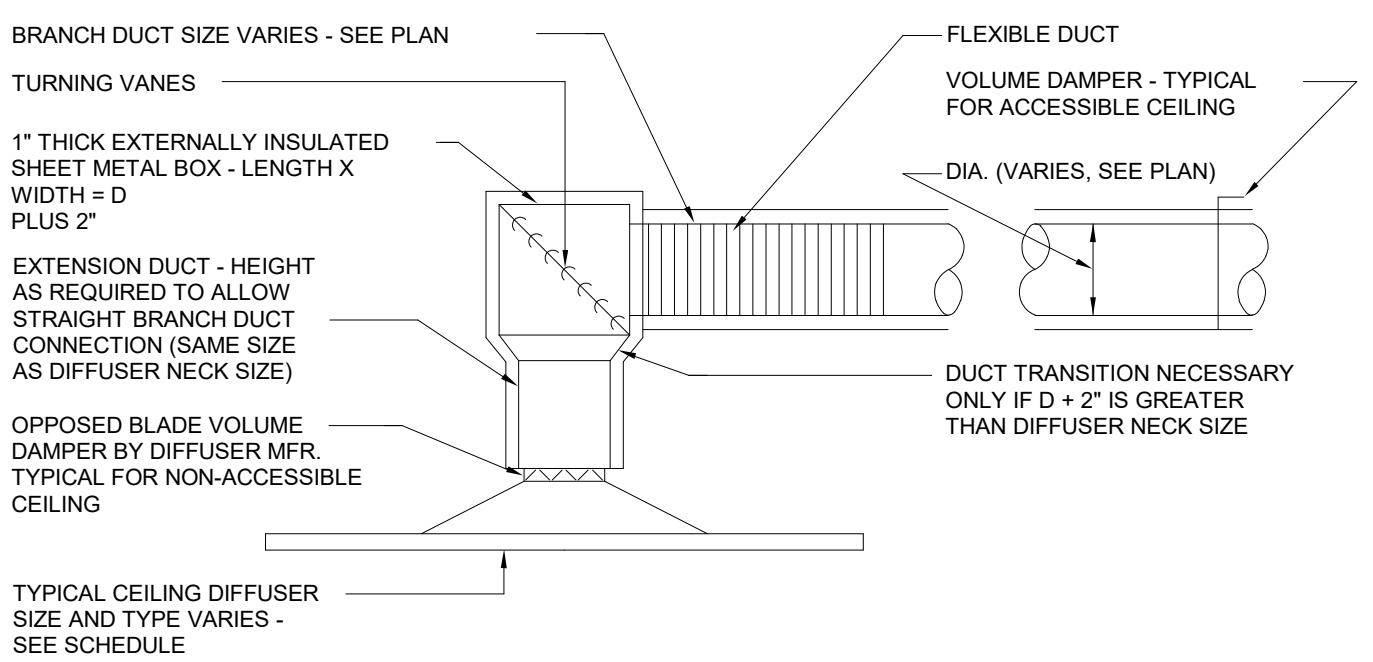
GAS FIRED UNIT HEATERS

Table with columns: SYMBOL, MANUFACTURER, MODEL, SIZE, CFM, FAN HP, MOUNTING HEIGHT, FUEL TYPE, INPUT MBH, OUTPUT MBH, EFF., TEMP. RISE (DEGREE F), VOLTAGE/PHASE, FLA AMPS, MOCP AMPS, REMARKS.

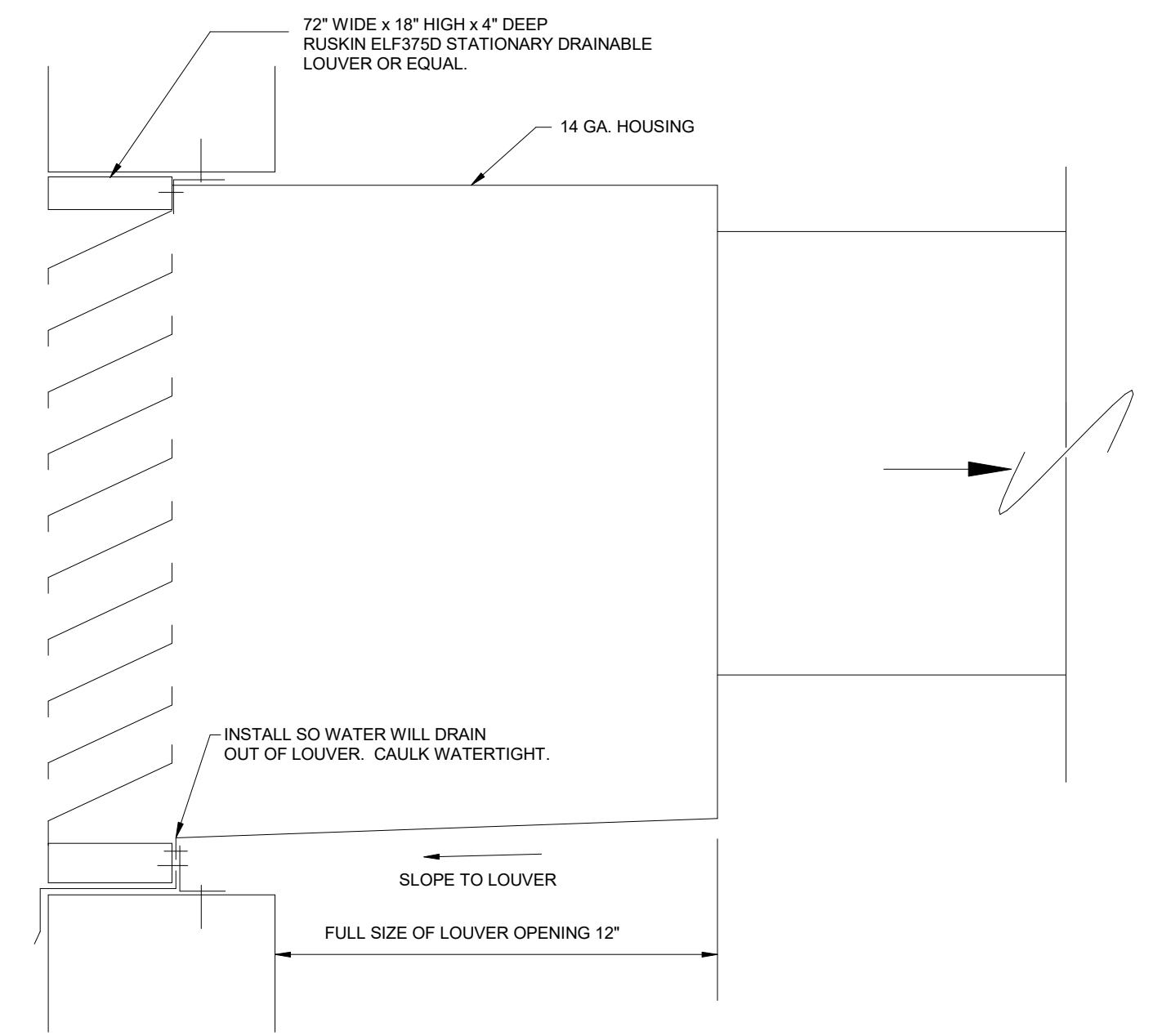
- REMARKS: 1. PROVIDE UNIT WITH FACTORY MOUNTED POWER EXHAUSTER. 2. PROVIDE UNIT WITH THERMAL OVERLOAD PROTECTION. 3. PROVIDE UNIT WITH DIRECT SPARK IGNITION.



CEILING EXHAUST FAN MOUNTING DETAIL NO SCALE



CONNECTION TO S.A. CEILING DIFFUSER NO SCALE



LOUVER MOUNTING DETAIL NO SCALE

LOUVERS

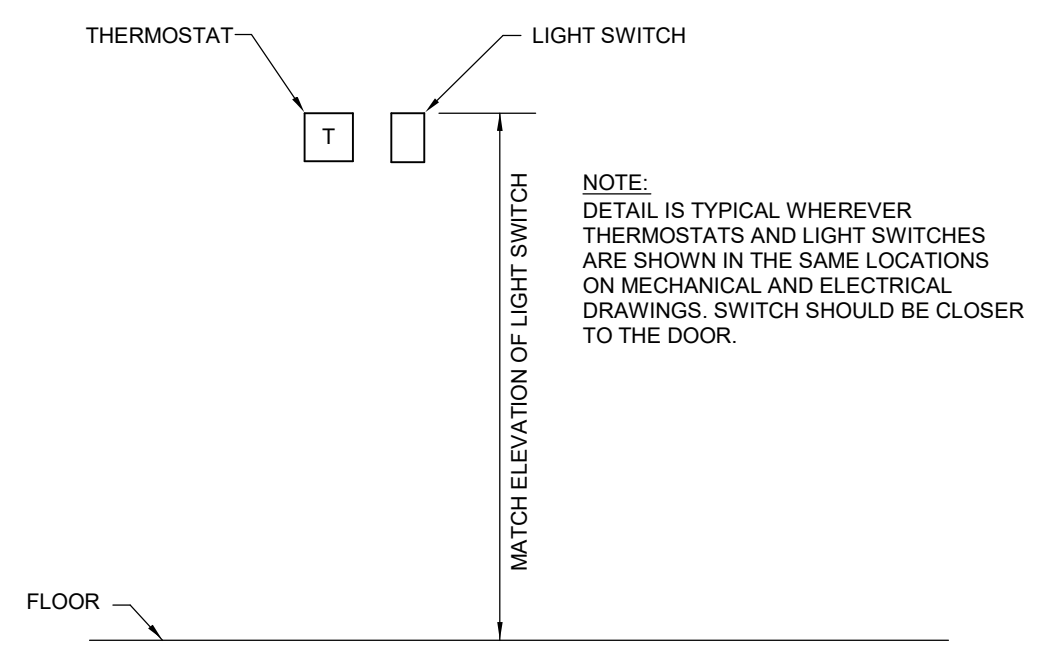
Table with columns: SYMBOL, MANUFACTURER, DESCRIPTION, MODEL/TYPE, SIZE (INCHES), CFM, FREE AREA SQ. FT., FREE AREA VELOCITY (FPM), P.D. IN. W.C., TYPE OF FRAME AND MOUNTING, MOUNTING HEIGHT, REMARKS.

- REMARKS: 1. MOUNTING HEIGHT MEASURED FROM BOTTOM OF LOUVER TO TOP OF FINISHED FLOOR. REFER TO ARCHITECTURAL PLANS FOR FINISHED MOUNTING HEIGHT AND LOCATION.

