BIDDING/CONTRACT DOCUMENTS

For The
"Happy Jack Landfill Front Entrance and Scale House" Project

APPROVED
By Alessandra at 1:04 pm, Sep 01, 2020

Bid No. S-7-21

BID OPENING: Friday, October 2, 2020 at 2:00 p.m.

In the
City Purchasing Office
Room 307, Municipal Building
2101 O'Neil Avenue
Cheyenne, WY 82001

Inquiries Regarding This Bid Should Be Directed To:

City of Cheyenne, Purchasing Manager, TJ Barttelbort
Phone: (307) 773-1045, Email: tbarttelbort@cheyennecity.org

INVITATION FOR BID
#S-7-21

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FY 2021

PART 1 – INVITATION FOR BIDS

CITY OF CHEYENNE, WYOMING

	CITY OF CHEYENNE **INVITATION FOR BIDS**
NAME OF JOB:	Happy Jack Landfill Front Entrance and Scale House
BID NUMBER:	S-7-21

The Governing Body of the City of Cheyenne, Wyoming ("the Governing Body") will receive sealed bid proposals at the Office of the City Purchasing Agent, located in Room 309 of the Municipal Building at 2101 O'Neil Avenue, Cheyenne, WY 82001, until 2:00 p.m. local time on the 2nd day of October, 2020, for the **"Happy Jack Landfill Front Entrance and Scale House"** project.

At the aforementioned time and place, such bids that are received for the project shall be publicly opened and read aloud.

The work to be performed will be in accordance with the plans and specifications on file in the City Purchasing Agent's office. Bidding documents may be downloaded online at https://www.cheyennecity.org/Bids.aspx.

A **MANDATORY** pre-bid meeting will be held at 2:00 P.M. on September 10, 2020, at the City of Cheyenne Municipal Building, Room 208, Cheyenne, WY 82001. The City will reject bids from any company who has not signed the attendance sheet prior to the commencement of the mandatory pre-bid meeting.**Any interested parties wishing to attend the pre-bid meeting are asked to wear a face-mask or face-covering.**

A bid guarantee in the amount of five percent (5%) of the total bid shall accompany any bid submitted. *See* Section 8.00 of Instructions to Bidders. The successful bidder shall furnish and pay for satisfactory performance and payment bonds in the amount of one hundred percent (100%) of the accepted bid. *See* Section 19.00 of Instructions to Bidders.

The City of Cheyenne ("the City") reserves the right to reject any or all bids or to waive any formalities in the bidding.

Prior to the award of the contract, the City may hold bids for a period not to exceed sixty (60) calendar days from the date of opening of bids for the purpose of reviewing the bids and investigating the qualifications of the bidders. Provisions of Wyo. Stat. § 15-1-113, incorporated by reference, are made an express part of the Contract Documents.

TJ Barttelbort
Purchasing Division

Publication Dates: September 4 & 11, 2020
Published in: Wyoming Tribune Eagle

PART 2 - INSTRUCTIONS TO BIDDERS

CITY OF CHEYENNE, WYOMING

1.00 USE OF SEPARATE BID FORMS

These Contract Documents include a complete set of bidding and contract forms which are for the convenience of bidders. Bidders shall make proposals upon the forms furnished herein and pursuant to the instructions and requirements set forth herein.

2.00 INTERPRETATION OF DOCUMENTS

The City will not provide oral interpretations to any bidder as to the meaning of the Contract Documents or any part thereof. If any person contemplating submitting a proposal requires interpretation or clarification regarding the meaning of any part of the drawings, specifications, or other portions of the contract documents, or finds discrepancies in or omissions from the drawings or specifications, that bidder shall submit a written request for interpretation, clarification, or correction thereof to the City of Cheyenne, hereinafter "City". The bidder submitting the request will be responsible for its prompt delivery. Questions shall be directed to the City Purchasing Manager, by e-mail at tbarttelbort@cheyennecity.org. **Questions will be received until 5:00 pm local time on September 16, 2020, after which no additional questions will be accepted. The City will respond via Addendum, no-later-than 5:00 pm local time on September 22, 2020.**

3.00 ADDENDA

The City will make every interpretation, clarification, or correction to bidders by written addendum to the Contract Documents. The City will make reasonable efforts to mail, e-mail, or fax addenda to persons identified on the City's plan-holders list, but it shall be the bidder's responsibility to make inquiry as to the addenda issued. It shall also be the bidder's responsibility to confirm that it is included on the City's plan-holders list. The bidder shall acknowledge all addenda issued during the time of bidding in the bid proposal and shall be made a part of the Contract. The City will consider as incomplete any bid proposal in which all addenda are not acknowledged.

4.00 DEFINITIONS AND TERMS

Contract Documents: All documents in the bidding packet, including addenda, as identified in Part V, Article 5.

Contract Modification: A written document that must, at minimum, be executed by the Contractor and by the Mayor of the City of Cheyenne. A Contract Modification may require the approval of the City's Governing Body. A contract modification must be executed to change the Contract Price, Contract Time, or to otherwise modify the Contract Agreement.

Contract Price: The original amount bid by the contractor, as specified in Article 4 of the Agreement and modified by any Contract Modifications.

Contract Time: Begins upon the date specified in the Notice to Proceed and consists of the number of calendar days up to and including the date specified in Part V, Article 3.

Field Order: A form issued by the City Engineer ("Engineer") to authorize the Contractor to proceed with changes or additions to the work as described in a Work Directive or a Request for Adjustment. A Field Order may either increase or decrease quantities or authorize work for payment under a Force Account, if included in the bid, but cannot increase the Contract Price.

Force Account: A method of payment for work performed by the Contractor at the Engineer's discretion and calculated in accordance with Part VI, Section 14.

Request for Adjustment: A form issued by the Engineer to allow the Contractor to request an adjustment of the Contract Time, the Contract Price, or to request any other modification of the Contract Agreement. The Contractor shall also use this form for submitting pricing as a result of a Work Directive.

Work Directive: A form issued by the Engineer to inform the Contractor of a change in the Work which does not alter the Contract Time, the Contract Price, or any other provisions of the Contract Agreement. If a change in the Work will increase the Contract Price, the City must approve and execute a Contract Modification before the Contractor may proceed with the Work as modified.

5.00 SITE INSPECTION AND CONTRACT DOCUMENTS EXAMINATION

Each bidder shall visit the proposed work site and become acquainted with the existing conditions of the site. Then, in preparing and submitting bids, contractors should take into account the observed existing conditions, construction necessities, required labor, facilities involved, and difficulties and restrictions that may be encountered in contract performance. If possible, the City will conduct a tour of the work areas. All interested parties should contact **Matt Theriault in the City's Public Works Office, at 307-637-6279.**

Each bidder should also thoroughly examine and become familiar with the Drawings, Technical Specifications, and all other Contract Documents.

The selected bidder, by executing a contract, shall in no way be relieved of any obligation under it due to the selected bidder's failure to review or examine any form, legal instrument, or to become acquainted with existing conditions in the work area. The City will be justified in rejecting any claim based on facts which the selected bidder knew or should have been aware of as a result of inspecting the site and Contract Documents.

6.00 ALTERNATE BIDS

The City **will not consider** alternate bids unless alternate bid items are specifically requested by the Specifications and the bid proposal.

7.00 BID PROPOSAL REQUIREMENTS

Bidders shall submit all bids on forms supplied by the City, and all such bids are subject to the Contract Documents requirements. All bids shall be regular in every respect. The bidder shall not make or include any interlineation, excisions, or special conditions in the bid forms. The bidder shall explain or note, in conjunction with its signature, any erasures or other changes in the bids.

The bidder shall submit bid documents, including the Bid Proposal, Bid Guarantee, Non-Collusion Affidavit of Prime Bidders, and Sub-Contractors and Material Suppliers List, to the City Purchasing Division in a sealed envelope. The envelope shall bear the bidder's name and address, the project name, bid number, and the date and time of bid opening in order to guard against premature opening of the bid proposal.

The City may consider as irregular any bid on which there is an alteration of or departure from the bid form provided and, at its option, may reject the bid.

Award of a contract resulting from this bid will be based on Section 15.00 below.

The bidder shall correctly fill in the blank spaces on the proposal form and state the unit or lump sum prices in the spaces provided. All proposals shall be totaled, and in the case of errors or discrepancies, the unit or lump sum prices shall govern.

Each bidder shall sign and display the name and address of the bidder in the blank spaces provided. If the bid is made by a sole proprietorship or partnership, the name and address of the sole proprietorship or partnership shall be shown, together with the names and addresses of the proprietor or partners. If the proposal is made by a corporation or other business entity, an official who is authorized to bind the corporation or other business entity shall sign in the name of such corporation or business entity.

The City will consider as incomplete and may reject any bid not displaying the information required by this Section.

City representatives and the successful bidder shall hold a pre-construction conference upon contract award. This conference will be for the purpose of reaching a complete understanding with the successful bidder concerning quality of work expected, work schedule and time of completion, work progress, and coordination of all construction.

8.00 BID GUARANTEE

Each bid proposal shall be accompanied by a bid guarantee which shall not be less than five percent (5%) of the bid amount.

The 5% bid guarantee may be in the form a bid bond secured and issued by a surety or guaranty company authorized to do business in the State of Wyoming or a cashier's check made payable to the City of Cheyenne. Cash deposits, personal checks or company checks (unless certified) will not be accepted.

If the bid guarantee is to be submitted in the form of a bid bond, bidders must use the attached bid bond form. No deviation from the attached form will be allowed. If a surety company's bid bond form is used, the wording shall be exactly as shown on the City's bid bond form. No bid will be considered unless it is accompanied by the required guarantee. The bid guarantee shall ensure the execution of the agreement. The successful bidder shall furnish a surety bond as required by the Contract Documents.

If the Contractor (i) withdraws the bid within sixty (60) calendar days after bid opening, (ii) fails to provide performance and payment bonds, (iii) or fails to provide the minimum insurance certificates within the time required by Wyo. Stat. § 15-1-113 after the City accepts the proposal, then the bidder shall be liable to the City for default in the amount set forth on the bid bond as liquidated damages for said default.

Bid guarantees of unsuccessful bidders will be returned as soon as practicable after bid proposals are opened.

9.00 COLLUSIVE AGREEMENTS

Each bidder submitting a bid to the City for any portion of the work contemplated by the documents on which bidding is based shall execute and attach thereto an affidavit substantially in the form herein provided to the effect that he or she has not colluded with any other person, firm, or corporation in regard to any bid submitted.

10.00 STATEMENT OF BIDDER QUALIFICATIONS

Each bidder shall, upon the City's request, submit satisfactory evidence that the bidder has practical knowledge of the particular work being bid upon, and has the necessary financial resources required to complete the proposed work. In awarding the contract, the City will give due consideration to the ability, reliability, work load, and general reputation of each bidder, as well as the City's past experience with the bidders.

Each bidder, upon the City's request, shall show that prior work performed by the bidder has been handled in such a manner that there are no just or proper claims against such work.

No bid proposal will be acceptable if the bidder is engaged in any other work which impairs his or her ability to finance this contract or provide equipment for the proper execution of the contract.

11.00 UNIT PRICES

If unit prices are called for, the unit price of each item in the proposal shall include the *pro rata* share of overhead and profit. As such, the sum of the products obtained by multiplying the quantity shown for each item by the unit price bid equals the total bid. The City may reject as irregular any bid not conforming to this requirement. Bidders should pay special attention to this provision.

If conditions make it necessary to revise bid quantities, no limit will be fixed for such quantity revisions, provided the net cash value of all such additive and subtractive changes shall not change the original, total contract price by more than twenty percent (20%). The

quantities appearing on the proposal form are approximate and are prepared for the comparison of bids. Payment to the contractor will be made only for the actual, accepted quantities of work performed and materials furnished in accordance with the contract.

The presence of any unit bid price that generates reasonable doubt that award to that bidder would result in the lowest ultimate cost to the City may be rejected as irregular.

12.00 TIME FOR RECEIVING BIDS

Bid proposals received before the advertised time for opening bids will be kept securely sealed until the time arrives to open bids. The officer whose duty it is to open bids will decide when the specified time has arrived, and no bid received thereafter will be considered.