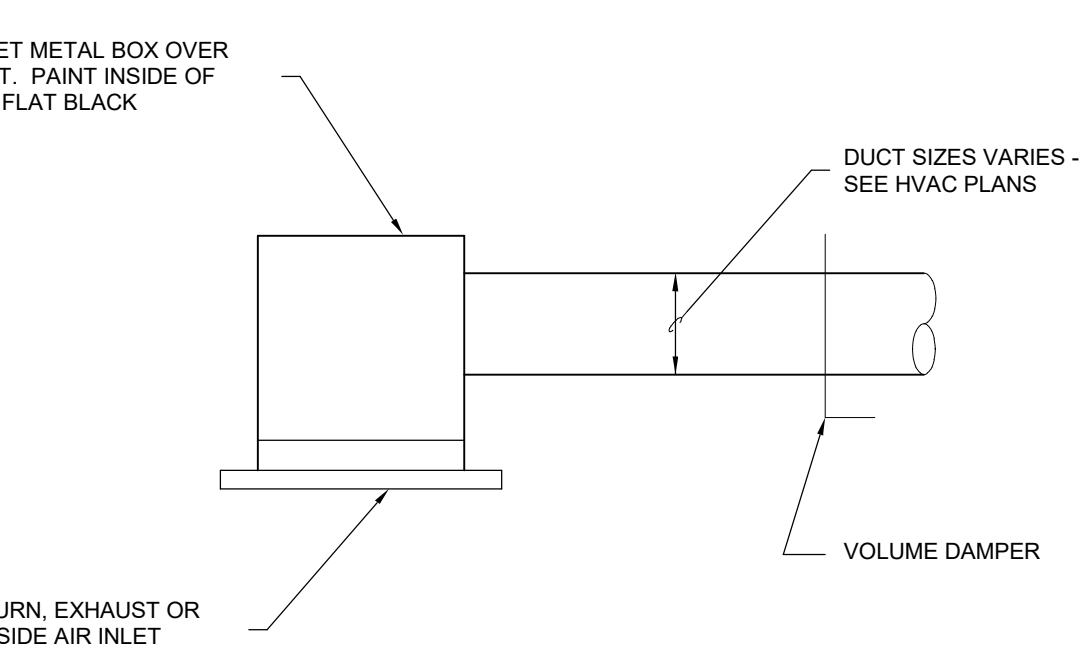
GRILLES, REGISTERS AND DIFFUSERS

Table with columns: SYMBOL, MANUFACTURER, MODEL, PANEL SIZE, NECK SIZE INCHES, CORE TYPE, CFM, P.D. (IN. W.G.), THROW (FT.), DIRECTION OF THROW, NC, MOUNTING, REMARKS.

- REMARKS: 1. FURNISH DIFFUSERS WITH SQUARE-TO-ROUND NECK TRANSITIONS AS REQUIRED. 2. FURNISH ALL DIFFUSERS AND GRILLES WITH POWDER-COATED FINISH IN COLOR AS SELECTED BY ARCHITECT FROM ALL AVAILABLE OPTIONS.



THERMOSTAT MOUNTING DETAIL NO SCALE



CONNECTION TO RETURN, EXHAUST OR OUTSIDE AIR INLET NO SCALE

Drawing information block including: STAGGS & FISHER CONSULTING ENGINEERS, INC., KYTC MAINTENANCE FACILITY CASEY COUNTY, KENTUCKY, HVAC SCHEDULES & DETAILS, H102, AS-BUILT DATE, DECA LOG # A1C-8656, and a revision table.

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# ELECTRICAL LEGEND

EQUIPMENT, CONDUITS, ETC.	
	CONDUIT BELOW FLOOR
	CONDUIT ABOVE FLOOR
	ENTRANCE POINT OF CONDUIT THROUGH FLOOR
	WIREWAY OR CABLE TRAY
	WIRE MOLD (FOR POWER AND/OR DATA)
	PANELBOARD OR TERMINAL CABINET (REFER TO PLANS AND RISER FOR SIZE)
	SECTIONAL SWITCH GEAR (REFER TO PLANS AND RISER FOR NUMBER OF SECTIONS AND LAYOUT)
	TRANSFORMER (REFER TO PLANS AND RISER FOR SIZE)
	JUNCTION BOX
	ENCLOSED CIRCUIT BREAKER
	DISCONNECT SWITCH
	FUSED DISCONNECT
	COMBINATION MAGNETIC STARTER AND FUSED SWITCH
	MOTOR
	WIRE / CONDUIT
	BOTTOM OF DEVICE (IN INCHES A.F.F.)
	SEE NOTE 1 THIS SHEET
	HEADWALL - FOR SERVICES, SEE DETAILS
	GROUND

LIGHTING & LIGHTING DEVICES	
	LIGHTING FIXTURES (REFER TO PLANS FOR TYPES OF FIXTURES THE LF# DESIGNATES THE TYPE OF FIXTURE)
	EMERGENCY LIGHTING FIXTURES (REFER TO PLANS FOR TYPES OF FIXTURES THE LF# DESIGNATES THE TYPE OF FIXTURE)
	WALL MOUNTED LIGHTING FIXTURES (REFER TO PLANS FOR TYPES OF FIXTURES THE LF# DESIGNATES THE TYPE OF FIXTURE)
	EMERGENCY WALL MOUNTED LIGHTING FIXTURES (REFER TO PLANS FOR TYPES OF FIXTURES THE LF# DESIGNATES THE TYPE OF FIXTURE)
	TRACK LIGHTING
	EMERGENCY TRACK LIGHTING
	WALL MOUNTED WARNING LIGHT
	EXIT LIGHT
	EXIT LIGHT WITH DIRECTION
	EXIT LIGHT (WALL MOUNTED)
	COMBINATION EMERGENCY BATTERY PACK AND EXIT SIGN
	EMERGENCY BATTERY PACK
	LIGHTING CONTROL RELAY
	EMERGENCY TRANSFER RELAY
	OCCUPANCY / VACANCY SENSOR
	WALL MOUNTED OCCUPANCY / VACANCY SENSOR
	PHOTO SENSOR
	LIGHTING CONTROL PANEL
	LF# = LIGHT FIXTURE TYPE TAG (REFER TO LIGHT FIXTURE SCHEDULE) 1 = CIRCUIT NUMBER a = SWITCHING ZONING DESIGNATION (IF APPLICABLE) NL = FIXTURE IS A NIGHT LIGHT (IF APPLICABLE)

WALL SWITCHES (BOTTOM 44" A.F.F.) (EXCEPT AS NOTED OTHERWISE)	
	SINGLE POLE
	DOUBLE POLE
	THREE-WAY
	FOUR-WAY
	LOW-VOLTAGE, MOMENTARY
	OCCUPANCY/VACANCY SENSOR SWITCH
	DIMMER
	PILOT LIGHT
	THERMAL OVERLOAD
	THERMAL OVERLOAD WITH PILOT LIGHT
	KEY OPERATED SWITCH
	LIGHTING CONTROL STATION
	MASTER LIGHTING CONTROL STATION

RECEPTACLES (BOTTOM 16" A.F.F.) (EXCEPT AS NOTED OTHERWISE)	
	DUPLEX CONVENIENCE OUTLET
	QUADPLEX CONVENIENCE OUTLET
	GROUND FAULT INTERRUPTING OUTLET
	WEATHERPROOF OUTLET
	SWITCHED/CONTROLLED DUPLEX OUTLET
	DUPLEX RECEPTACLE ON EMERGENCY CIRCUIT
	CEILING MOUNTED RECEPTACLE
	USB DUPLEX RECEPTACLE
	SIMPLEX WALL OUTLET (RATING AS NOTED)
	WALL OUTLET (240V, 1-PHASE) (RATING AS NOTED)
	WALL OUTLET (240V, 3-PHASE) (RATING AS NOTED)
	FLOOR BOX / POKE-THRU FOR POWER AND/OR DATA
	HOOD CONNECTION
	EQUIPMENT CONNECTION
	CONTROL RELAY

COMMUNICATIONS	
	TELECOMMUNICATIONS RACK
	DATA OUTLET (DATA & COMMUNICATIONS) MOUNTED AT 16" TO THE BOTTOM AFF (UNLESS OTHERWISE NOTED)
	COMMUNICATION OUTLET NOTATION: x0 xC xV x0 NUMBER OF DATA PORTS xC NUMBER OF CATV PORTS xV NUMBER OF VOICE PORTS
	GROUNDING BAR

SECURITY	
	CARD READER / PROXIMITY READER
	DOOR PUSH PLATE
	KEY PAD
	DOOR CONTACTS
	T.V./SECURITY CAMERA OUTLET
	T.V./SECURITY CAMERA OUTLET WALL MOUNTED
	MOTION DETECTOR
	SIREN
	AUDIO OR GLASS BREAK SENSOR

FIRE ALARM	
	FIRE ALARM BREAK/GLASS STATION (BOTTOM 44" A.F.F.)
	FIRE ALARM SPKR/FLASHING LIGHT (80" TO BOTTOM, WALL MNT)
	FIRE ALARM FLASHING LIGHT (80" TO BOTTOM, WALL MOUNTED)
	FIRE ALARM SPEAKER (80" TO BOTTOM, WALL MOUNTED)
	FIRE ALARM SPEAKER FLASHING LIGHT (CEILING MOUNTED)
	FIRE ALARM SPEAKER (CEILING MOUNTED)
	SINGLE STATION SMOKE DETECTOR (CEILING MOUNTED)
	ADDRESSABLE SMOKE DETECTOR (CEILING MOUNTED)
	DUCT TYPE SMOKE DETECTOR
	AUTOMATIC HEAT DETECTOR
	FIRE ALARM CONTROL PANEL
	FIRE ALARM ANNUNCIATOR PANEL
	ELECTROMAGNETIC DOOR HOLDER
	ELECTROMAGNETIC DOOR CLOSER
	TAMPERS
	FLOW SWITCH
	REMOTE TEST ACTIVATOR

SOUND AND INTERCOM	
	CEILING MOUNTED SPEAKER
	WALL MOUNTED SPEAKER
	WALL MOUNTED HORN
	ALARM TYPE SPEAKER
	VOLUME CONTROL
	MASTER INTERCOM STATION
	INTERCOM STATION
	MICROPHONE OUTLET IN FLOOR (FLUSH TYPE)
	MICROPHONE OUTLET IN WALL (BOTTOM 16" A.F.F.)
	CALL IN SWITCH