13.00 BID OPENING

At the time and place fixed for opening bids, the City will open and publicly read aloud every bid received within the time set for receiving bids, irrespective of any irregularities therein. Bidders and other persons properly interested may be present in person or by representative.

14.00 BID WITHDRAWAL

Bids may be withdrawn by written or faxed request at any time prior to the scheduled closing time for receipt of proposals.

15.00 CONTRACT AWARD AND BID REJECTION

The City will award the contract to the most qualified and responsible bidder, as determined in the City's sole discretion, who submits the lowest total responsive bid shown on Itemized Bid Sheet "A" plus "B". This bid must also be less than funds available for this project. The City reserves the right to reject a bid if the total bid shown on the last Itemized Bid Sheet is not identical to the total bid shown on the Bid Proposal Sheet, included in this Bid Packet. The City reserves the right to reject a bid if the total bid price shown on the last Itemized Bid Sheet is not calculated correctly.

The City reserves the right to reject any or all proposals or to waive any formality or irregularity in any proposal in the interest of the City. No bidder may withdraw his proposal for a period of sixty (60) calendar days after the date of opening thereof.

16.00 FUNDS PROGRAMMED

The funds programmed for construction are estimated to be sufficient to provide for the proposed work shown on the plans. In the event contract unit prices indicate a total cost of the project in excess of the allotted funds, the project length may be shortened or quantities decreased to keep the cost of work within the funds allocated to the project. Similarly, if the contract unit prices indicate a total cost of the project less than the allotted funds, the length of the project may be increased and quantities added to ensure the allotted funds for the project are used.

17.00 PREFERENCE FOR STATE LABOR AND MATERIALS

Pursuant to Wyo. Stat. § 16-6-104, Wyoming made materials and products, and Wyoming suppliers of products and materials of equal quality and desirability shall have preference over materials or products produced or supplied outside the state and any contract let shall so provide. The City shall apply the preference created by Wyo. Stat. § 16-6-104 in a manner identical to the preference for resident contractors in Wyo. Stat. § 16-6-102.

Pursuant to Wyo. Stat. § 16-6-102, the City shall award the contract to the responsible, certified resident making the lowest responsible bid, if the certified resident's bid is not more than five percent (5%) higher than the lowest responsible, nonresident bidder.

Pursuant to Wyo. Stat. § 16-6-103, a successful resident bidder shall not subcontract more than thirty percent (30%) of the work covered by the contract to nonresident contractors.

Pursuant to Wyo. Stat. § 16-6-106, preference is hereby given to materials, supplies, agricultural products, equipment, machinery, and provisions produced, manufactured, or grown in Wyoming, or supplied by a state resident, quality being equal to articles offered by the competitors outside of the state.

Pursuant to W.S.§ 16-6-107, the structure or structures to be constructed pursuant to this invitation to bidders shall be constructed and maintained by materials produced or manufactured in Wyoming if Wyoming materials are suitable and can be furnished in marketable quantities. Preference shall not be granted for materials of an inferior quality to those offered by competitors outside of the state, but a differential of five percent (5%) shall be allowed in cost of contracts Wyoming materials produced or manufactured in Wyoming.

Pursuant to Wyo. Stat. § 16-6-203, the successful bidder shall employ only Wyoming laborers on the project, and the contract awarded to the successful bidder shall contain a provision requiring that Wyoming labor be used, except other laborers may be used when Wyoming laborers are not available for employment within the state, or are not qualified to perform the work involved. In addition, the contract shall contain a provision requiring specific acknowledgement of the requirements of this section. The successful bidder may employ laborers other than Wyoming laborers if:

(i) The successful bidder informs the nearest state workforce center of his employment needs at least eleven (11) calendar days before work is commenced;

(ii) The state workforce center certifies that the bidder's need for laborers cannot be filled from those Wyoming laborers listed with the Wyoming Department of Workforce Services. The department shall respond to a bidder's request for certification within ten (10) calendar days of the date the information is filed; and

(iii) The successful bidder shall also agree to promptly respond to requests from the Wyoming Department of Workforce Services for the most recent construction schedule for the project.

18.00 CERTIFICATE OF RESIDENCY STATUS FOR IN-STATE PREFERENCE

Wyoming Contractors desiring residency status for the purpose of obtaining the five percent (5%) preference for resident bidders on public works projects must be so certified by the Wyoming Department of Workforce Services. No bidder may be considered a resident for the purpose of the five percent (5%) preference unless his residency has been certified as provided in Wyo. Stat. § 16-6-101.

19.00 AGREEMENT EXECUTION, PERFORMANCE, AND PAYMENT BONDS

Subsequent to the award and within fifteen (15) calendar days after the prescribed forms are presented for signature, the successful bidder shall execute and deliver to the City an agreement in the form included in the Contract Documents in such number of copies as the City may require and at the same time shall also provide the insurance, Workers Compensation and Unemployment insurance certificates, and the performance and payment bonds. The performance and payment bonds will remain active for the two (2) year warranty period, which is the two (2) year period following the City's acceptance of the substantial completion certificate. If the Contractor is required to perform corrections in the work of the project in the two (2) year warranty period, the Contractor shall provide copies of their current insurance, Worker's Compensation, and Unemployment Insurance Certificates as required in the original project.

Having satisfied all conditions of award as set forth elsewhere in these documents, the successful bidder shall, within the period specified in paragraph "a." above, furnish a surety bond, not less than the amount of the contract as awarded, as security for the faithful performance of the contract and a bond in an equal sum as surety for the payment of all persons, firms, or corporations to whom the successful bidder may become legally indebted for labor, materials, tools, equipment, or services of any nature, including utilities and transportation services employed or used by him in performing the work. Such bond or bonds shall be in the same form as that included in the Contract Documents and shall bear the same date as that of the agreement. The current power of attorney for the person who signs for any surety company shall be attached to such bonds. These bonds shall be signed by an authorized agent of the surety company qualified to do business in the State of Wyoming. The successful bidder shall notify the surety of any changes affecting the general scope of the project or change in the Contract Price, and the amount of the bonds shall be adjusted accordingly. The successful bidder shall furnish proof of such adjustment to the City.

The successful bidder's failure to execute such agreement, or to supply the required bond or bonds within thirty (30) calendar days after the prescribed forms are presented for signature, or within such extended period as the City may grant based upon reasons determined sufficient by the City, shall constitute a default. The City may then award the contract to the next lowest, responsible bidder or re-advertise for bids, and the bid guarantee of the bidder shall be forfeited to the City as liquidated damages as per Wyo. Stat. § 15-1-113(f). The City may also charge against the defaulting bidder the additional

difference between the amount of the original low bid and the amount for which the contract is subsequently let, if the amount exceeds the amount of the bid bond. If a more favorable bid is received by re-advertising, the defaulting bidder shall have no claim against the City for a refund.

If the cost of a payment and performance bond is included in the bid, the successful bidder may receive reimbursement for the costs of the bonds subject to the following requirements. If the bond cost is not included as a bid item, the bond cost shall be deemed to have been included in the Contract Price.

Subsequent to the contract award and compliance with the conditions stated in the preceding paragraph, the successful bidder may submit a written request to the engineer in charge of the project requesting the payment and performance bid item. The successful bidder shall include with this written request, a statement from the insuring firm, indicating the bond cost based on the preliminary estimate of the cost of the contract or as adjusted by the final contract price. Payment for the bond cost will be computed on the basis of the final Contract Price or on the basis of the preliminary cost estimate of the contract, whichever is less. The payment for a payment and performance bond may be adjusted upon project completion based on approved modifications to the Contract Price.

20.00 SALES AND USE TAX PROVISIONS

The successful bidder shall abide by Wyo. Stat. § 39-15-101 *et seq.*, and Wyo. Stat. § 39-16-101 *et seq.*, relating to Sales and Use Taxes. In particular, the successful bidder shall abide by the guidance provided in State of Wyoming, Department of Revenue Bulletin, "Use Tax and You" issued December 5, 2012, revised July 1, 2014. This Bulletin is available on-line through the Wyoming Department of Revenue's website. If the Contractor has difficulty locating the Bulletin, they may contact the Wyoming Department of Revenue for assistance.

The successful bidder shall cause all subcontractors to abide by and perform their work on the same terms and conditions as provided above. The successful bidder shall cause the above statements to be inserted in any contract or agreement between the successful bidder and subcontractors.

The successful bidder shall notify the Wyoming Department of Revenue, Excise Tax Division, when they begin work on any project in the State of Wyoming. The notice shall include the project name, specific project location and contract amount. Questions regarding sales and use taxes should be directed to the Wyoming Department of Revenue, Excise Tax Division at (307) 777-5204.

21.00 TRADE NAME PROVISIONS

When in the specifications or drawings, an item is identified by a manufacturer's name, trade name, catalog number, or reference, the bidder proposes to furnish the item so identified and does not propose to furnish an "equal" unless the proposed "equal" is clearly communicated to the City by the bidder, and the bidder has obtained prior certification from the City for approval of the proposed "equal".

The reference to a manufacturer's name, trade name, or catalog number is intended to be descriptive, but not restrictive, and only to indicate to the bidder articles that will be satisfactory. Bids on other makes, catalog numbers, etc., will be considered, provided each bidder clearly states on the bid proposal exactly what the bidder proposes to furnish, and has submitted to the City, at least seven (7) calendar days prior to the bid opening date, illustrations, specifications, or other descriptive matter which clearly indicate the character of the article(s) to be covered by the bid, and has obtained the prior approval of the City for the proposed "equal".

The City reserves the right to approve as an equal, or to reject as not being equal, any article the bidder proposes to furnish which contains major or minor variations from specifications but which may comply substantially therewith.

22.00 RETAINAGE ADMINISTRATION FOR CONTRACTS EXCEEDING $50,000.00

The City will withhold five percent (5%) of the work's dollar value completed throughout the contract term.

If requested by the general contractor, the City shall enter into an interest bearing deposit agreement with any depository designated by the general contractor, after notice to the surety, to provide an agent for the custodial care and servicing of any deposits placed with it pursuant to this act on any contract of more than fifty thousand dollars ($50,000.00) pursuant to Wyo. Stat. § 16-6-704. Interest income will be paid to the successful bidder as collected or as otherwise instructed by the successful bidder. All expenses incurred for this service will be charged to the successful bidder and deducted from payments due and retained funds.

If the City finds that satisfactory progress is being made in all phases of the contract it may, upon written request by the contractor, authorize payment from the withheld percentage. Before the payment is made, the public entity shall determine that satisfactory and substantial reasons exist for the payment and shall require written approval from any surety furnishing bonds for the contract work in accordance with Wyo. Stat. § 16-6-116.

No payments returning retainage from this fund will be made until the City has determined that satisfactory and substantial reasons exist for the payment, and the required Certificate of Completion; Affidavit of Release of Liens; Contractor's Final Waiver of Liens; Sub-Contractor's Final Waiver of Liens; Consent of Surety for final payment; Sworn Statement for Final Payment Pursuant to Wyo. Stat. § 16-6-116 and § 16-6-117; and Engineer's Certificate of Completion have all been received by the City, and all the items on the punch list have been completed.

23.00 SUB-CONTRACTORS, MATERIALMEN PROTECTION UNDER A BOND OR GUARANTEE; LIMITATIONS.

For contracts of $150,000.00 or more, the Contractor shall post on the construction site a prominent sign citing Wyo. Stat. § 16-6-121 and stating that any Sub-Contractor or materialmen shall give notice to the Contractor of a right to protection under the bond or guarantee and that failure to provide the notice shall waive the Sub-Contractor or materialmen's protection under the bond or guarantee and shall waive any right to a lien

for material or services provided. The general contractor shall post on the construction site a prominent sign citing this section and stating that any subcontractor or materialman shall give notice to the general contractor of a right to protection under the bond or guarantee and that failure to provide the notice shall waive the subcontractor or materialman's protection under the bond or guarantee.

24.00 PERMITS AND LICENSES

The Contractor shall obtain all permits necessary to execute the work. Fees will be waived for permits issued by the City. Permits may be required by other entities which are not furnished or paid for by the City. The successful bidder and its subcontractors shall be required to hold and pay for any licenses required and shall also pay for all public utility charges.

25.00 PRE-BID CONFERENCE

A **MANDATORY** pre-bid meeting will be held at 2:00 P.M. on September 10, 2020, at the City of Cheyenne Municipal Building, Room 208, Cheyenne, WY 82001. The City will reject bids from any company who has not signed the attendance sheet prior to the commencement of the mandatory pre-bid meeting.

Any bidder attending the pre-bid meeting shall wear a face mask or face covering while present in the City of Cheyenne Municipal Building, or while present in any meeting room.

PART 3 – PROPOSAL FORMS

CITY OF CHEYENNE, WYOMING

	CITY OF CHEYENNE BID PROPOSAL FORM
BID NO.	S-7-21
OPEN DATE:	Friday, October 2, 2020
TIME:	2:00 PM
PROJECT:	Happy Jack Landfill Front Entrance and Scale House

TO: GOVERNING BODY
CITY OF CHEYENNE
2101 O'NEIL AVENUE
CHEYENNE, WY 82001

(Submit bids to the City Purchasing Division, Room 309, Municipal Bldg. at 2101 O'Neil Avenue)

1. Pursuant to and in full compliance with all Bidding Documents, the undersigned Bidder hereby proposes to furnish all the labor and materials and to perform all the work required for the complete and prompt execution of everything described or shown in or reasonably implied by the Bidding Documents, including the Drawings and Specifications, for the work above indicated for the monies stated herein, which includes all State, County and local taxes normally payable in respect to such work when done for an entity not entitled to any exemption from such taxes. The amounts stated include all allowances for profit and overhead, taxes, fees and permits, transportation, services, tools and equipment, labor and materials and other incidental costs.

2. The Bidder has carefully examined the Bidding Documents, including the Drawings and Specifications and the work site, and has fully apprised him/her -self of the conditions affecting the work to be executed, and hereby proposes to construct and complete the above-referenced project, all in accordance with the Bidding Documents, at and for the following sum, as reflected in the total on the attached itemized bid sheets:

_____Dollars

($_____).

3. This Bid Proposal is accompanied by the required Bid Guarantee of five percent (5%) based upon the total cost of all items required to be bid. The City of Cheyenne is authorized to hold said Bid Guarantee for a period of not more than sixty (60) calendar days after the opening of the bids for the purpose of evaluating bids prior to award. If awarded the contract for this work, the undersigned Bidder agrees to execute the Agreement and furnish the required Bonds and Insurance Certificates within thirty (30) calendar days from the date of Notice of Award.

4. Attached hereto is an affidavit in proof that the undersigned has not entered into a collusive agreement with any person in respect to this bid or any other bid or the submitting of bids for which this bid is submitted.

5. The undersigned bidder **has [ ] has not [ ]** been granted a State of Wyoming Certificate of Residency Status. If the bidder has been granted a State of Wyoming Certificate of Residency Status, the undersigned **bidder has [ ] has not [ ]** subcontracted more than thirty percent (30%) of the work covered by this contract to nonresident bidders, as per Wyo. Stat. § 16-6-103 regarding limitations on subcontracting by resident contractors.

Dated this _____ day of _____, _____
(Month) (Year)

FIRM NAME:_____

Bidder's Legal Stature: ☐Corporation
☐Partnership
☐Individual Sole Proprietorship
☐L.L.C.
☐Other:_____

State of Incorporation:_____

Bidder's Address:_____

_____

_____

Telephone Number:_____

Email Address: _____

By:_____
(Bidder's Signature)

Title:_____

_____
Witness

The Bidder acknowledges receipt of the following addenda to the Bid Documents (if none, so state):_____.

Addendum No. Dated

_____

_____

_____

PROJECT: LANDFILL FRONT ENTRANCE AND SCALE HOUSE **BID NO. S-7-21**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	TOTAL COST
01000	PERFORMANCE BOND	BOND	1		
01000	MOBILIZATION	LS	1		
01000	FORCE ACCOUNT	LS	1	LS	$ 20,000.00
01200	QUALITY CONTOL & MATERIAL TESTING	LS	1		
10500	TRAFFIC CONTROL	LS	1		
01563	SEDIMENT EROSION CONTROL AND STORM WATER MANAGEMENT	LS	1		
02050	STRUCTURE AND PAVEMENT DEMOLITION	LS	1		
02645	BOLLARD	EA	21		
02900	CLEARING AND GRUBBING	LS	1		
03320	4" ASPHALT PAVEMENT INCLUDES 9" COMPACTED BASE	SQYD	8400		
03330	6-INCH CURB AND GUTTER	LF	165		
03340	R&R SIDEWALK 4", INCLUDES 4" COMPACTED BASE	SQFT	785		
03340	DETECTABLE WARNING PLATES	EA	3		
	ENTRANCE GATE	LS	1		
	WATER SUPPLY CISTERN AND PIPING	LS	1		
	SEWER PIPING AND SEPTIC SYSTEM	LS	1		
	GARAGE OVERHEAD DOOR REPLACEMENT	LS	1		
	SCALE FOUNDATIONS AND ACCESS RAMPS	LS	1		
	SCALE RELOCATION	LS	1		
	ADMINSTRATION BUILDING	LS	1		
	SCALE HOUSE	LS	1		
	STRIPING AND SIGNAGE	LS	1		
				TOTAL BID	

COMPANY NAME: _____

ADDRESS: _____

CITY, STATE, ZIP: _____

BIDDER'S SIGNATURE: _____

	CITY OF CHEYENNE NON-COLLUSION AFFIDAVIT OF PRIME BIDDERS FORM
State of:	
County of:	

_____, being first duly sworn, deposes and says that:

(1) S/he is (owner, partner, officer, representative, or agent) of _____, the bidder that has submitted the attached bid;

(2) S/he is fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such bid;

(3) Such bid is genuine and is not a collusive or sham bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees, or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other bidder, firm, or person to submit a collusive or sham bid in connection with the contract of which the attached bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly, sought by agreement, collusion, communication, or conference with any other bidder, firm or person to fix the price or prices in the attached bid or of any other Bidder; to fix any overhead, profit, or cost element of the bid price or the bid price of any other Bidder; or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against the City or any person interested in the proposed contract; and

(5) The price or prices quoted in the attached bid are fair and proper and are not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the bidder or any of the bidder's agents, representatives, owners, employees, or parties in interest, including this affiant.

Signed_____

Subscribed and sworn to before me this _____ day of _____, _____.

_____
(Title) (Signature)

My Commission expires_____

CITY OF CHEYENNE BID BOND FORM

PROJECT	Happy Jack Landfill Front Entrance and Scale House
BID NUMBER	S-7-21

KNOW ALL MEN BY THESE PRESENTS, that_____, as Principal, and_____, as Surety, a corporation duly organized under the laws of the State of _____ and authorized to do business within the State of Wyoming, are held and firmly bound unto the City of Cheyenne, Wyoming, in the full and just sum of _____Dollars ($_____), lawful money of the United States, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal is herewith submitting a Proposal for_____ _____, and the City of Cheyenne, Wyoming has required as a condition for submitting said Proposal, that said Principal deposit specified Bid Security in an amount not less than five percent (5%) of the amount of said Proposal, conditioned that in event of failure of Principal to execute the contract and furnish the required performance and payment bonds if the contract is awarded to said Principal, that said sum be paid immediately to the City of Cheyenne, Wyoming as liquidated damages, and not as penalty, for the Principal's failure to perform.

The condition of this obligation is such that if the aforesaid Principal will, within the time required, enter into a formal contract and give such bonds as are specified in the bidding documents with surety acceptable to the City; or if Principal shall fail to do so, pay to the City the sum determined herein as liquidated damages and not as a penalty, then this obligation shall be void; otherwise to remain in full force and effect.

Signed, sealed, and delivered this _____day of_____, _____.

_____ Witness

_____ Principal (seal)

by_____

Title_____

_____ Witness

_____ Surety (seal)

by_____ Attorney-in-fact

(Attach Power of Attorney)

	CITY OF CHEYENNE SUBCONTRACTORS AND MATERIALS SUPPLIERS LIST FORM
BIDDER'S NAME	

List all materials suppliers and subcontractors proposed for this project and return list with bid:

ATTENTION!
Any Resident Bidder using Non-Resident subcontractors must fill in the percentage of work being done by the subcontractor.

WORK	SUBCONTRACTOR OR MATERIAL SUPPLIER	CITY/STATE	% OF WORK

BID SUBMISSION CHECKLIST

THE FOLLOWING CHECKLIST REPRESENTS THE REQUIRED FORMS TO BE EXECUTED AND DOCUMENTS TO PREPARE. THESE FORMS AND DOCUMENTS ARE TO BE INCLUDED IN THE CONTRACTOR'S SUBMITTED BID PACKAGE.

COMPLETED & INCLUDED

1. City of Cheyenne Bid Proposal Form [ ]
2. Bid Price Total [ ]
3. Itemized Bid Schedule [ ]
4. Sub-Contractors and Material Suppliers List [ ]
5. Non-Collusion Affidavit of Prime Bidders [ ]
6. Bid Security / Bid Guarantee [ ]
7. Acknowledgement of Addenda (If Any) [ ]

	CITY OF CHEYENNE **BID ACCEPTANCE FORM**
BID NUMBER:	**S-7-21**
DATE:	
TO:	

To Whom It May Concern:

The City of Cheyenne, having duly considered the proposals submitted on ___/____/____ for the construction of **"Happy Jack Landfill Front Entrance and Scale House",** as outlined in these Contract Documents, and it appearing that your Proposal for performing the work outlined is fair, equitable, and in the City's best interest, the bid items are hereby accepted at the bid prices contained therein.

In accordance with the terms of these Contract Documents, you are required to execute the formal Agreement and furnish the required Performance and Payment Bonds within thirty (30) calendar days from and including the date of this notice.

In addition, you are required to furnish at the same time a copy of Certificate of Insurance evidencing compliance with the requirements for insurance stated in the Bidding Documents, including unemployment insurance, and a copy of your Worker's Compensation Certificate.

The Bid Guarantee submitted with your Proposal will be retained until the Agreement has been executed and the required Performance and Payment Bonds have been furnished and approved. In event that you should fail to execute the contract and furnish the Performance and Payment Bonds within the time limit specified, the said bid security will be retained as liquidated damages and not as penalty for the delay and extra work caused thereby.

CITY OF CHEYENNE, WYOMING

By_____
Purchasing Manager

	CITY OF CHEYENNE **NOTICE TO PROCEED FORM**
BID NUMBER:	**S-7-21**
DATE:	
TO:	

You are hereby authorized to proceed on this date, _____ with the construction of **"Happy Jack Landfill Front Entrance and Scale House"** as set forth in detail in the Contract Documents. No work may be done at the site prior to the date stated above.

CITY OF CHEYENNE, WYOMING

By_____
Purchasing Manager

The Contractor is required to return an acknowledged copy of this Notice to the City.

Acknowledged:

Contractor:	
By [Printed Name]:	
By: [Signature]:	
Title:	
Date:	

	CITY OF CHEYENNE CONTRACTOR'S CERTIFICATION OF COMPLETION FORM
DATE:	
PROJECT:	Happy Jack Landfill Front Entrance and Scale House
JOB NUMBER:	
CONTRACT NUMBER:	
OWNER:	
FROM:	

This is to certify that I, _____, am an authorized official of _____, working in the capacity of _____, and have been properly authorized by said firm or corporation to sign the following statements pertaining to the subject contract:

I know of my own personal knowledge, and do hereby certify, that the work of the contract described above has been performed, and materials used and installed in every particular, in accordance with, and in conformity to, the contract drawings and specifications.

The contract work is now complete in all parts and requirements, and ready for your final inspection.

I understand that neither the determination by the Engineer/Architect that the work is complete, nor the acceptance thereof by the Owner, shall operate as a bar to claim against the Contractor under the terms of the guarantee provisions of the Contract Documents.

BY:_____

TITLE:_____

FOR:_____

	CITY OF CHEYENNE **CONSENT OF SURETY FOR FINAL PAYMENT FORM**
PROJECT NAME:	Happy Jack Landfill Front Entrance and Scale House
LOCATION:	
PROJECT NUMBER:	**S-7-21**
TYPE OF CONTRACT:	
AMOUNT OF CONTRACT:	

In accordance with the provisions of the above-named contract between the Owner and the Contractor, the following named surety:

_____
_____
_____

On the Payment Bond of the following named Contractor:

_____
_____
_____

hereby approves of final payment to the Contractor, and further agrees that said final payment to the Contractor shall not relieve the Surety Company named herein of any of its obligations to the following named Owner as set forth in said Surety company's bond:

_____
_____
_____

IN WITNESS WHEREOF, the Surety Company has hereunto set its hand and seal this _____ day of _____, _____.