ELECTRICAL ABBREVIATIONS	
AFB	ABOVE FINISHED FLOOR
ATCP	AUTOMATIC TEMPERATURE CONTROL PANEL
C	CONDUIT
FA	FIRE ALARM
GF	GROUND FAULT INTERRUPTER
IG	ISOLATED GROUND
JB	JUNCTION BOX
TTC	TELEPHONE TERMINAL CABINET
W	WIRE
F	FLUSH
P	PEDESTAL
CKT	CIRCUIT
REC(S)	RECEPTACLE(S)
LTG	LIGHTING
NL	NIGHT LIGHT
AIC	AMPERE INTERRUPTING CAPACITY
UN	UNLESS OTHERWISE NOTED
WP	WEATHER PROOF
FACP	FIRE ALARM CONTROL PANEL
FAAP	FIRE ALARM ANNUNCIATOR PANEL
LCP	LIGHTING CONTROL PANEL

### ELECTRICAL DEMOLITION GENERAL NOTES:

- ALL ITEMS SHOWN AS DASHED TO BE DEMOLISHED, INCLUDING ALL CONDUIT, WIRE, JUNCTION BOXES, ETC. REMOVE WIRING COMPLETE BACK TO PANEL. EXISTING BREAKER IN PANEL TO REMAIN UNLESS OTHERWISE NOTED. EXISTING BOXES IN EXISTING BLOCK WALLS SHALL BE PROVIDED WITH A BLANK COVER PLATE. EXISTING CONDUIT IN BLOCK WALLS TO REMAIN AND CAPPED. CONDUIT ABOVE CEILING SHALL BE REMOVED COMPLETE BACK TO PANEL.
- BEFORE START OF WORK, THE CONTRACTOR SHALL CHECK ALL EXISTING DEVICES, LIGHT FIXTURES AND EQUIPMENT THAT IS NOTED OR REQUIRED TO BE REUSED TO SATISFY THEMSELVES THAT THEY ARE OPERATING PROPERLY. SHOULD ANY OF THE ITEMS NOT BE OPERATING, THE CONTRACTOR SHALL REPORT SAME TO THE ARCHITECT AND AWAIT DIRECTIONS. CONTRACTORS NOT COMPLYING WITH THE ABOVE WILL BE RESPONSIBLE FOR PROVIDING OPERATIONAL ITEMS AT HIS EXPENSE.
- IN EXISTING AREAS WHERE NEW WORK IS SHOWN, REMOVE ALL EXISTING EXPOSED CONDUITS, WIREMOLD, SURFACE AND FLUSH OUTLET BOXES, WIRING DEVICES, FIXTURES, PANELS, ETC. NOT REQUIRED FOR NEW ARRANGEMENT.
- INSTALL ALL NEW WORK AS INDICATED. FLUSH OUTLET BOXES MAY BE REUSED IF AT PROPER HEIGHT, LOCATION AND IN GOOD CONDITION. EXISTING CONCEALED CONDUITS MAY BE REUSED IF IN GOOD CONDITION. CIRCUITRY SHOWN ON PLANS SHALL GOVERN. ALL OTHER MATERIALS REMOVED SHALL BE REMOVED FROM THE JOB SITE OR TURNED OVER TO THE OWNER.
- MAINTAIN AND RESTORE, IF INTERRUPTED BY REMOVALS OR IN PATH OF NEW CONSTRUCTION, ALL CIRCUITS, CONDUITS AND FEEDERS PASSING THROUGH AND SERVING UNDISTURBED AREAS (SHOWN OR NOT SHOWN).
- WHERE ANY EXISTING OUTLET (ELECTRIC, COMMUNICATION, ETC.) IS NOTED OR REQUIRED TO BE REMOVED, THE CONTRACTOR UNDER THIS DIVISION SHALL CONNECT CONDUIT, PULL IN NEW CONDUCTORS AND RECONNECT AS REQUIRED FOR FEED-THRU OF CIRCUITS TO ENSURE ALL CIRCUITS DOWNSTREAM FROM REMOVED OUTLETS WILL REMAIN OPERATIONAL.
- IN GENERAL, REMOVE EXISTING WORK INDICATED. THE DRAWINGS SHOW EXISTING WORK TO THE EXTENT POSSIBLE. HOWEVER, ALL EXISTING WORK MAY NOT BE SHOWN ON THE DRAWINGS. REMOVE OR RELOCATE EXISTING MECHANICAL AND ELECTRICAL WORK THAT INTERFERES WITH NEW WORK EVEN IF IT IS NOT SHOWN ON THE DRAWINGS. RELOCATE EXISTING WORK THAT MUST REMAIN IN SERVICE THAT INTERFERES WITH NEW WORK EVEN IF IT IS NOT SHOWN ON THE DRAWINGS. TURN OVER TO OWNER REMOVED EXISTING EQUIPMENT AS INDICATED AND REMOVE OTHER REMOVED EXISTING WORK FROM PROJECT SITE.
- IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO REPAIR ANY HOLES LEFT IN THE EXISTING BUILDING FLOORS, WALLS, OR CEILINGS DUE TO THE DEMOLITION OF THE EXISTING ELECTRICAL SYSTEM.
- ELECTRICAL CONTRACTOR SHALL REMOVE ALL ELECTRICAL CONNECTIONS TO EQUIPMENT TO BE REMOVED. EXISTING EXPOSED CIRCUITS NOT TO BE REUSED SHALL BE REMOVED. EXISTING CONCEALED CIRCUITS NOT TO BE REUSED SHALL BE ABANDONED AFTER CONNECTIONS ARE REMOVED. CONDUITS EXPOSED BY CONSTRUCTION SHALL BE REMOVED.
- ALL ITEMS SHOWN AS HALF-TONE/GRAY ARE EXISTING AND ARE TO REMAIN.
- ALL EXISTING ELECTRICAL CONNECTIONS AND DEVICES NOT SPECIFICALLY INDICATED TO REMAIN AND NOT REQUIRED FOR THE NEW ARRANGEMENT SHALL BE REMOVED UNLESS OTHERWISE NOTED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO SURVEY THE SITE TO DETERMINE THE TOTAL SCOPE OF THE WORK.
- ALL ITEMS SHOWN AS HALF-TONE/GRAY ARE EXISTING AND ARE TO REMAIN.
- ALL EXISTING ELECTRICAL CONNECTIONS AND DEVICES NOT SPECIFICALLY INDICATED TO REMAIN AND NOT REQUIRED FOR THE NEW ARRANGEMENT SHALL BE REMOVED UNLESS OTHERWISE NOTED. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO SURVEY THE SITE TO DETERMINE THE TOTAL SCOPE OF THE WORK.
- IN REMOVED AREAS OF EXISTING BUILDING, EXISTING CONDUIT IS SHOWN AS OBTAINED FROM ORIGINAL BUILDING DRAWINGS FOR BID PURPOSES ONLY. CONTRACTOR SHALL VERIFY EXACT ROUTING AND LOCATION FOR RECONNECTING CIRCUITS AS SHOWN OR REQUIRED TO WORK WITH NEW SYSTEM.