_____
(Name of Surety Company)

_____
(Signature of Authorized Representative)

(Affix corporate seal here)

Title _____

CITY OF CHEYENNE
FINAL WAIVER OF LIEN
FORM

(Instructions at bottom of form)

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by	
A.	
to furnish labor and materials for	
B.	
work, under a contract	
C.	
for the improvement of the premises described as	
D.	
in the City of Cheyenne, Laramie County, Wyoming, of which the City of Cheyenne is the Owner.	

NOW, THEREFORE, this ____ day of _____, _____, for and in consideration of the sum of	
E.	
dollars, paid simultaneously herewith, the receipt whereof is hereby acknowledged by the undersigned, the undersigned does hereby waive and release any lien rights to, or claim of lien with respect to and on said above-described premises, and the improvements thereon, and on the monies or other considerations due or to become due from the owner, on account of labor, services, material, fixture, apparatus or machinery heretofore or which may hereafter be furnished by the undersigned to or for the above described premises by virtue of said contract.	

(F)_____ (SEAL)
(Name of sole ownership, corporation or partnership)

_____
(Signature of Authorized Representative)

TITLE: _____

INSTRUCTIONS FOR FINAL WAIVER:	
A.	Person or firm with whom you agreed to furnish either labor, or services, or materials, or both.
B.	Fill in nature and extent of work; strike the word labor or the word materials if not in your contract.
C.	If you have more than one contract on the same premises, describe the contract by number if available, date and extent of work.
D.	Furnish an accurate enough description of the improvement and location of the premises so that it can be distinguished from any other property.
E.	Amount shown should be the amount actually received and equal to total amount of contract as adjusted.
F.	If waiver is for a corporation, corporate name should be used, corporate seal affixed and title of officer signing waiver should be set forth; if waiver is for a partnership, the partnership name should be used, partner should sign and designate himself as partner.

CITY OF CHEYENNE
AFFIDAVIT OF RELEASE OF LIENS FORM

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by _____ to furnish labor and materials for _____work, under a contract _____ for the improvement of the property described as _____

_____

in the city/town of _____, County of _____ , State of _____ of which _____ _____ is the Owner.

NOW, THEREFORE, this _____ day of _____, _____, the undersigned, as the Contractor for the above-named contract pursuant to the conditions of the contract hereby certifies that to the best of his knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of work, labor or services, who have or may have liens against any property of the Owner arising in any manner out of the performance of the contract referenced above.

Exceptions: (List names of suppliers and/or subcontractors and amounts owed. If none, write "None.") The City will withhold the amounts listed below from final payment due the Contractor until these obligations have been satisfied.

CONTRACTOR _____ (SEAL)
(Name of sole ownership, corporation or partnership)

(Affix corporate seal here)

_____(SEAL)
(Signature of Authorized Representative)

TITLE:_____

ATTACHMENTS:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers.

CITY OF CHEYENNE
AFFIDAVIT OF PAYMENT
FORM

TO ALL WHOM IT MAY CONCERN:

WHEREAS, the undersigned has been employed by _____ to furnish labor and materials for _____ (work) under contract #_____ for the improvement of the property described as _____ _____ in the city/town of _____, County of _____, State of _____ of which _____ is the Owner.

NOW, THEREFORE, this ____ day of _____, _____, the undersigned, as the Contractor for the above-named Contract pursuant to the Conditions of the Contract hereby certifies that, except as listed below, he has paid in full or has otherwise satisfied all obligations for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or his property might in any way be held responsible.

EXCEPTIONS: (If none, write "None." If required by the Owner, the Contractor shall furnish bond satisfactory to the Owner for each exception.)

ATTACHMENTS:

I. Consent of Surety to Final Payment. (Whenever Surety is involved, Consent Of Surety is required.)
II. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
III. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers.
IV. Contractor's Affidavit of Release of Liens.

CONTRACTOR_____(SEAL)
(Name of sole ownership, corporation or partnership)

(Affix corporate seal here)

_____(SEAL)
(Signature of Authorized Representative)

TITLE: _____

	CITY OF CHEYENNE **CONTRACT PAYMENT REQUEST FORM**
DATE:	
PROJECT:	Happy Jack Landfill Front Entrance and Scale House
CITY BID NUMBER:	**S-7-21**
CITY CONTRACT NUMBER:	
CONTRACTOR:	
CONTRACT PAYMENT REQUEST NUMBER:	
FOR WORK COMPLETED THROUGH DATE OF:	

The present status of the account for this contract is as follows:

Original Contract Amount	$
Net Change by Change Orders to Date	$
Current Contract Amount	$
Total Completed to Date	$
Less 5% Retainage	$
Total Earned Less Retainage	$
Less Previous Payments	$
Total Payment Due	$
Total Retainage Due	$

Contractor's Certification:

The undersigned Contractor certifies that: (1) all previous progress payments received from the City on account of work done under the Contract referred to above have been applied to discharge Contractor's legitimate obligations incurred in connection with work covered by prior Contract Payment Request numbered one through _____ inclusive: (2) title of all work, materials and equipment incorporated in said work or otherwise listed in or covered by this Contract Payment Request will pass to Owner at the time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by Bond acceptable to owner indemnifying Owner against such liens, security interest or encumbrance); and (3) all work covered by this Contract Payment Request is in accordance with the Contract Documents and not defective.

_____ _____

Date Contractor

_____ _____

Authorized Signature Print Name and Title

Payment of the above AMOUNT DUE THIS PAY REQUEST is recommended.

_____ _____

Project Manager Signature Print Name and Title

Authorization by City Representative

_____ _____

City Representative Signature Print Name and TitlE

	CITY OF CHEYENNE **ITEMIZED PAY REQUEST** **FORM**
CONTRACTOR:	
PROJECT:	Happy Jack Landfill Front Entrance and Scale House
PAY REQUEST NUMBER:	
This form must be submitted with the above pay request, or submit AIA document G702and G703.	

A	B	C	D	E	F	G	H	I	J	K
					Work Completed					
Description of Work/Material	Unit	Original QTY	Contract Unit Price	Original Contract Price	QTY Complete This period	Total Complete This period	QTY Complete from Previous Period	Total Complete From Previous Period	Total Complete (G+I)	Balance to finish

Signature:_____ Print Name:_____

PART 5 - AGREEMENT AND PERFORMANCE PAYMENT BONDS

CITY OF CHEYENNE, WYOMING

	CITY OF CHEYENNE AGREEMENT FORM
BID NUMBER:	**S-7-21**
CONTRACT NUMBER:	

THIS AGREEMENT, entered into this ____ day of _____, _____, by and between the CITY OF CHEYENNE, WYOMING, hereinafter referred to as the "CITY", and _____, hereinafter referred to as the "CONTRACTOR".

WITNESSETH that the Contractor and the City, for the considerations stated herein, mutually agree as follows:

ARTICLE 1. STATEMENT OF WORK. The Contractor shall furnish all supervision, technical personnel, labor, materials, machinery, tools, equipment, and services, including utility and transportation services, and perform and complete all work in an efficient and workmanlike manner in the construction of the **"Happy Jack Landfill Front Entrance and Scale House"** project all in strict accordance with the Contract Documents including all addenda thereto, numbered and dated:

ARTICLE 2. RESPONSIBLE DESIGNEE FOR THE CITY. The Contractor shall in any and all matters relating to the scope of services to be provided under this Contract or any other provisions herein, contact the City Engineer, or his/her designated representative.

ARTICLE 3. TIME FRAME FOR COMPLETION. The services to be performed under this Agreement shall commence on the date stipulated in the "Notice to Proceed" that will be issued by the City. The work shall be completed by _____**.** If the work has not been completed within the time stipulated above, including any extensions of time issued by the City for excusable delays, the Contractor and his/her sureties shall pay the City fixed, agreed liquidated damages, as stipulated in the Supplemental Conditions, for each calendar day of delay until the work is completed.

ARTICLE 4. COMPENSATION AND METHOD OF PAYMENT. The CITY will pay the Contractor for the performance of the Contract in current funds, the sum of _____Dollars ($_____). In the event there are changes in the estimated quantities shown on the Bid Proposal, the unit prices multiplied by the actual quantities shall govern, and the total contract amount will be adjusted accordingly. The City agrees to pay the above amount for contractual services in the following manner, upon receipt of appropriate documentation:

a. The Contractor will be paid on a monthly basis for percentage of estimated work completed. Submittal will be at least seven (7) business days prior to the payable due date as established

annually by the City Treasurer's Office. The pay request shall be submitted on the Contract Payment Request Form and Itemized Pay Request or the AIA Documents G702 and G703. The engineer will review the estimate for approval prior to payment.

b. The City will withhold five percent (5%) of the dollar value of the work completed for a minimum of forty-one (41) calendar days after Notice of Final Settlement has been published in accordance with Wyo. Stat. §15-1-113(h). Upon completion of the work under this Contract, the Contractor shall submit a Contractor's Certificate of Completion; the Consent of Surety; Final Waivers of Lien from the Contractor, and all Sub-Contractors, Suppliers and Materialmen; Affidavit of Release of Liens; Affidavit of Payment; and a current Workers Compensation Certificate. Final payment will not be made until the above documents have been received by the City and all items on the Punch List have been completed, and the advertising requirements have been met.

ARTICLE 5. CONTRACT. The executed Contract Documents shall consist of the following:

1. This Agreement;
2. Addenda;
3. Invitation for Bids;
4. Instructions to Bidders;
5. Signed Bid Proposal;
6. General Conditions and Insurance;
7. Supplemental Conditions;
8. Part IV Forms & Notices;
9. Specifications and Special Provisions;
10. Drawings.

This Agreement, together with other documents enumerated in this Article 5, which said other documents are as fully a part of the Contract as if hereto attached or herein repeated, forms the Contract between the parties hereto.

IN WITNESS WHEREOF, THAT the governing body of the City of Cheyenne has authorized the Mayor as Executive Officer of the City to enter into this Agreement, and that the parties hereto have caused this Agreement to be executed on the day and year in the first part herein written.

ATTEST:

_____
Kristina F. Jones, City Clerk

CITY OF CHEYENNE, WYOMING

_____
Marian J. Orr, Mayor

_____
Contractor
By
_____
_____
Title
_____
Address

Notary or Corporation Secretary:
SUBSCRIBED AND SWORN TO BEFORE ME
this ___ day of _____, ____
by_____
My Commission expires:_____

CITY OF CHEYENNE
PERFORMANCE AND PAYMENT BOND REQUIREMENTS

1.	Signature of principal must be affixed to the bond.
2.	Signature of principal must be witnessed.
3.	Name of principal must be witnessed.
4.	The legal capacity of the principal must be stated in the caption of the bond (i.e., corporation, partnership or sole proprietorship).
5.	If the principal is jointly owned, all owners must sign the bond.
6.	If the principal is a partnership, at least two partners must sign the bond.
7.	Signature of the attorney-in-fact acting on behalf of the surety company must appear on the bond.
8.	The surety's seal must be affixed to the signature of the attorney-in-fact (Facsimile seals are NOT acceptable).
9.	The surety company must be registered with the state insurance commission and qualified to do business in the State of Wyoming.
10.	Power of Attorney/Acknowledgment of Surety must be signed, sealed and dated with the same date as execution of bond.
11.	Date of written Agreement and date of bond must be same. Post-dated bonds are not acceptable.
12.	Bond form must be completely executed. Bonds with blank spaces, including dates, are unacceptable.
13.	The bond must be accompanied by a properly executed authorization of Power of Attorney. ***Note***: The bond shall continue in force throughout the project and a two-year warranty period; and at the discretion of the City, for any additional warranty period specified in the contract documents.
CORPORATE PRINCIPALS ONLY	
14.	The person signing on behalf of the corporate principal must state his/her legal capacity and he/she must be either the president or the vice-president if it is a corporation. If the officer or person signing on behalf of the corporate principal is other than the president or vice-president, there must be attached to the bond a resolution or certified evidence of authority that such officer or person has authority to sign in behalf of the principal.
15.	The signature of the principal must be witnessed, or attested to if it is a corporate principal by ONLY the secretary or assistant secretary of the corporation.
16.	The corporate seal must be affixed to the signature of the principal. (Facsimile seals are NOT accepted).
17.	Each party is required to sign his/her own name.
18.	All changes or strike-throughs must be initialed by the resident agent or attorney-in-fact of the surety company. The surety company must be notified of such changes.

CITY OF CHEYENNE PERFORMANCE AND PAYMENT BOND FORM

KNOW ALL MEN BY THESE PRESENTS:

That

_____
(Name of Contractor)

_____
(Address of Contractor)

a _____, hereinafter called Principal,

and _____ hereinafter called Surety, are
(Name of Surety)

held and firmly bound unto the City of Cheyenne, Wyoming, Municipal Building, 2101 O'Neil Avenue, hereinafter called City, in the penal sum of:

_____ Dollars

($_____), in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the City, dated the _____ day of _____, _____, a copy of which is hereto attached and made a part hereof for the

_____

_____.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms and conditions, and agreements, of said contract during the original term thereof, and any extensions thereof which may be granted by the City, with or without notice to the Surety and during the two-year guarantee period, and if the Principal shall satisfy all the claims and demands incurred under such contact, and shall fully indemnify and save harmless the City from all costs and damages which the City may suffer by reason of failure to do so, and shall reimburse and repay the City all outlay and expense which the City may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the City and the Contractor shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in ___ counterparts, each one of which shall be deemed an original, this the ___ day of _____, _____.

_____
(Witness)

_____
(Principal) (Seal)
By_____
_____
(Title)
_____
_____
(Address)

_____
(Witness)

_____
(Surety) (Seal)

By_____
_____
(Attorney-in-fact)
_____
_____
(Address)

Countersigned by:

By_____
(Wyoming Resident Agent)
_____
_____
(Address)

NOTE: Date of Bond must be same date as date of Contract. If Contractor is a partnership, all partners must execute bond.

IMPORTANT: Surety companies executing bonds must hold a Certificate of Authority issued by the State of Wyoming Insurance Department.

PART 6 – GENERAL CONDITIONS

CITY OF CHEYENNE, WYOMING

1.00 PROJECT SITE

City of Cheyenne Landfill, 1461 Happy Jack Rd, Cheyenne, WY 82009

2.00 NOTICES

Any notice, correspondence, or billing required by the terms of this Agreement shall be delivered by hand or mail, prepaid, to the address of the respective party representative(s) named below:

CITY: Matt Theriault
Public Works / Landfill
2101 O'Neil Ave.
Cheyenne, WY 82001
Ph: 307-637-6279

3.00 DRUG-FREE WORKPLACE

In compliance with the Drug Free Work Place Act of November 1988, the City has established an "Alcohol and Controlled Substance Policy" that pertains to alcohol and drug usage by City employees. All independent contractors under contract with the City and their employees and subcontractors are required to comply with the provisions of this policy for drug and/or alcohol usage on City property or other sites occupied by the Contractor while performing the duties and responsibilities of the contract. It is the responsibility of the Contractor to become familiar with the requirements of this policy and to inform all subcontractors and employees of their obligation to comply and to ensure their compliance therewith. If the Contractor, the Contractor's employees, or subcontractors are found in violation of this policy, the contract may be terminated. The Contractor is an independent Contractor and shall comply with the City's Alcohol and Controlled Substance Policy and the provisions of this section.

4.00 NONDISCRIMINATION

The parties shall comply with the Civil Rights Act of 1964, the Wyoming Fair Employment Practices Act (Wyo. Stat. § 27-9-105 *et seq.*), the Americans With Disabilities Act (ADA (42 U.S.C. § 12101 *et seq.*)), the Age Discrimination Act of 1975, and any properly promulgated rules and regulations thereto and all parties to this Agreement assure that no person shall be excluded from participation in, denied the benefits of, or otherwise discriminated against in connection with the award and performance of this Agreement on the grounds of age, sex, race, creed, color, national origin, ancestry, religion, pregnancy, qualifying disability, sexual orientation, or gender identity. The parties further assure that they will include the language of this paragraph in all agreements associated or connected in any way with this Agreement and shall cause all existing Agreements to similarly include this clause therein.

5.00 CONTRACTS FOR PUBLIC IMPROVEMENTS

Wyo. Stat. § 15-1-113 is expressly incorporated herein by this reference as though fully set forth herein.

6.00 SAFETY PROGRAMS

The City, as mandated by Occupational Safety and Health Administration ("OSHA"), has in place many safety programs. All independent contractors, their employees, and their subcontractors, under contract with the City, must be familiar with and comply with any and all applicable OSHA standards, regulations, and provisions.

7.00 INDEPENDENT CONTRACTOR

At all times during the term of this Agreement, the Contractor shall be considered an independent contractor. Neither Contractor nor any one employed by it shall represent, act, purport to act, or be deemed to be the agent, representative, employee, or servant of the City.

8.00 CONFIDENTIALITY

To the extent allowed by law, the City and the Contractor shall treat as confidential and not disclose to others information (including technical information, experience, or data) regarding either party's plans, programs, plants, processes, products, costs, equipment, operations, or customers which come within the knowledge of the parties, without in each instance securing the prior written consent of the other party, unless such disclosure is required by law or legal process. However, nothing shall prevent either Contractor or the City from disclosing to others, or using in any manner, information which either party can show (a) has been published or has become part of the public domain other than by acts of Contractor or the City; (b) has been furnished or made known to Contractor or the City by third parties without restrictions on its disclosure; or (c) was in either party's possession prior to the disclosure thereof by the City or Contractor to each other. Contractor shall not be restricted in any way from releasing information in response to a subpoena, court order, or legal process, but shall notify City of the demand for information before Contractor responds to such demand. The City reserves the right to prohibit the release of said information as provided by law.

9.00 CONFLICT OF INTEREST

In entering this Agreement, the Contractor covenants that it presently has no interest, and shall not acquire any interest, direct, indirect, financial, or otherwise, which would conflict in any manner or degree with performance of the services hereunder. Contractor further covenants that in the performance of the Agreement, no subcontractor, or person having such an interest, shall be employed by the City. Contractor certifies that no one who has or will have any financial interest under this Agreement is an officer or employee of the City.

10.00 ACCEPTANCE NOT WAIVER

The City's approval of drawings, plans, specifications, reports, and incidental work, or materials furnished hereunder shall not in any way relieve Contractor from responsibility for the technical accuracy of the work. The City's approval or acceptance of, or payment for, any services shall not be construed to operate as a waiver of any of the City's rights under this Agreement or any of its legal rights under statute and common law arising out of the performance of this Agreement.

11.00 INSURANCE REQUIREMENTS

The Contractor shall file a Certificate of Insurance with the City verifying each type of insurance coverage listed below.

The Certificate of Insurance shall be submitted to and approved by the City before the Contractor begins to perform under this bid and the subsequent contract.

TYPE OF COVERAGE	MINIMUM POLICY REQUIREMENTS
Commercial General Liability (*Including Products and Completed Operations; Explosion, Collapse and Underground if applicable to the hazards of a specific project*.)	$1,000,000 per Occurrence $2,000,000 Aggregate
Business Automobile Liability	$1,000,000 (Combined Single Limit)
Workers' Compensation *OR* Employer's Liability	Statutory $500,000 Each Accident $500,000 Each Disease-Policy Limit $500,000 Disease/Each Employee

It is understood and agreed that these policies are primary and not contributory. All policies required under this contract shall be in effect for the duration of the project and contract. The Contractor shall immediately notify in writing the City Risk Manager, City Clerk, and City Attorney of any fact, circumstance, or occurrence that has resulted in, or may result in, the cancellation or substantive change of any insurance coverage required by this contract, and failure to do so shall be construed to be a breach of this contract.

The Contractor shall name the City as an additional insured on the Contractor's insurance policies, except workers' compensation, and the Contractor shall provide a copy of the endorsements providing this coverage.

The City has the right to reject a certificate of insurance if the City determines that the Contractor's insurance company is widely regarded in the insurance industry as financially unstable. Any insurance company providing coverage under this contract shall have a minimum A.M. Best rating of A- (excellent).

The City has the right to review the insurance certificates of any or all Sub-Contractors used by the Contractor. Further, the City requires that the Sub-Contractors' insurance coverages be at least equivalent to that required of the Contractor.

The City has the right to increase the required minimum limit of liability on any contract project as warranted by an increase in hazard. Examples of increased hazard include, but are not limited to, handling of hazardous materials and activities involving large congregations of people.

The City shall have the right to consult with the Contractor's insurance agent for disclosure of relevant policy information, but the City's non-request or non-review such policies, endorsements, or certificates shall not affect the City's rights or Contractor's obligations hereunder. Disclosure of relevant policy information would specifically involve, but is not limited to, exclusions, deductibles, and claims in progress which could significantly reduce the annual aggregate limit.

12.00 INDEMNITY

In entering into the Agreement, the Contractor agrees to hold harmless, defend, and indemnify the City of Cheyenne, its officials, employees, agents, and authorized volunteers against any and all claims and costs, including attorneys' fees, arising during or resulting from the Contractor's performance of the contract. The Contractor shall carry insurance as set forth in these Contract Documents. The Contractor acknowledges its understanding of this paragraph and realizes it may have a financial responsibility to the City. The City does not waive any applicable defenses and expressly reserves the right to invoke governmental immunity pursuant to the Wyoming Governmental Claims Act, Wyo. Stat. § 1-39-101, *et seq*. for any claim arising out of performance of this agreement.

The Contractor expressly understands and agrees that although the City and the Engineer have the right under this Contract to observe and review the Contractor's work and operations, this right shall not relieve the Contractor from any of its covenants, obligations, or duties hereunder. The Contractor shall be responsible for and hold harmless the City, the Engineer, and their representatives from all suits, actions, or claims of any character, due to injuries or damages sustained by any person or property, in consequence of any neglect in performing the work, observing safety standards or regulations, through the use of unsafe or unacceptable practices or materials in the performance of the work, the Contractor's failure to comply with any law, ordinance or regulation or otherwise.

13.00 PROJECT RECORD DOCUMENTS

The Contractor shall maintain at the job site one copy of all Contract and project documents, each portion of which shall be clearly marked, "Project Record Copy". These documents, including drawings, specifications, addenda, approved shop drawings, change orders, field orders, other Contract Modifications, and other approved documents submitted by the Contractor in compliance with various sections of the Contract Documents, shall be maintained in good condition, available at all times for inspection by the City, and not used for construction purposes.

The Contractor shall mark up the most appropriate document to show significant changes made during construction progress, and significant detail not shown in the original Contract

Documents. The information shall include, but shall not be limited to, location of underground utilities and appurtenances referenced to permanent surface improvements, and location of internal utilities and appurtenances concealed in building structures referenced to visible and accessible features of structures.

The Contractor shall keep the project record documents current and not permanently conceal any work until required information has been recorded. Upon completion of the project and prior to final acceptance, the Contractor shall submit the marked up set of project record documents to the Engineer for the City along with the "Contractor's Certificate of Completion" found in the bidding documents. After the Engineer has inspected the work and has determined it to be substantially complete, the City will issue a "Certificate of Substantial Completion", which will establish the date of commencement of the warranty period.

14.00 CONTRACT DOCUMENTS

The City will furnish to the Contractor, without charge, two (2) copies of the Contract Documents including technical specifications and drawings. Additional copies requested by the Contractor will be furnished at cost.

15.00 TIME FOR COMPLETION

The Contractor shall commence the work required under this contract at the time stipulated by the City in the Notice to Proceed. The Contractor shall complete the work by the following:

The Project shall be completed within One (1) Year, from the time of Contract Award.

Time will not be counted when the project is officially suspended by the City due to acts of God, winter shutdown, and City-originated suspensions that are necessary through no fault of the Contractor. In the latter instance, if the City suspends the work for more than ninety (90) calendar days, the Contractor may apply for a price adjustment to compensate for reasonable expenses caused by the suspension. Any application for price adjustment or Contract Time extension will be submitted to the Governing Body of the City for its consideration in the form of a Contract Modification. It will be the responsibility of the Contractor to provide sufficient documentation to substantiate any claim.