### ELECTRICAL GENERAL NOTES:

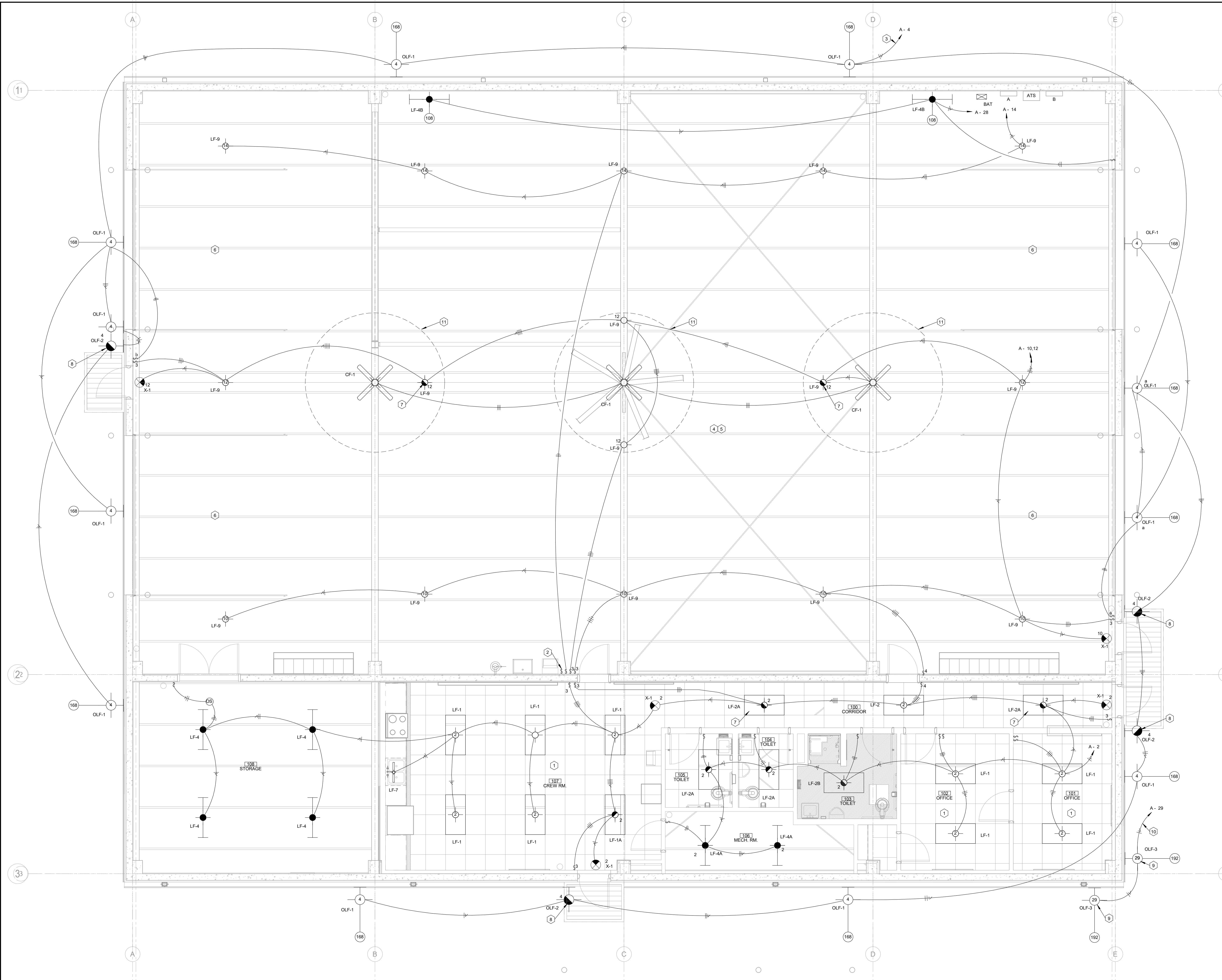
- INSTALL PANELBOARDS WITH THE TOP AT 6'-6" ABOVE FINISHED FLOOR.
- PROVIDE SUPPORTS FOR ALL VERTICAL CONDUIT RUNS IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.
- INSTALL SECONDARY UNDERGROUND CONDUCTORS A MINIMUM OF 36" DEEP TO TOP OF CONDUIT OR ENCASEMENT.
- FLUSH MOUNTED PANELBOARDS SHALL BE PROVIDED WITH FOUR (4) 1" SPARE CONDUITS CONCEALED IN WALL TO ABOVE ACCESSIBLE CEILING. TURN OUT 4" FROM WALL AND CAP.
- ELECTRICAL CONTRACTOR SHALL INSTALL ALL ELECTRICAL EQUIPMENT IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.
- PROVIDE A COPY OF ALL COMPLETED PANEL SCHEDULES IN THE O & M MANUAL.
- LIGHTS IN MECHANICAL SPACES SHALL BE LOCATED SO AS TO CLEAR PIPING, DUCTWORK, AND EQUIPMENT ON CEILING FIELD VERIFY.
- COORDINATE EXACT LOCATION OF ALL LIGHT FIXTURES WITH ARCHITECTURAL REFLECTED CEILING PLANS.
- FLEXIBLE CONDUIT SHALL BE USED FOR FIXTURE WHIPS TO LIGHT FIXTURES. FLEXIBLE CONDUITS TO LIGHT FIXTURES SHALL NOT EXCEED 6'-0" AND SHALL BE A MINIMUM OF 1/2".
- CHAIN FOR SUPPORTING LIGHT FIXTURES SHALL BE GALVANIZED STEEL WELL CHAIN WITH A MINIMUM DEAD WEIGHT CAPACITY OF 100 LBS.
- RECESSED LIGHTING FIXTURE WITH IN A GRID TYPE CEILING TO BE SUPPORTED INDEPENDENTLY FROM THE GRID. SUPPORT FIXTURE FROM STRUCTURE ABOVE WITH 12 GAUGE WIRE ONE ON EACH CORNER.
- WALL MOUNTED OCCUPANCY/VACANCY SENSORS SHALL BE MOUNTED AND INSTALLED IMMEDIATELY BELOW THE CEILING AND PER THE MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR BEST COVERAGE. REFER TO ARCHITECTURAL DRAWINGS FOR CEILING HEIGHTS.
- CONTRACTOR SHALL CHECK ALL DOOR SWINGS AND SHALL BE RESPONSIBLE FOR INSTALLING ALL ROOM LIGHT SWITCHES/CONTROL STATIONS ASSOCIATED WITH DOORS ON THE STRIKE SIDE OF THE DOORS REGARDLESS OF THE INDICATION ON THE ELECTRICAL DRAWINGS. SWITCHES NOT COMPLYING SHALL BE RELOCATED AT THE CONTRACTOR'S EXPENSE.
- ALL CONDUIT SHALL BE HOMERUN TO PANELBOARD AS INDICATED ON THE DRAWINGS. COMBINING OF CIRCUITS IN HOMERUNS WILL NOT BE ALLOWED. ANY DEVIATIONS IN SUCH WORK SHALL NOT BE APPROVED EXCEPT AS REQUIRED TO MEET THE NATIONAL ELECTRICAL CODE OR BY PERMISSION OF THE ENGINEER.
- ALL CONDUIT SHALL BE CONCEALED IN EXISTING AND NEW WALLS AND CEILINGS EXCEPT MECHANICAL ROOMS. REFER TO SPECIFICATIONS.
- ELECTRICAL CONTRACTOR SHALL LOCATE ALL ELECTRICAL EQUIPMENT AS REQUIRED TO INSURE MINIMUM CLEARANCES ARE PROVIDED IN ACCORDANCE WITH THE N.E.C.
- CONCERNING ALL RISER DIAGRAMS AN ATTEMPT HAS BEEN MADE TO SHOW ALL DEVICES ON RISER DIAGRAM. ANY DEVICES NOT SHOWN ON RISER PLANS AND NOT SHOWN ON RISER DIAGRAMS SHALL BE CONNECTED TO SYSTEM AS REQUIRED.
- ALL SCHEMATICS ARE FOR BID PURPOSES ONLY. SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH WIRING DIAGRAMS OBTAINED FROM THE MANUFACTURER.
- ALL DEVICES SHALL BE LOCATED ON CLEAR WALL SPACES. CLEAR OF ALL SHELVING, CHALKBOARDS, TACKBOARDS, CASEWORK, ETC. OUTLETS NOT COMPLYING WITH THE ABOVE SHALL BE RELOCATED AT THE CONTRACTOR'S EXPENSE.
- ROUGH-IN FOR ELECTRIC DRINKING FOUNTAINS (WATER COOLERS) SHALL BE PERFORMED IN ACCORDANCE WITH APPROVED SHOP DRAWINGS.
- ROUGH-IN FOR EQUIPMENT SHALL BE DONE IN ACCORDANCE WITH APPROVED SHOP DRAWINGS.
- ELECTRICAL CONTRACTOR SHALL COORDINATE HEIGHT OF ALL DEVICES AT ALL CASEWORK LOCATIONS TO AVOID CONFLICTS. ALL OUTLETS SHALL BE ROUGH-IN IN ACCORDANCE WITH ARCHITECTURAL CASEWORK ELEVATIONS. EXACT LOCATION OF ALL OUTLETS SHALL BE AS DIRECTED BY THE OWNER.
- COORDINATE EXACT LOCATION OF ALL DEVICES IN THE CEILING WITH THE ARCHITECTURAL HVAC, LIGHTING, AND FIRE PROTECTION REFLECTED CEILING PLANS.
- THE CONTRACTOR SHALL PROVIDE EQUIPMENT GROUNDING CONDUCTORS IN ALL FEEDERS TO GROUND BUS IN PANELBOARDS AND IN ALL CIRCUITS TO EQUIPMENT AND RECEPTACLES. SEE SPECIFICATIONS.
- ALL EXTERIOR UNDERGROUND CIRCUITS SHALL BE INSTALLED WITH TOP OF CONDUIT OR CONCRETE ENCASEMENT A MINIMUM OF 24" BELOW FINISHED GRADE, UNLESS NOTED OTHERWISE.
- LIQUIDTITE FLEXIBLE METAL CONDUIT (LFMC) SHALL BE USED FOR FIXTURE WHIPS TO MOTORS. FLEXIBLE CONDUIT TO MOTORS SHALL BE A MINIMUM OF 3/4" AND SHALL NOT EXCEED 24" IN LENGTH.
- ALL ELECTRICAL OUTLETS WITHIN 6'-0" OF A WATER SOURCE SHALL BE OF THE GFI TYPE.
- FIRE ALARM SYSTEM LAYOUT IS FOR BID PURPOSES ONLY. SYSTEM SHALL BE INSTALLED AND CONNECTED IN ACCORDANCE WITH WIRING DIAGRAMS OBTAINED FROM MANUFACTURER. DEVICE QUANTITY AND LOCATION SHALL PROVIDE COVERAGE IN ALL AREAS PER NFPA 72. PROVIDE DEVICES AS REQUIRED WHETHER SHOWN ON THE DRAWINGS OR NOT.
- PROVIDE 5' EXCESS CABLE COILED ABOVE THE CEILING FOR EACH DATA DROP.
- LABEL CABLES BOTH AT THE RACK AND AT THE INDIVIDUAL OUTLET.
- INSTALL STEEL SLEEVES BETWEEN STACKED TELECOMMUNICATIONS ROOMS. SLEEVES SHALL EXTEND 4" AFF AND 4" BELOW THE DECK. A MINIMUM OF TWO (2) SLEEVES ON THREE (3) WALLS IS REQUIRED. ALL SLEEVES MUST BE FIRE CALKED AND SEALED. INITIAL FIRE CALKING IS THE RESPONSIBILITY OF THE CONTRACTOR INSTALLING THE SLEEVES. INSTALL GROUND BUSHINGS ON ALL SLEEVES AND PROPERLY GROUND TO THE GROUNDING BAR.
- TELECOMMUNICATIONS ROOMS THAT ARE NOT STACKED WILL REQUIRE THE INSTALLATION OF SIX (6) RISER CONDUITS (4 INCH MINIMUM DIAMETER) WITH PULL STRINGS AND APPROPRIATE JUNCTION PULL BOXES CONNECTING ALL TELECOMMUNICATIONS ROOMS.
- FIRE TREATED PLYWOOD, 3/4 INCH THICK, MUST BE MECHANICALLY FASTENED TO ALL WALLS OF EACH TELECOMMUNICATIONS ROOM. THE FIRE TREATED PLYWOOD WILL BEGIN AT 4" AFF AND END AT 8' AFF. THE ROOM WALLS WILL BE FINISHED WITH DRYWALL, COMPLETELY TAPED, SANDED, AND PAINTED) OR CONCRETE BLOCK (PAINTED) PRIOR TO MOUNTING THE PLYWOOD.
- CABLE TRAY WILL LOOP THE ENTIRE PERIMETER INSIDE A TELECOMMUNICATIONS ROOM AT 8' AFF. MAINTAIN A 4" CLEARANCE FROM EACH WALL. SUPPORT WITH TRAPEZE MADE UP OF ALL THREAD AND UNISTRUT. UNIVERSAL 1/2" CABLE TRAY WILL BE INSTALLED AT THE TOP OF THE COMMUNICATIONS RACKS SPANNING THE WIDTH OF THE ROOM. RADIUS DROP OUTS WILL BE INSTALLED ON ALL CABLE TRAYS WHERE CABLES EXIT THE TRAY TO A LOWER ELEVATION.
- ALL TELECOMMUNICATIONS ROOMS SHALL HAVE A GROUNDING BAR, WHICH MEASURES 12" LONG BY 4" WIDE BY 1/2" THICK WITH PRE-DRILLED 1/2" HOLES. THE GROUND BAR SHALL BE CONNECTED TO THE MAIN BUILDING GROUND USING #2 OR GREATER AWG COPPER WIRE WITH A MAXIMUM RESISTANCE OF 0.15 OHMS OR LESS. NEC REQUIREMENTS SHALL BE FOLLOWED.
- ALL CABLE TRAY WITHIN THE TELECOMMUNICATIONS ROOM SHALL BE GROUNDED TO THE MAIN BUILDING GROUNDING SYSTEM WITH A WIRE NOT SMALLER THAN #2 AWG COPPER. GROUND WIRE AND CLAMPS WILL BE INSTALLED ON THE EXTERIOR OF THE CABLE TRAY.
- NO MORE THAN AN EQUIVALENT OF 270 DEGREES OF BEND, INCLUDING OFFSETS, IS ALLOWED IN A CONDUIT RUN BETWEEN JUNCTION BOXES OR PULL BOXES.
- ABSOLUTELY NO "LBS" ARE ALLOWED IN ANY COMMUNICATIONS CONDUIT INSTALLATION.
- CONDUIT ENDS AT A CABLE TRAY WILL HAVE PLASTIC BUSHINGS AND BE WIRE BONDED TO THE TRAY.
- CONDUIT THAT TERMINATES IN THE TELECOMMUNICATIONS ROOM MUST HAVE PLASTIC BUSHINGS AND BE WIRE BONDED TO THE GROUND BAR LOCATED IN THE ROOM.
- ALL COMMUNICATIONS OUTLETS SHALL BE FED WITH CONDUIT AND PULL STRING, WITH AN ABSOLUTE MINIMUM NUMBER OF BENDS FROM THE OUTLET TO THE CABLE TRAY OR HOMERUN DIRECTLY TO THE TELECOMMUNICATIONS ROOM. PULL BOXES MUST BE INSTALLED AFTER EVERY 270 DEGREES OF BEND (INCLUDING OFFSETS) OR 100 FEET OF THE CONDUIT RUN.
- PREPACKAGED INTUMESCENT MATERIALS ARE THE PREFERRED MATERIAL FOR FIREPROOFING FOR TELECOMMUNICATIONS ROOMS. DO NOT USE CONCRETE FOR FIRE STOPPING ON CABLE TRAYS, WIREWAYS OR CONDUIT. CONTRACTORS WHO USE THIS METHOD WILL BE REQUIRED TO REPLACE ALL CABLES AFFECTED.