16.00 JOB OFFICES AND STAGING AREA

The Contractor and Sub-Contractor(s) may maintain office and storage facilities on the site which are necessary to properly conduct the work. These facilities' locations shall not cause any interference to any work performed on the site. The Contractor shall consult with the City regarding the locations. Upon completion of the improvements, or as directed by the City, the Contractor shall remove all such temporary structures and facilities from the site. The Contractor shall leave the site of the work in the condition required by the Contract.

On-site toilet facilities for employees of Contractors and Sub-Contractor(s) shall be provided and maintained in a sanitary condition. The Contractor shall remove all trace of these facilities prior to completion of the project.

17.00 THE USE OF CITY OWNED REFUSE CONTAINERS

All City contracts shall require all Contractors to use City-provided Sanitation services if available.

18.00 REFERENCE POINTS

Project survey points are provided by the City one time only, unless otherwise noted by the City in the appropriate project manual.

The Contractor shall make all surveys that will be necessary for the proper construction. The Contractor shall preserve all property pins and control points. If any of these are destroyed or disturbed due to the Contractor's construction activities or negligence, the Contractor will be charged at the Engineer's established hourly crew rate for replacing them, with payment for this extra work to be made directly to the Engineer by deduction from the monthly periodic estimate payments to the Contractor. The Contractor shall also be responsible for any mistakes or damage resulting from the unnecessary loss or disturbances of control points.

19.00 SEQUENCE OF WORK

The Contractor shall make every effort to complete the work in a manner and fashion that minimizes roadway closures and inconveniences to the traveling public and adjacent property owners. Once barricades are placed in the right-of-way, the Contractor shall show progress of work during normal Working Days and hours. If no progress of work is recorded for twenty-four (24) hours and no concrete is waiting for strength, the Contractor shall remove barricades, re-open the right-of-way, and provide a safe travel way for the public. If the Contractor does not re-open the right-of-way or show progress of work within twenty-four (24) hours, the City shall use any and all means necessary to re-open the area at the Contractor's expense. The Contract Documents are compiled to support the efficient operations of the Contractor and are not intended to supplant the Contractor's responsibility of superintendence. Special consideration regarding schedules or work sequences necessary or anticipated during the course of the project will be identified in the Special Provisions.

20.00 GENERAL TRAFFIC REQUIREMENTS

The Contractor shall provide adequate signs, barricades, lights, and flaggers, and take all necessary precautions to prevent accident or injury and to minimize inconvenience to the public during the progress of the work.

All traffic control or other protective devices shall be installed and maintained in accordance with the Uniform Manual of Traffic Control Devices or in conformance with the applicable requirements of the authority having jurisdiction in such matters. The Contractor shall provide an American Traffic Safety Services Association ("ATSSA") certified work site supervisor to supervise all traffic control operations if the City deems necessary.

Material stored on or adjacent to public streets shall not obstruct or inconvenience the traveling public.

Streets, driveways, or other access points shall not be closed without the prior consent of the City, Engineer, and proper governmental authorities. Fire hydrants on or near the site of the work shall be accessible at all times. The Contractor shall notify affected property owners, the City and the Engineer at least 48 hours in advance of any proposed closure for construction operations including any work to be done by utility companies.

The Contractor shall submit a traffic control diagram to the City for approval before work begins. The diagram shall indicate location and type of signs, cones, flashers, flagging, reflective barricades, and all other devices deemed necessary for the proper protection of the work area.

21.00 EXISTING ROADWAYS AND OTHER PROPERTY

The Contractor shall take all necessary precautions to protect adjacent roadways, properties, improvements, and underground facilities affected by the Contractor's operations, regardless of the facilities' ownership.

Any existing improvements or facilities damaged by the Contractor's operations in the performance of the work under this Agreement shall be repaired or replaced by and at the expense of the Contractor to the satisfaction of the City.

The Contractor shall be responsible for the preservation and maintenance of all existing roadways affected but not directly disturbed by the work. The Contractor shall repair, replace, or clean any roadway indirectly affected by his or her operations during the course of the project. Such work shall be accomplished by and at the expense of the Contractor without reimbursement by the City.

22.00 FINAL CLEANUP

The Contractor shall clean all sidewalks, streets and other areas affected by construction and ensure removal of all loose surface materials. All piles of excess excavation, rocks, rubbish, or other debris shall be cleaned up and disposed of. Damage to any areas by the Contractor will be repaired or replaced by the Contractor at no expense to the City. No extra compensation will be allowed for final cleaning of the site, but the cost thereof shall be included in the unit price bid for other items in the Proposal. If work is suspended for any reason, the Contractor will be required at the Contractor's expense, prior to shut down, to provide for the public's safety and use as directed by the City or Engineer.

23.00 ENGINEER OR INSPECTOR OVERTIME AND USE OF CITY RESOURCES:

Inspection work required beyond normal working hours by any Engineer or Inspector having authority on the project must have the City's written approval twenty-four (24) hours in advance of scheduled work. In emergency situations, verbal approval may be given followed by written approval on the next working day. In an emergency situation, verbal approval will suffice until the next working day at which time written approval will be obtained.

The City of Cheyenne Board of Public Utilities ("BOPU") requires that requests for services on the weekend be made not later than 4:30 p.m. on the Thursday prior to need so that appropriate personnel arrangements can be made.

All costs for overtime inspection or professional services associated with the work will be paid for by the Contractor.

No City services, equipment, or personnel will be provided for this project unless specifically defined and stated in the bidding or contract documents, nor will any be provided free of charge unless expressly stated in these documents.

24.00 FORCE ACCOUNT, EXTRA WORK, AND WORK CHANGES

When the Contractor is required to do work or services under the force account or extra work, the cost for said work will be calculated using the provisions of the Wyoming Department of Transportation system for determining costs for equipment, operators and labor involved. Any extra work, additions, deletions or revisions in the work will be authorized by written Contract Modification or change orders. The Engineer may authorize minor changes or alterations in the work not involving extra cost and not inconsistent with the overall intent of the Contract Documents in the form of a Field Order.

25.00 CONTRACT MODIFICATIONS

a. General: Contract Modifications are used to increase or decrease the total Contract Price, to alter the Contract Time, or to alter any other contract agreement provision. Each Contract Modification must be in writing, approved by the City's Governing Body, and executed by the Mayor and Contractor.

b. A Contract Modification does not invalidate the contract or release the surety. If the parties agree to a Contract Modification, the Contractor shall perform the work in the manner required by the contract as modified, except that the Contractor shall not perform any work which is subject to the Contract Modification, until such time as the City Engineer authorizes the Contractor to proceed. The City will initiate a request to modify the Contract by submitting the proposed Contract Modification to the Contractor for review and approval.

The City Engineer or agent thereof, *e.g.*, a project manager, may issue a Field Order to authorize the work to be paid for under the Force Account bid item or to adjust existing bid item quantities without increasing the total Contract Price. *See* Section 24.00. The Contractor may not begin work under any Contract Modification until the City Engineer has authorized the Contractor to proceed.

The Contractor shall use a Request for Adjustment form to request an adjustment of the Contract Time or Contract Price. The City shall have no obligation to process oral requests for modification of the Contract Time or Contract Price, and no City official shall have the authority to approve oral modification requests. Proposed adjustments may be based upon extra work necessitated by an emergency, a change of conditions, or the City Engineer's interpretation of the contract requirements. Requests for Adjustments shall not be valid unless the Contractor has filed the request with the Engineer within:

1. Two (2) Working Days after the occurrence of the emergency or the discovery of any change in conditions which necessitates Additional Work; or

2. Five (5) Working Days after the effective date of a Work Directive.

The City will pay for adjustments and modifications based on contract unit bid prices. If the Contractor's cost of production or the character of the work is materially changed, the City may adjust the contract as specified in this section or seek a Contract Modification. The City will not pay for loss of anticipated profits resulting from adjustments or modifications, unless so specified in the adjustment or modification.

Differing Site Conditions: Before the conditions are disturbed or the affected work is performed or continued, the Contractor shall notify the City in writing if either of the following is encountered: (1) latent physical conditions that differ materially from those indicated in the contract; or (2) unusual physical conditions that differ materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the contract. The City will not grant or consider Contract Modifications based on differing site conditions if the Contractor does not timely notify the City within two (2) Working Days after discovering latent or unusual physical conditions.

Significant Changes in the Character of Work: The Contract Unit Price of each bid item in the proposal shall include the *pro rata* share of overhead and profit so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price bid represents the total bid. The City may alter the contract quantities, the Work, or both as necessary to complete the project, subject to the requirement that modifications to the Contract Price may be necessary in the event the alterations significantly change the character of the work. If alterations do not significantly change the character of the work specified in the contract, the City will pay for the altered work at contract unit prices and additional mark-ups for overhead and profit are not allowed.

Either of the following constitutes a "significant change" (1) when the character of the work, as altered, differs materially in kind or nature from that specified in the contract; or (2) in accordance with the relevant section in the Instruction to Bidders, when the net monetary value of all such additive and subtractive changes in quantities of such items increases or decreases the original total Contract Price by more than twenty percent (20%).

Extra and Force Account Work: When necessary or desirable to complete the project, the City may direct the Contractor to perform unforeseen work for which there is no pay item or unit price in the contract. The City shall seek a Contract Modification in the event the City's direction to perform unforeseen work results in an increase in the Contract Price, the alteration of the Contract Time or required any other modification of the Contract Agreement. The City Engineer may direct the Contractor to perform work under the Force Account item for minor changes or alterations in the work that do not increase the original Contract Price. All Force Account Work shall be approved with a Field Order in accordance with the above procedures.

Extra work under the Force Account item shall be paid by one of the following methods: (1) Contract unit bid prices that are representative of the work being performed, as specified in item Significant Changes in the Character of Work; and (2) Negotiated unit bid prices for items where the Contractor's cost of production or the character of the work is

materially changed. The negotiated unit bid prices shall include the *pro rata* share of overhead and profit. Overhead and profit mark-up on Sub-Contractor unit bid prices shall be limited to five percent (5%); (3) lump sum, as stipulated in the order authorizing the work. Documentation for lump sum pricing shall be provided to a degree sufficient for the City Engineer to review for acceptability. Overhead and profit shall be limited to five percent (5%) on Sub-Contractor work and fifteen percent (15%) on work by Contractor's own forces; and (4) Time and material basis utilizing approved materials, equipment, and labor costs calculated under the provisions of the latest edition of the Wyoming Department of Transportation Specifications Subsection 109.4.4.

26.00 PARTIAL USE OF SITE IMPROVEMENTS

The City may give notice to the Contractor and place in use those sections of the improvements which have been completed, inspected, and can be accepted as complying with the Contract Documents if, in its opinion, each section is reasonably safe, fit and convenient for the use and accommodation for which it was intended, provided:

The use of such sections of the improvements shall in no way impede the completion of the remainder of the work by the Contractor;

The Contractor will not be responsible for any damages or maintenance costs due directly to the use of such sections;

The use of such sections shall in no way relieve the Contractor of liability arising from having used defective materials or to poor workmanship.

Any guarantee period shall not commence until the date of the final acceptance of all work which the Contractor is required to construct under this contract.

27.00 TWO YEAR WARRANTY PERIOD

If after the approval of final payment and prior to the expiration of two (2) years after the date of Substantial Completion or such longer period as may be prescribed by law or by the terms of any applicable special guarantee, the Contractor shall promptly, without cost to the City and in accordance with the City's written instructions, either correct such defective work or, if it has been rejected by the City, remove it from the site and replace it with non-defective work within thirty (30) calendar days of written notification by the City. If the Contractor does not promptly comply with the terms of such instruction, the City may have the defective work corrected or the rejected work removed and replaced, and all costs incurred therefore, including compensation for additional professional services, shall be paid by the Contractor and its sureties. The remedies provided in this section are in addition to all other remedies available to the City under applicable law and shall not be construed as exclusive of any other legal right or remedy available to the City.

28.00 COMPLETION AND WARRANTY

The following replaces the City of Cheyenne & Board of Public Utilities Standard Construction Specifications and Standard Drawings, 2014 Edition, Section 01054.1.10-Acceptance of the Standard Specification.

Substantial Completion. Shall be defined as when the project can be safely and effectively used by the public for its intended use, without further delays, disruptions, or other impediments and only clean up and work of a minor nature remains to be finished, as agreed to by the City Engineer or as otherwise specified. After written notice from the Contractor of Substantial Completion, the Engineer and the City shall make a determination of acceptance of substantial completion. If in agreement, the City will issue written notice of Substantial Completion at which date the contract time will stop. The Engineer will then make an inspection of the project and develop a punch list of items to be completed. The Contractor will have thirty (30) calendar days to complete all punch list items, with the exception of seasonal work item, which will be as agreed by the Engineer and the City. Liquidated damages may be assessed by the City, in accordance with Section 29.00, for every day that expires after the allotted time for the completion of the punch list.

Warranty. The specified date in the City's Notice of Substantial Completion issued to the Contractor shall be the effective date for the beginning of the two-year warranty period.

Final Completion. After completion of the punch list, the Contractor shall issue the Contractor's Certificate of Completion along with the marked-up Project Record Drawings in accordance with Project Documents. At that time the Engineer and the City shall inspect and if all construction provided for and contemplated by the contract is found to be complete to their satisfaction, this inspection shall constitute the final inspection and the Engineer shall make the final acceptance. The Contractor shall be notified in writing as to the date of the Final Completion.

Prior to the end of the Warranty Period, the City shall inspect the Project for defects in the workmanship or material. A written deficiency list shall be developed and provided to the Contractor. Normal wear and tear shall not be considered a deficiency. The Contractor shall promptly, without cost to the City and in accordance with the City's written instructions, either correct such defective work or, if it has been rejected by the City, remove it from the site and replace it with non-defective work within thirty (30) calendar days of written notification by the City.

29.00 LIQUIDATED DAMAGES

For each calendar day that any work shall remain uncompleted after the contract time specified for the completion of the work provided for in the contract, the following liquidated damages charges will be deducted from any monies due the Contractor:

ORIGINAL CONTRACT AMOUNT		LIQUIDATED DAMAGE CHARGE
From ($)	To and including ($)	Charge per calendar day ($)
0.00	25,000.00	250.00
25,000.01	50,000.00	500.00
50,000.01	100,000.00	1000.00
100,000.01	500,000.00	1500.00
500,000.01	1,000,000.00	2000.00
1,000,000.01	1,500,000.00	3000.00
1,500,000.01	and greater	3500.00

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the use of additional contract time, will in no way constitute a waiver on the part of the City to any of its rights under the contract.

Unless otherwise provided in the contract, liquidated damage charges will be calculated in accordance with the table. All time in excess of the required Contract Time will be calculated on a calendar day basis.

30.00 GOVERNMENTAL IMMUNITY

The City and its officials and employees do not waive governmental immunity by entering into this Agreement and specifically retain all immunities and defenses available to them as Governmental Entities pursuant to Wyo. Stat. § 1-39-101, *et seq*, and all other applicable laws. Further, the City fully retains all immunities and defenses provided by law with regard to any action, whether in tort, contract. or any other theory of law, based on this Agreement. The City does waive its governmental immunities solely for the enforcement of the terms and conditions of this Agreement.

31.00 GOVERNING LAW, JURISDICTION, AND VENUE

The construction, interpretation, and enforcement of this Agreement shall be governed by the laws of the State of Wyoming. The courts of the State of Wyoming shall have jurisdiction over any action arising out of this Agreement and over the parties, and the venue shall be the First Judicial District, Laramie County, Wyoming.

32.00 COMPLIANCE WITH LAWS

This Agreement shall be governed in all respects by the laws of the State of Wyoming. The parties hereto shall comply with all applicable federal, state, and local laws, rules, and regulations in the performance of this contract. The identified laws or regulations are included in this Agreement as mandated by statute or for the convenience of the Contractor. The Contractor's attention is directed to the fact that all applicable federal and state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over design and construction of the project shall apply to the Agreement throughout, and they are deemed incorporated herein. Other laws and regulations apply which are not included herein, and are within the Contractor's duty and responsibility for compliance therewith.

33.00 DEFAULT

Each and every term and condition herein shall be deemed a material element of this Agreement. In the event either party shall fail or refuse to perform according to the terms of this Agreement, such party may be declared in default.

34.00 REMEDIES

In the event a party declares the other party in default hereof, said party declaring default shall notify the defaulting party in writing, and such defaulting party shall be allowed a period of fifteen (15) calendar days to cure said default. In the event that the default

remains uncorrected, the party not in default may elect to: (a) terminate this Agreement and seek damages; (b) treat this Agreement as continuing and require specific performance; or (c) avail itself of any other remedy at law or equity.

In the event Contractor fails to strictly perform in accordance with this Agreement, the City may elect to make good such deficiencies and charge Contractor therefore.

35.00 TERMINATION

The City may, by written notice to Contractor, terminate this Agreement, in whole or in part, by giving Contractor fifteen (15) calendar days written notice. Upon receipt of such notice, Contractor shall discontinue all services affected (unless the notice directs otherwise), and deliver to the City representative within five (5) calendar days all documents belonging to the City, including but not limited to, data, drawings, specifications, reports, estimates, and summaries accumulated by the Contractor in the performance of this Agreement, whether completed or in progress. In the event of termination, the City shall pay Contractor for all work accepted as of the date of termination.

36.00 WAIVER

The waiver by either party of any term, condition, or covenant, or breach of any term, condition, or covenant, shall not constitute a waiver of any other term, condition, or covenant, or breach thereof.

37.00 SEVERABILITY

If any provision, section, subsection, sentence, clause, or phrase of this Agreement is invalidated by any court of competent jurisdiction, such holding shall not affect the validity of the remainder of the Agreement, which shall continue in full force and affect.

38.00 SUCCESSORS AND ASSIGNS

All the terms, conditions, and provisions herein shall inure to the benefit of and be binding upon the parties hereto and their respective successors and assigns.

39.00 ASSIGNMENT

Neither party shall assign this Agreement without prior written consent of the other party. Any delegation or assignment shall not operate to relieve either party of its responsibilities hereunder.

40.00 THIRD PARTY RIGHTS

The parties do not intend to create in any other individual or entity the status of third party beneficiary, and this Agreement shall not be construed so as to create such status. The rights, duties and obligations contained in this Agreement shall operate only between the parties to this Agreement, and shall inure solely to the benefit of the parties to this Agreement. The parties to this Agreement intend and expressly agree that only the parties signatory to this Agreement shall have any legal or equitable right to seek to enforce this

Agreement, to seek any remedy arising out of a party's performance or failure to perform any term or condition of this Agreement. This paragraph is not intended nor shall it be construed to waive all the parties' immunities.

41.00 FORCE MAJEURE

The performance of the Agreement by either party shall be subject to force majeure including, but not limited to, acts of God, fire, flood, natural disaster, war or threat of war, acts or threats of terrorism, civil disorder, unauthorized strikes, governmental regulation or advisory, recognized health threats as determined by the World Health Organization, the Centers for Disease Control, or local government authority or health agencies (including, but not limited to, the health threats of COVID-19, H1N1, or similar infectious diseases), curtailment of transportation facilities, or other similar occurrence beyond the control of the parties, where any of those factors, circumstances, situations, or conditions or similar ones prevent, dissuade, or unreasonably delay the performance required by this Agreement. The Agreement may be cancelled by either party, without liability, damages, fees, or penalty, and any unused deposits or amounts paid shall be refunded, for any one or more of the above reasons, by written notice to the other party.

PART 7 - SPECIFICATIONS

CITY OF CHEYENNE, WYOMING

THE STANDARD SPECIFICATIONS GOVERNING THIS PROJECT SHALL BE THE "CITY OF CHEYENNE/BOARD OF PUBLIC UTILITIES CONSTRUCTION SPECIFICATIONS AND STANDARD DRAWINGS, 2014" WITH APPROVED AMENDMENTS ISSUED BY THE CITY ENGINEER AT THE TIME OF THIS CONTRACT.

IT IS THE CONTRACTOR'S RESPONSIBILITY TO KEEP CURRENT ON THESE AMENDMENTS. COPIES OF THESE AMENDMENTS ARE AVAILABLE ON THE CITY'S WEBSITE AT http://www.cheyennecity.org.

SPECIAL PROVISIONS

THE SPECIAL PROVISIONS WILL ADD TO OR REVISE CERTAIN SECTIONS OF THE "CITY OF CHEYENNE/BOARD OF PUBLIC UTILITIES CONSTRUCTION SPECIFICATIONS AND STANDARD DRAWINGS, 2014". REVISED PARAGRAPHS AND ADDITIONS WILL CORRESPOND TO THE STANDARD NUMERICAL AND TITLE DESIGNATIONS.

THE SPECIAL PROVISIONS MAY ALSO INCLUDE NEW SECTIONS OF SPECIFICATIONS NOT COVERED IN THE STANDARD SPECIFICATIONS AND WILL BE NUMBERED STARTING FROM SECTION 04000.

City of Cheyenne, Wyoming

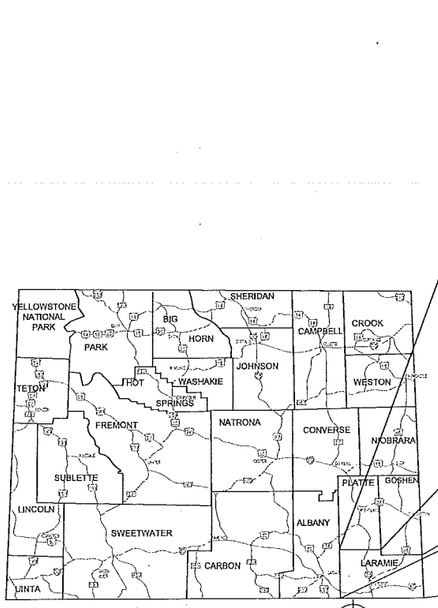
Happy Jack Landfill

Front Entrance and Scale House

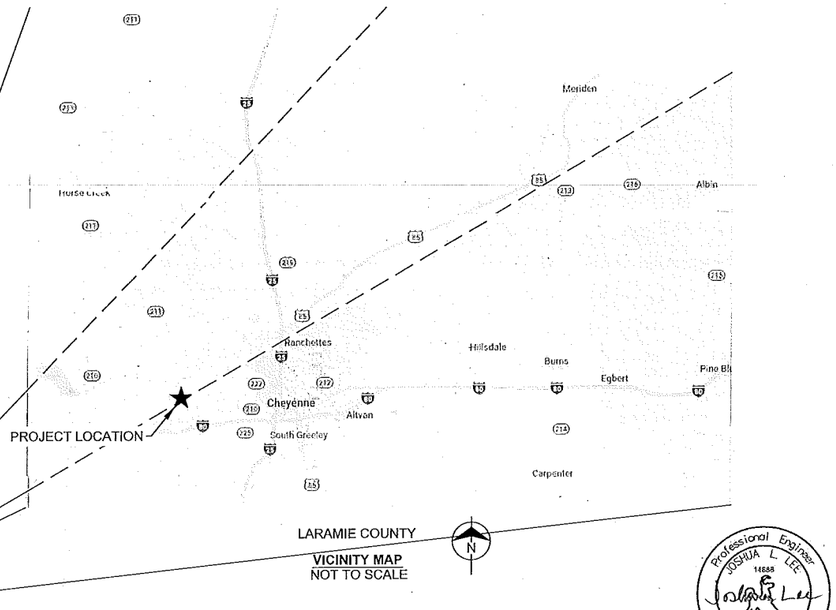
Laramie County, Wyoming

July 2020

BMcD Project No. 118706



WYOMING COUNTY MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

Professional Engineer
JOSHUA L. LEE
14688
Date 07/10/2020
WYOMING

no.	date	by	ckd	description
0	3/31/20	SW	JL	ISSUED FOR BID

BURNS McDONNELL

HAPPY JACK LANDFILL FRONT
ENTRANCE AND SCALE HOUSE
City of Cheyenne, Wyoming
118706

Cover

City of Cheyenne, Wyoming

Contract Drawings

NORTH ARROW MAY BE ROTATED TO TRUE NORTH

VIEW SCALE MAY BE REPLACED WITH "NTS" OR "NOT TO SCALE"