**NOTE:**  
THE SYMBOLS LISTED ON THIS SHEET MAY NOT ALL BE USED ON THIS SET OF CONTRACT DRAWINGS, HOWEVER, WHEREVER A SYMBOL IS USED THE ITEM SHALL BE FURNISHED AND INSTALLED.

	DRAWING INFORMATION		KYTC MAINTENANCE FACILITY		DRAWING NO.	
	A & E FILE NO.	2011	CASEY COUNTY, KENTUCKY			E000
	DRAWING DATE	12/16/2020	ELECTRICAL LEGEND AND GENERAL NOTES			
DRAWN BY	WAT	ACCOUNT NO.	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY		AS-BUILT DATE	
CHECKED BY	WAT	609-C9NW-Z001-A10			DECA LOG #	
PHASE	RTA				A1C-8657	
RTA DATE	12/16/2020					
28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859.273.3700 / FAX 859.271.6605						
REVISION HISTORY OF THIS DRAWING						
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE			
1		5				
2		6				
3		7				
4		8				



- CODED NOTES:**
- 1 PROVIDE TWO LEVEL LIGHTING IN THIS ROOM USING STEP DIMMING DRIVER IN LIGHT FIXTURES.
  - 2 FAN SPEED CONTROLLER. SEE FAN SPECIFICATION.
  - 3 CONTROL CIRCUIT WITH PHOTOCELL WITH AN OVERRIDE SWITCH. INSTALL SWITCH ADJACENT TO PANELBOARD TO ALLOW FIXTURES TO BE MANUALLY TURNED ON AT ANY TIME. RUN UNSWITCHED CIRCUIT TO FIXTURE BATTERY UNITS. USE #10 CONDUCTORS FOR ENTIRE CIRCUIT.
  - 4 INSTALL LF-9 FIXTURES AT 16'-8" AFF. INSTALL CF-1 FANS AS HIGH AS POSSIBLE AND COORDINATE WITH STRUCTURAL DETAILS.
  - 5 IN THE GARAGE AREA, RUN OVERHEAD CONDUIT ALONG ROOF LINE TO MAXIMIZE OVERHEAD CLEARANCES.
  - 6 COORDINATE LIGHT FIXTURE AND CONDUIT INSTALLATIONS TO CLEAR THE WAY FOR THE OVERHEAD GARAGE DOORS TO OPEN WITHOUT OBSTRUCTION.
  - 7 INDICATED FIXTURE SHALL BE AN ALWAYS-ON NIGHT LIGHT.
  - 8 INSTALL OLF-2 FIXTURE JUST BELOW CANOPY.
  - 9 AIM FIXTURES AT FLAG AT TOP OF FLAG POLE.
  - 10 CONTROL WITH ASTRONOMICAL TIMECLOCK MOUNTED ADJACENT TO PANEL "B".
  - 11 APPROXIMATE LIMITS OF CEILING FAN. SEE HVAC PLANS.



**LIGHTING PLAN**  
SCALE: 1/4" = 1'-0"

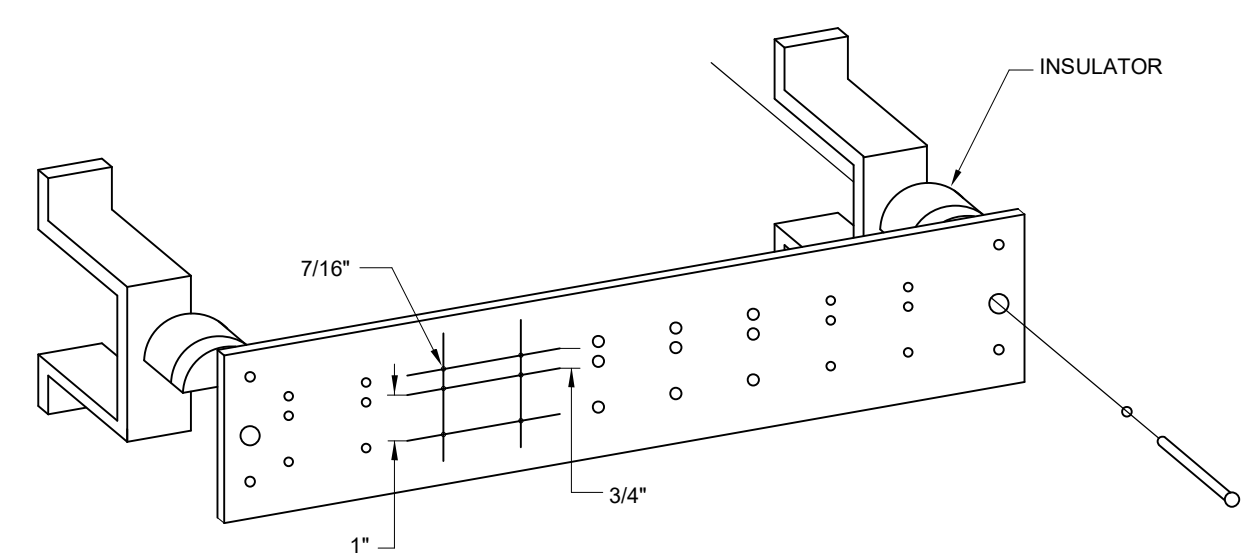
**NOTE:**  
IT IS NOT INTENDED THAT THE PLANS SHOW ALL OFFSETS IN PIPES, CONDUITS, AND DUCTS REQUIRED FOR INSTALLATION OF THE WORK. DETAILS AND SECTIONS ARE INCLUDED FOR SOME AREAS TO SHOW INTENDED RELATIONSHIP OF THE WORK OF VARIOUS TRADES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SUBCONTRACTORS TO COORDINATE INSTALLATION OF THE WORK AND TO PROVIDE THE NECESSARY OFFSETS, TRANSFORMATIONS, AND FITTINGS REQUIRED. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR CORRECTION CONFLICTS BETWEEN THE WORK OF VARIOUS TRADES. DETAILS AND SECTIONS ARE SHOWN FOR THE CONTRACTORS CONVENIENCE AND SHALL NOT BE CONSIDERED COMPLETE IN EVERY DETAIL.

<p><b>STAGGS &amp; FISHER</b> CONSULTING ENGINEERS, INC. 2354 Loch Tree Drive Lexington, KY 40517 606-271-3266</p>	DRAWING INFORMATION		<b>KYTC MAINTENANCE FACILITY</b> <b>CASEY COUNTY, KENTUCKY</b>		DRAWING NO.  <b>E101</b>  AS-BUILT DATE  DECA LOG # <b>A1C-8658</b>
	A & E FILE NO.	2011	LIGHTING PLAN		
	DRAWING DATE	12/16/20	ACCOUNT NO.	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	
	DRAWN BY	WAT	609-C9NW-Z001-A10		
CHECKED BY	WAT				
PHASE	RTA				
RTA DATE	12/16/2020				
<p>Architecture   Interiors   Landscapes   Planning</p>		28 E. REYNOLDS RD., SUITE ONE, LEXINGTON, KY 40517 / PH. 859.273.3700 / FAX 859.271.6605			
REVISION HISTORY OF THIS DRAWING		REVISION HISTORY OF THIS DRAWING			
DESCRIPTION OF REVISIONS	DATE	DESCRIPTION OF REVISIONS	DATE		
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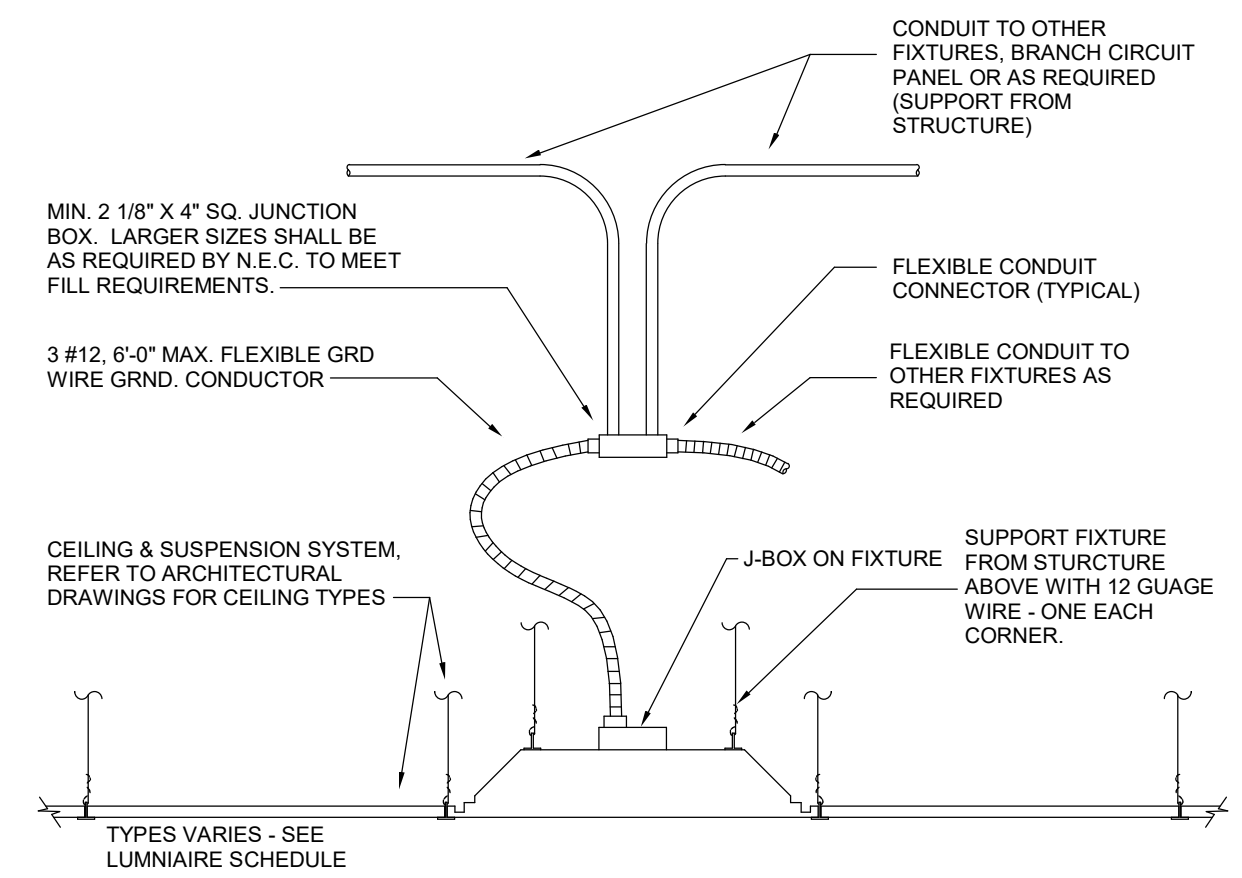




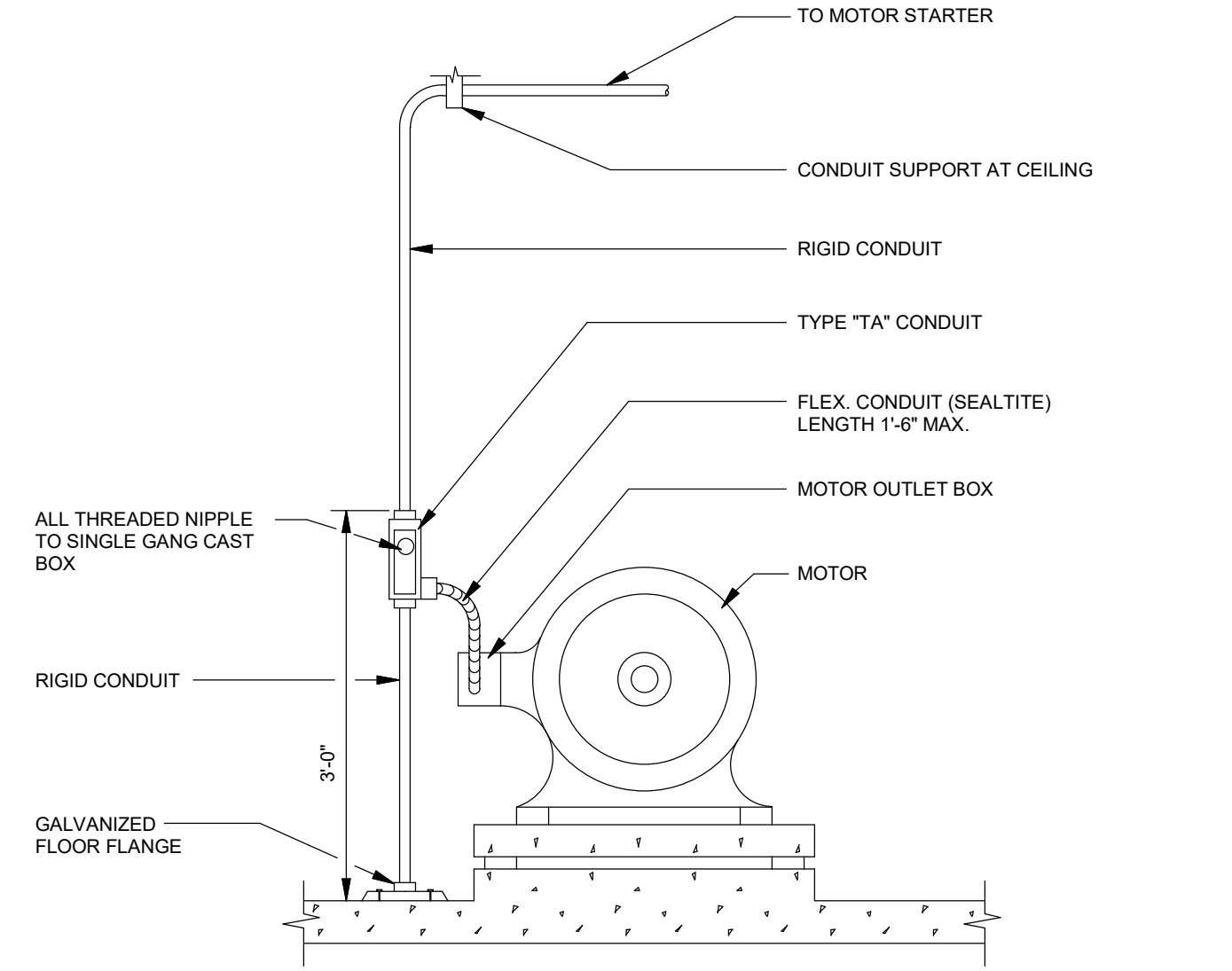




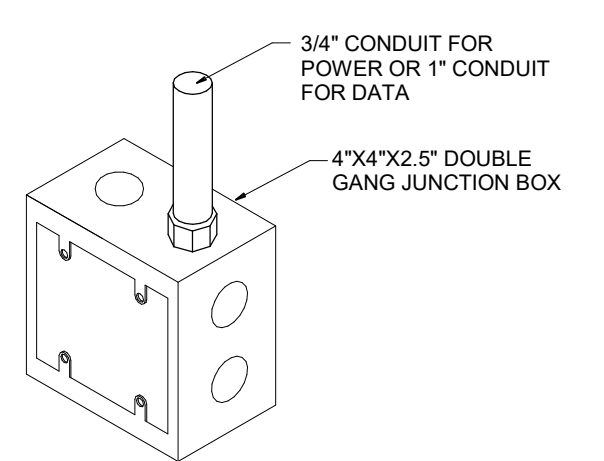
**GROUND BAR 1/4" x 4" x 20" COPPER**  
SCALE: NONE



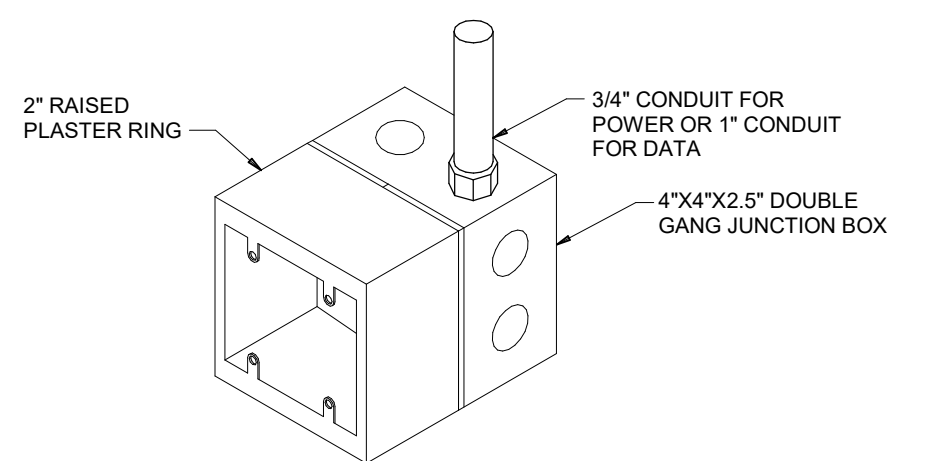
**LUMINAIRE CONNECTION DETAIL**  
SCALE: NONE



**TYPICAL MOTOR CONNECTION DETAIL**  
SCALE: NONE



**OUTLET DETAIL FOR DRYWALL APPLICATION**  
SCALE: NONE



**OUTLET DETAIL WITH PLASTER RING FOR MASONRY APPLICATION**  
SCALE: NONE

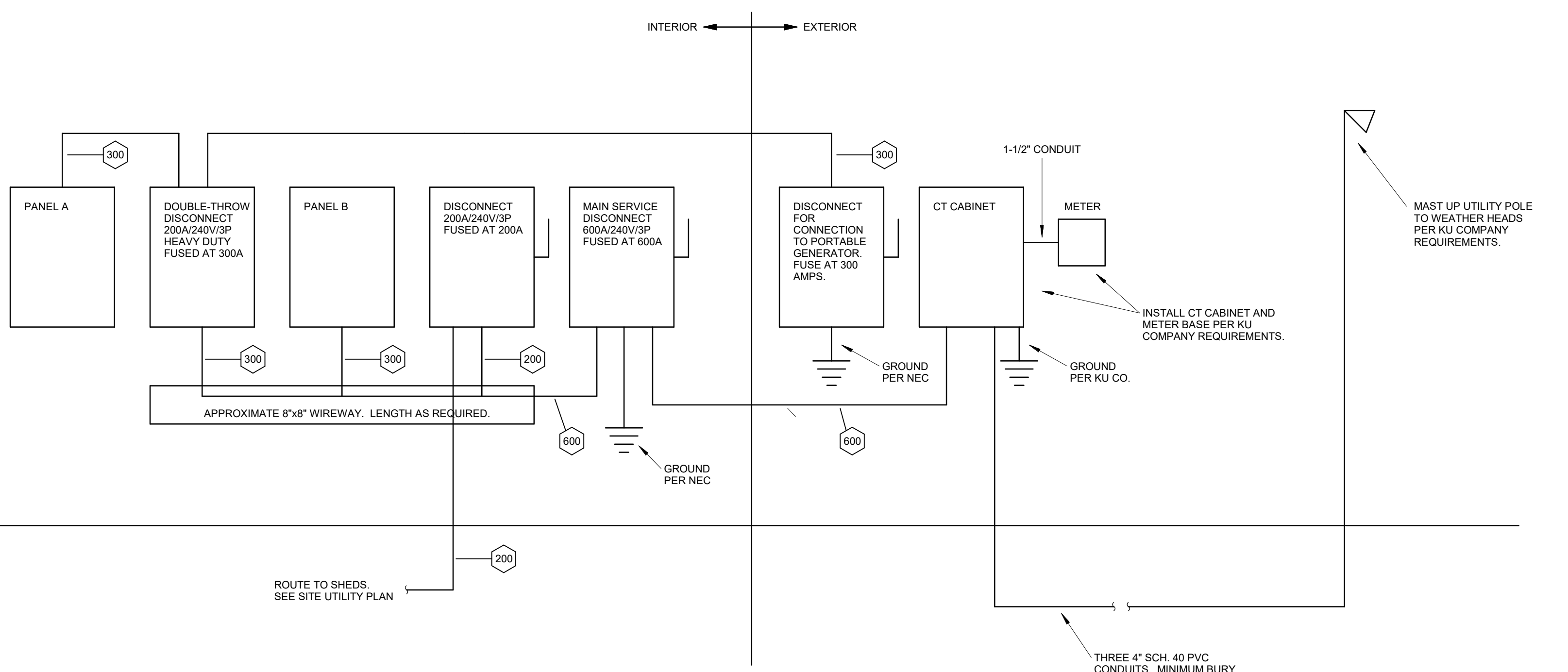
LF#	FIXTURE DESCRIPTION	VOLTAGE	WATTAGE	LAMP	LUMEN OUTPUT	TEMPERATURE	COLOR RENDERING INDEX (CRI)	DRIVER	MANUFACTURER	MODEL	EQUIVALENT MANUFACTURERS
BAT	SURFACE MOUNTED, 375 WATT, BATTERY INVERTOR WITH INTEGRAL TEST SWITCH, 120V/IN120V OUT								JOFA	HS-375-LED	LIEBERT, CHEORIDE
CF-1	60\"/>										

Branch Panel: A		Location: 120/240 Single		A.I.C. Rating: 10,000					
Supply From:	Phases: 1	Wires: 3	Main Type: MCB	MCB/MLO Rating: 300					
Mounting: SURFACE	Enclosure: TYPE 1	Notes:							
OKT	Circuit Description	Trip	Poles	A	B	Poles	Trip	Circuit Description	OKT
1	DOOR POWER SUPPLY - MECH. RM. 106	20 A	1	300 VA	433 VA	1	20 A	LIGHTING - OFFICE AREA	2
3	RECS - CREW RM. 107 (REFRIGERATOR)	20 A	1	0 VA	800 VA	1	20 A	LIGHTING - EXTERIOR	4
5	SPARE	20 A	1	0 VA	800 VA	2	20 A	CEILING FAN - GARAGE	6
7	SPARE	20 A	1	0 VA	600 VA	1	20 A	LIGHTING - GARAGE	8
9	SPARE	20 A	1	0 VA	772 VA	1	20 A	LIGHTING - GARAGE	10
11	SPARE	20 A	1	0 VA	1120 VA	1	20 A	LIGHTING - GARAGE	12
13	RECS - CREW RM. 107	20 A	1	900 VA	765 VA	1	20 A	LIGHTING - GARAGE	14
15	RECS - CREW RM. 107	20 A	1	360 VA	250 VA	1	20 A	RECS - CREW RM. 107 (WATER COOLER)	16
17	RECS - OFFICE 101	20 A	1	720 VA	1000 VA	1	20 A	RECS - CREW RM. 107 (ICE MACHINE) (GF)	18
19	RECS - OFFICE 101	20 A	1	540 VA	720 VA	1	20 A	RECS - OFFICE 102	20
21	RECS - TOILET ROOMS 103, 104, 105	20 A	1	540 VA	720 VA	1	20 A	RECS - OFFICE 102	22
23	RECS - MECH. RM. 106	20 A	1	540 VA	540 VA	1	20 A	RECS - STORAGE 108	24
25	RECS - MECH. RM. 106 (TELECOMM BACKBOARD)	20 A	1	720 VA	720 VA	1	20 A	RECS - STORAGE 108	26
27	UNIT HEATERS UH-1, UH-2, UH-3 - GARAGE & STOR	20 A	1	84 VA	4080 VA	1	20 A	LIGHTING - GARAGE	28
29	LIGHTING - FLAG POLE	20 A	1	84 VA	4080 VA	2	50 A	AC-1 - EXTERIOR	30
31	WATER HEATER RM. 106	50 A	2	4500 VA	5000 VA	2	60 A	RECS - CREW RM. 107 (RANGE)	32
33	RECS - CREW RM. 107 (ABOVE COUNTER)	20 A	1	180 VA	360 VA	1	20 A	RECS - STORAGE 108	34
35	RECS - CREW RM. 107 (ABOVE COUNTER & HOOD)	20 A	1	180 VA	360 VA	1	20 A	RECS - STORAGE 108	36
37	RECS - CREW RM. 107 (ABOVE COUNTER & HOOD)	20 A	1	180 VA	360 VA	1	20 A	RECS - STORAGE 108	38
39	RECS - STORAGE 108	20 A	1	360 VA	360 VA	1	20 A	EXHAUST FAN (EF-6) - STORAGE 108	40
41	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	42
43	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	44
45	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	46
47	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	48
49	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	50
51	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	52
53	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	54
<b>Total Load:</b>		23828 VA		23288 VA					
<b>Total Amps:</b>		199 A		194 A					

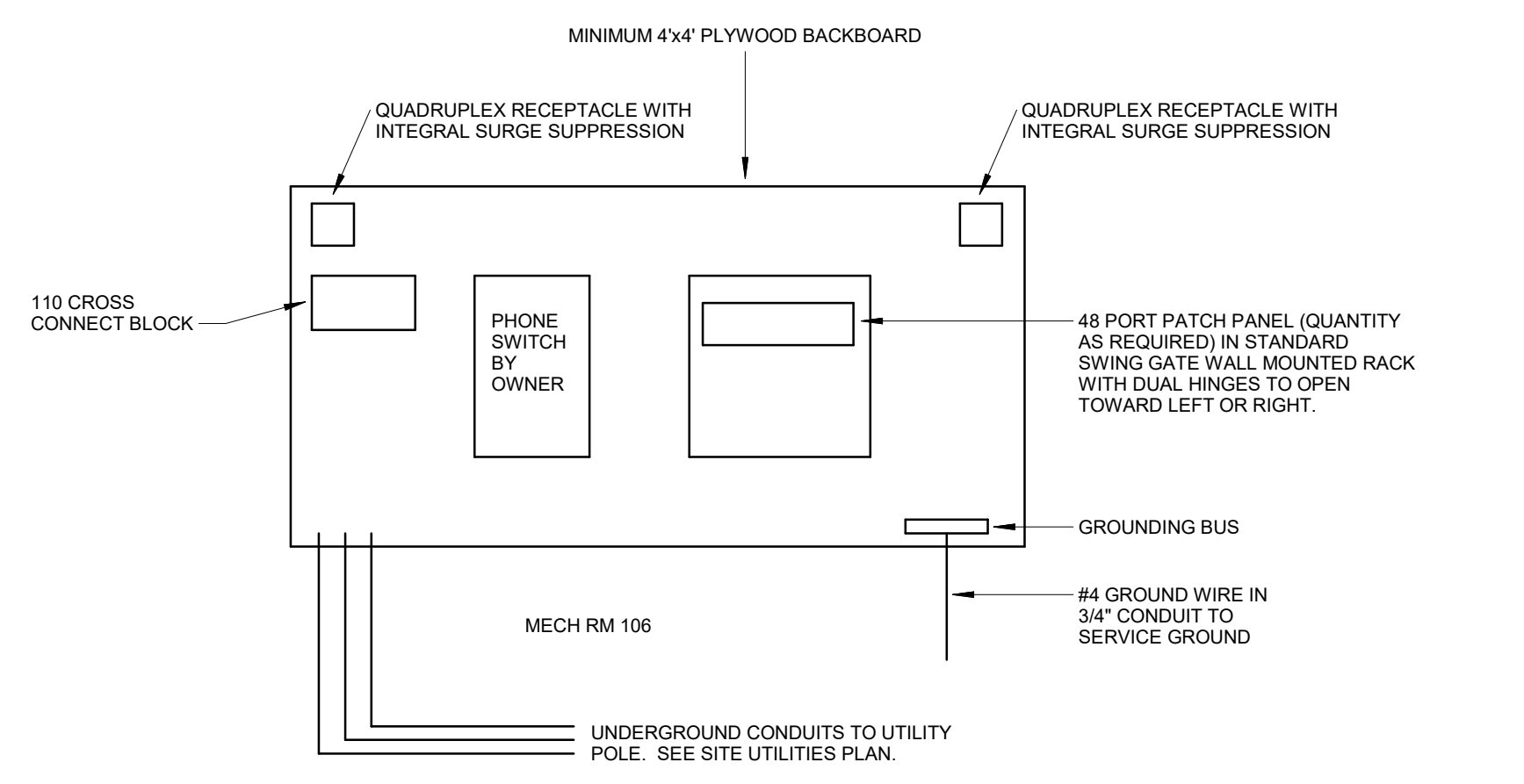
Branch Panel: B		Location: 120/240 Single		A.I.C. Rating: 10,000					
Supply From:	Phases: 1	Wires: 3	Main Type: MCB	MCB/MLO Rating: 300					
Mounting: SURFACE	Enclosure: TYPE 1	Notes:							
OKT	Circuit Description	Trip	Poles	A	B	Poles	Trip	Circuit Description	OKT
1	UNIT HEATERS UH-3 & UH-4 - GARAGE	20 A	1	1044 VA	180 VA	1	20 A	RECS - GARAGE	2
3	AIR COMPRESSOR - GARAGE	60 A	2	2280 VA	720 VA	1	20 A	RECS - GARAGE	4
5	RECS - EXTERIOR (POWER WASHER)	20 A	2	850 VA	180 VA	1	20 A	RECS - EXTERIOR	6
7	RECS - EXTERIOR (POWER WASHER) (GF)	20 A	2	850 VA	180 VA	1	20 A	RECS - EXTERIOR	8
9	SPARE	20 A	1	0 VA	0 VA	1	20 A	RECS - EXTERIOR	10
11	WELDER - GARAGE	50 A	2	2500 VA	180 VA	1	20 A	RECS - EXTERIOR	12
13	RECS - GARAGE	20 A	1	2500 VA	180 VA	1	20 A	RECS - EXTERIOR	14
15	RECS - CREW RM. 107 (ABOVE COUNTER)	20 A	1	180 VA	720 VA	1	20 A	RECS - GARAGE	16
17	RECS - CREW RM. 107 (ABOVE COUNTER)	20 A	1	180 VA	720 VA	1	20 A	RECS - GARAGE	18
19	RECS - CREW RM. 107 (ABOVE COUNTER)	20 A	1	180 VA	720 VA	1	20 A	GARAGE DOOR OPENER	20
21	RECS - GARAGE	20 A	1	180 VA	1000 VA	1	20 A	GARAGE DOOR OPENER	22
23	RECS - GARAGE	20 A	1	180 VA	1000 VA	1	20 A	GARAGE DOOR OPENER	24
25	RECS - GARAGE	20 A	1	180 VA	1200 VA	2	20 A	EXHAUST FAN (EF-5) - GARAGE	26
27	RECS - GARAGE (WATER COOLER)	20 A	1	360 VA	1000 VA	1	20 A	EXHAUST FAN (EF-4) - GARAGE	28
29	RECS - EXTERIOR	20 A	1	360 VA	1200 VA	2	60 A	SPARE - FUTURE EQUIPMENT SHED	30
31	RECS - GARAGE	20 A	1	2500 VA	0 VA	2	20 A	SPARE	32
33	GARAGE DOOR OPENER	20 A	1	1000 VA	0 VA	2	60 A	SPARE	34
35	RECS - GARAGE	20 A	1	2500 VA	0 VA	2	20 A	SPARE	36
37	WELDER - GARAGE	50 A	2	2500 VA	0 VA	2	20 A	SPARE	38
39	RECS - GARAGE	20 A	1	300 VA	0 VA	1	20 A	SPARE	40
41	HVAC LOUVERS	20 A	1	0 VA	0 VA	1	20 A	SPARE	42
43	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	44
45	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	46
47	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	48
49	SPARE	20 A	2	0 VA	0 VA	1	20 A	SPARE	50
51	SPARE	20 A	2	0 VA	0 VA	1	20 A	SPARE	52
53	SPARE	20 A	1	0 VA	0 VA	1	20 A	SPARE	54
<b>Total Load:</b>		18713 VA		16200 VA					
<b>Total Amps:</b>		139 A		135 A					

FEEDER AND BRANCH CIRCUIT SCHEDULE	
NO.	CONDUCTORS THWN/THHN COPPER
20	4#12 & 1#12 GND. IN 3/4" CONDUIT.
30	4#10 & 1#10 GND. IN 3/4" CONDUIT.
40	4#8 & 1#10 GND. IN 1" CONDUIT.
50	4#6 & 1#10 GND. IN 1" CONDUIT.
60	4#4 & 1#8 GND. IN 1-1/4" CONDUIT.
70	4#4 & 1#8 GND. IN 1-1/4" CONDUIT.
80	4#3 & 1#8 GND. IN 1-1/4" CONDUIT.
90	4#2 & 1#8 GND. IN 1-1/4" CONDUIT.
100	4#1 & 1#8 GND. IN 1-1/2" CONDUIT.
110	4#1 & 1#8 GND. IN 1-1/2" CONDUIT.
120	4#1 & 1#8 GND. IN 1-1/2" CONDUIT.
130	4#1 & 1#8 GND. IN 2" CONDUIT.
140	4#20 & 1#8 GND. IN 2" CONDUIT.
150	4#20 & 1#8 GND. IN 2" CONDUIT.
160	4#20 & 1#8 GND. IN 2" CONDUIT.
170	4#20 & 1#8 GND. IN 2" CONDUIT.
180	4#20 & 1#8 GND. IN 2" CONDUIT.
190	4#20 & 1#8 GND. IN 2" CONDUIT.
200	4#20 & 1#8 GND. IN 2" CONDUIT.
210	4#20 & 1#8 GND. IN 2" CONDUIT.
220	4#20 & 1#8 GND. IN 2" CONDUIT.
230	4#20 & 1#8 GND. IN 2" CONDUIT.
240	4#20 & 1#8 GND. IN 2" CONDUIT.
250	4#20 & 1#8 GND. IN 2" CONDUIT.
260	4#20 & 1#8 GND. IN 2" CONDUIT.
270	4#20 & 1#8 GND. IN 2" CONDUIT.
280	4#20 & 1#8 GND. IN 2" CONDUIT.
290	4#20 & 1#8 GND. IN 2" CONDUIT.
300	4#20 & 1#8 GND. IN 2" CONDUIT.
310	4#20 & 1#8 GND. IN 2" CONDUIT.
320	4#20 & 1#8 GND. IN 2" CONDUIT.
330	4#20 & 1#8 GND. IN 2" CONDUIT.
340	4#20 & 1#8 GND. IN 2" CONDUIT.
350	4#20 & 1#8 GND. IN 2" CONDUIT.
360	4#20 & 1#8 GND. IN 2" CONDUIT.
370	4#20 & 1#8 GND. IN 2" CONDUIT.
380	4#20 & 1#8 GND. IN 2" CONDUIT.
390	4#20 & 1#8 GND. IN 2" CONDUIT.
400	4#20 & 1#8 GND. IN 2" CONDUIT.
410	4#20 & 1#8 GND. IN 2" CONDUIT.
420	4#20 & 1#8 GND. IN 2" CONDUIT.
430	4#20 & 1#8 GND. IN 2" CONDUIT.
440	4#20 & 1#8 GND. IN 2" CONDUIT.
450	4#20 & 1#8 GND. IN 2" CONDUIT.
460	4#20 & 1#8 GND. IN 2" CONDUIT.
470	4#20 & 1#8 GND. IN 2" CONDUIT.
480	4#20 & 1#8 GND. IN 2" CONDUIT.
490	4#20 & 1#8 GND. IN 2" CONDUIT.
500	4#20 & 1#8 GND. IN 2" CONDUIT.
510	4#20 & 1#8 GND. IN 2" CONDUIT.
520	4#20 & 1#8 GND. IN 2" CONDUIT.
530	4#20 & 1#8 GND. IN 2" CONDUIT.
540	4#20 & 1#8 GND. IN 2" CONDUIT.
550	4#20 & 1#8 GND. IN 2" CONDUIT.
560	4#20 & 1#8 GND. IN 2" CONDUIT.
570	4#20 & 1#8 GND. IN 2" CONDUIT.
580	4#20 & 1#8 GND. IN 2" CONDUIT.
590	4#20 & 1#8 GND. IN 2" CONDUIT.
600	4#20 & 1#8 GND. IN 2" CONDUIT.
610	4#20 & 1#8 GND. IN 2" CONDUIT.
620	4#20 & 1#8 GND. IN 2" CONDUIT.
630	4#20 & 1#8 GND. IN 2" CONDUIT.
640	4#20 & 1#8 GND. IN 2" CONDUIT.
650	4#20 & 1#8 GND. IN 2" CONDUIT.
660	4#20 & 1#8 GND. IN 2" CONDUIT.
670	4#20 & 1#8 GND. IN 2" CONDUIT.
680	4#20 & 1#8 GND. IN 2" CONDUIT.
690	4#20 & 1#8 GND. IN 2" CONDUIT.
700	4#20 & 1#8 GND. IN 2" CONDUIT.
710	4#20 & 1#8 GND. IN 2" CONDUIT.
720	4#20 & 1#8 GND. IN 2" CONDUIT.
730	4#20 & 1#8 GND. IN 2" CONDUIT.
740	4#20 & 1#8 GND. IN 2" CONDUIT.
750	4#20 & 1#8 GND. IN 2" CONDUIT.
760	4#20 & 1#8 GND. IN 2" CONDUIT.
770	4#20 & 1#8 GND. IN 2" CONDUIT.
780	4#20 & 1#8 GND. IN 2" CONDUIT.
790	4#20 & 1#8 GND. IN 2" CONDUIT.
800	4#20 & 1#8 GND. IN 2" CONDUIT.
810	4#20 & 1#8 GND. IN 2" CONDUIT.
820	4#20 & 1#8 GND. IN 2" CONDUIT.
830	4#20 & 1#8 GND. IN 2" CONDUIT.
840	4#20 & 1#8 GND. IN 2" CONDUIT.
850	4#20 & 1#8 GND. IN 2" CONDUIT.
860	4#20 & 1#8 GND. IN 2" CONDUIT.
870	4#20 & 1#8 GND. IN 2" CONDUIT.
880	4#20 & 1#8 GND. IN 2" CONDUIT.
890	4#20 & 1#8 GND. IN 2" CONDUIT.
900	4#20 & 1#8 GND. IN 2" CONDUIT.
910	4#20 & 1#8 GND. IN 2" CONDUIT.
920	4#20 & 1#8 GND. IN 2" CONDUIT.
930	4#20 & 1#8 GND. IN 2" CONDUIT.
940	4#20 & 1#8 GND. IN 2" CONDUIT.
950	4#20 & 1#8 GND. IN 2" CONDUIT.
960	4#20 & 1#8 GND. IN 2" CONDUIT.
970	4#20 & 1#8 GND. IN 2" CONDUIT.
980	4#20 & 1#8 GND. IN 2" CONDUIT.
990	4#20 & 1#8 GND. IN 2" CONDUIT.
1000	4#20 & 1#8 GND. IN 2" CONDUIT.

DESIGNATES THAT THE NEUTRAL CONDUCTOR IS NOT REQUIRED.  
ADJUST QUANTITY OF WIRES FOR BRANCH CIRCUITS IN ACCORDANCE WITH CIRCUIT BREAKER SIZE SHOWN IN PANEL SCHEDULES.  
INCREASE WIRE SIZE TO THE NEXT WIRE SIZE FOR BRANCH CIRCUITS OVER 150 FEET.  
INCREASE WIRE SIZE TO NEXT WIRE SIZE FOR EVERY ADDITIONAL 150 FEET.



**ELECTRICAL DISTRIBUTION SYSTEM RISER DIAGRAM**  
SCALE: NONE



**TELECOMMUNICATION BACKBOARD DETAIL**  
SCALE: NONE

	DRAWING INFORMATION		KYTC MAINTENANCE FACILITY CASEY COUNTY, KENTUCKY	
	A & E FILE NO.	2011	ELECTRICAL DISTRIBUTION RISER, SCHEDULES, AND DETAILS	
	DRAWING DATE	12/16/20	ACCOUNT NO.	609-C9NW-Z001-A10
	DRAWN BY	WAT	COMMONWEALTH OF KENTUCKY FINANCE AND ADMINISTRATION CABINET DEPARTMENT FOR FACILITIES AND SUPPORT SERVICES DIVISION OF ENGINEERING AND CONTRACT ADMINISTRATION FRANKFORT, KENTUCKY	