View Name

0 1' 2' 3'

SCALE IN FEET

NORTH

VIEW TITLE EXAMPLE

ONE OR TWO CHARACTER DISCIPLINE DESIGNATOR (MAY NOT BE PRESENT IF CALLOUT AND TITLE ARE ON DRAWINGS WITHIN THE SAME DISCIPLINE)

1 / A101 SIM

LETTER OR NUMBER DESIGNATOR

DRAWING SEQUENCE NUMBER INDICATES WHERE TITLE IS LOCATED (MAY NOT BE PRESENT IF CALLOUT AND TITLE ARE ON THE SAME DRAWING)

SIMILAR SECTION INDICATOR

SECTION, DETAIL, AND ELEVATION SYMBOL IDENTIFIERS

1 / A101 SIM

OR

1 / A101 SIM

SECTION CALLOUT EXAMPLE

1 / A101 SIM

DETAIL CALLOUT EXAMPLE

0 / AA888

EXTERIOR ELEVATION

1 / AA888 / 1 / 1

INTERIOR ELEVATION

ELEVATION CALLOUT EXAMPLE

"SECTION" MAY BE REPLACED WITH "ELEVATION" OR "DETAIL"

SECTION 1 / R101

SECTION, DETAIL, OR ELEVATION TITLE EXAMPLE

SECTION, DETAIL, AND ELEVATION IDENTIFICATION SYSTEM

SHEET NUMBER	SHEET TITLE
GENERAL	
G000	COVER SHEET
G001	INDEX OF DRAWINGS
CIVIL	
C001	GENERAL NOTES, LEGEND AND ABBREVIATIONS
CX101	EXISTING CONDITIONS PLAN
CD101	DEMOLITION PLAN
CS101	CONSTRUCTION SITE PLAN
CS102	LANDFILL ACCESS ROAD AND PROFILE
CS103	LANDFILL ACCESS ROAD PROFILES
CS104	ENTRANCE PLAN
CS105	BUILDING PLAN
CU101	UTILITIES PLAN
CU102	SOLAR SITE PLAN
CP101	PAVING AND STRIPING PLAN
C501	DETAILS
C502	DETAILS
C503	DETAILS
STRUCTURAL	
S001	SPECIAL INSPECTIONS, STRUCTURAL NOTES AND LEGENDS
S002	STRUCTURAL NOTES
S003	STANDARD CONCRETE DETAILS
S004	STANDARD MASONRY DETAILS
S005	MISCELLANEOUS STANDARD DETAILS
S006	STANDARD JOIST DETAILS
S101	ADMINISTRATION BUILDING FOUNDATION PLAN
S102	ADMINISTRATION BUILDING ROOF PLAN
S103	ADMINISTRATION BUILDING FOUNDATION SECTIONS AND DETAILS
S201	SCALE HOUSE BUILDING FOUNDATION PLAN
S202	SCALE HOUSE FOUNDATION SECTIONS AND DETAILS
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A002	CODE REVIEW & NOTES
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A104	ADMINISTRATION BUILDING REFLECTED CEILING PLAN
A105	ADMINISTRATION BUILDING ELEVATIONS
A106	ADMINISTRATION BUILDING ELEVATIONS
A107	ADMINISTRATION BUILDING SECTIONS
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A109	ADMINISTRATION BUILDING INTERIOR ELEVATIONS
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A111	ADMIN BUILDING DOOR & WINDOW SCHEDULES AND DETAILS
A112	ARCHITECTURAL DOOR & WINDOW DETAILS
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A115	ARCHITECTURAL DETAILS II
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A201	SCALE HOUSE PERFORMANCE CRITERIA
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P402	PLUMBING ENLARGED DOMESTIC WATER PLAN
P501	PLUMBING DETAILS
P601	PLUMBING SCHEDULES
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ES101	ELECTRICAL SITE PLAN
ES102	ENLARGED ELECTRICAL SITE PLAN - ADMN
ES103	ENLARGED ELECTRICAL SITE PLAN - ENTRANCE
E100	ELECTRICAL GROUNDING PLAN - ADMN
E101	ELECTRICAL GROUNDING PLAN - SCALE HOUSE
E104	LIGHTNING PROTECTION - ADMN
E200	ELECTRICAL POWER AND DATA PLAN - ADMN
E202	ELECTRICAL POWER PLAN ROOF - ADMN
E300	ELECTRICAL LIGHTING PLAN - ADMN
E500	ELECTRICAL DETAILS
E501	ELECTRICAL DETAILS
E600	ELECTRICAL LIGHT FIXTURE SCHEDULE
E601	ELECTRICAL ONE-LINE DIAGRAM AND PANEL SCHEDULES

Professional Engineer JOSHUA L. LEE 14658 WYOMING Date 07/10/2020

no.	date	by	chk	description
0	7/10/20	KDT	JLL	ISSUED FOR BID

BURNS McDONNELL

HAPPY JACK LANDFILL FRONT ENTRANCE AND SCALE HOUSE
City of Cheyenne, Wyoming
118706

Index

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GENERAL NOTES:

1. THE PROJECT SITE IS LOCATED WEST OF CHEYENNE IN THE SOUTHEAST QUARTER OF SECTION 13T ON THE PARCEL OWNED BY THE CITY OF CHEYENNE, WYOMING (OWNER). CONTRACTOR SHALL CONTRACT WITH OWNER DIRECTLY TO PERFORM WORK.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL UTILITIES, FOR REPAIRING ANY DAMAGE TO THEM, AND FOR ANY CLAIMS RESULTING FROM HIS/HER ACTIONS AND ACTIVITIES. THE CONTRACTOR SHALL IDENTIFY, LOCATE, AND PROTECT ALL UNDERGROUND UTILITIES THAT MAY BE POTENTIALLY AFFECTED BY CONSTRUCTION UNDER THIS CONTRACT. CONTRACTOR SHALL CONTACT WYOMING 811 AT 1-800-849-2476 TO LOCATE UTILITIES A MINIMUM OF THREE BUSINESS DAYS PRIOR TO CONSTRUCTION ACTIVITIES.
3. THE CONTRACT DRAWINGS REPRESENT THE FINISHED WORK. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL MEANS AND METHODS OF CONSTRUCTION. CONTRACTOR SHALL FURNISH ALL LABOR, EQUIPMENT, MATERIALS, AND TOOLS NECESSARY TO COMPLETELY PERFORM THE WORK IN SAFE, EXPEDITIOUS, AND WORKMAN LIKE MANNER. COORDINATE SCHEDULE OF THE WORK WITH THE OWNER. CONTRACTOR SHALL INSTALL MATERIALS PER MANUFACTURERS RECOMMENDATIONS UNLESS NOTED OTHERWISE. THE CONTRACTOR ACCEPTS FULL RESPONSIBILITY FOR PROPER HANDLING AND INSTALLATION OF MATERIALS.
4. CONTRACTOR SHALL UNDERTAKE ALL NECESSARY MEASURES TO ENSURE SAFETY OF ALL PERSONS AND STRUCTURES AT THE SITE AND ADJACENT TO THE SITE. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY CLAIMS RESULTING FROM HIS/HER ACTIONS AND ACTIVITIES. VISITS TO THE SITE BY OWNER OR THE ENGINEER SHALL NOT RELIEVE THE CONTRACTOR OF SUCH RESPONSIBILITY.
5. THE CONTRACTOR SHALL ACCEPT FULL RESPONSIBILITY FOR EQUIPMENT AND MATERIALS THROUGH PROJECT COMPLETION. CONTRACTOR SHALL STORE MATERIALS IN A SECURE LOCATION (ON OR OFF-SITE).
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER SAFEGUARDING OF THE INSTALLATION AND MATERIALS STORED ON THE SITE TO PREVENT THEFT, VANDALISM OR DAMAGE.
7. CONTRACTOR SHALL MINIMIZE DISTURBANCES TO ADJACENT PROPERTIES.
8. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL CONSTRUCTION PERMITS REQUIRED TO PERFORM THE WORK AND TO PROVIDE CERTIFICATES OF INSURANCE AND OTHER DOCUMENTATION REQUIRED BY THE JURISDICTIONAL AGENCY BEFORE PERFORMING THE WORK.
9. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH OSHA REQUIREMENTS.
10. ALL WORK SHALL BE COMPLETED TO THE LINES, SLOPES AND GRADES INDICATED IN THESE CONTRACT DRAWINGS.
11. THESE NOTES AND OTHER DRAWING NOTES CONTAINED HEREWITH ARE PROVIDED TO MEET SPECIFIC REQUIREMENTS AND TO SUPPLEMENT THE CONTRACT DOCUMENTS. THESE DRAWINGS AND NOTES WILL BE GIVEN PRECEDENCE OVER THE SPECIFICATIONS IN RESOLVING CONFLICTS AND DISCREPANCIES.
12. THESE DRAWINGS SHALL BE USED IN CONJUNCTION WITH ANY SHOP DRAWINGS PROVIDED BY SUPPLIERS. ALL SHOP DRAWINGS PROVIDED BY OTHERS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO THE FABRICATION OF MATERIAL OR THE PURCHASE OF NON-RETURNABLE STOCK. DIMENSIONAL REVIEW IS THE CONTRACTOR'S RESPONSIBILITY.
13. ALL DIMENSIONS, ELEVATIONS, AND CONDITIONS SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR AND ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION BEFORE PROCEEDING WITH THE AFFECTED PART OF WORK.
14. ALL WORK SHOWN IS IN APPROXIMATE LOCATIONS. THE CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF/HERSELF WITH THE EXISTING CONDITIONS BEFORE SUBMITTING HIS/HER BID. SCALING FROM THE DRAWINGS IS PROHIBITED.
15. IF CERTAIN FEATURES ARE NOT FULLY SHOWN OR CALLED FOR ON THE CONTRACT DRAWINGS OR SPECIFICATIONS, THEIR CONSTRUCTION SHALL BE OF THE SAME CHARACTER AS FOR SIMILAR CONDITIONS THAT ARE SHOWN OR CALLED FOR, SUBJECT TO THE APPROVAL OF THE ENGINEER.
16. ALL MONITORING WELLS, FENCES, AND UTILITIES SHALL BE PROTECTED AT ALL TIMES BY CONTRACTOR. ANY DAMAGE TO THESE STRUCTURES SHALL BE REPAIRED AT CONTRACTOR'S SOLE EXPENSE. ALL SUCH DAMAGE SHALL BE PROMPTLY REPORTED TO OWNER AND ENGINEER.

TRAFFIC CONTROL

1. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL CORDON OFF THE CONSTRUCTION WORK AREA AND ASSOCIATED ROADWAYS BY USING BARRICADES APPROVED BY THE OWNER.
2. CONSTRUCTION EQUIPMENT SHALL HAVE AUTOMATIC SIGNALING DEVICES TO SOUND AN ALARM WHEN MOVING IN REVERSE.
3. ONLY RUBBER-TIRE VEHICLES WILL BE ALLOWED ON EXISTING PAVEMENT-TO-REMAIN.
4. NO PEDESTRIAN TRAFFIC SHALL BE ALLOWED INSIDE THE CONSTRUCTION LIMITS.
5. PRIOR TO THE REMOVAL OF BARRICADES AND TRAFFIC CONTROL DEVICES, THE CONTRACTOR SHALL REQUEST THE OWNER TO SCHEDULE AN INSPECTION. NO ROADWAY SHALL BE RE-OPENED UNTIL THE OWNER HAS COMPLETED INSPECTION AND APPROVED THE RE-OPENING OF ACTIVE AREAS.
6. ANY DAMAGE TO ROADS AND PAVEMENTS-TO-REMAIN DUE TO CONSTRUCTION EQUIPMENT OR TRAFFIC SHALL BE REPAIRED TO RESTORE THE ROADS AND PAVEMENTS TO THEIR ORIGINAL CONDITION TO THE SATISFACTION OF THE OWNER.

ABBREVIATIONS

ADMIN.	ADMINISTRATION
AMSL	ABOVE MEANS SEA LEVEL
AUTH.	AUTHORIZATION
BGS	BELOW GROUND SURFACE
℄	CENTERLINE
CM	CENTIMETER
CMP	CORRUGATED METAL PIPE
CONC.	CONCRETE
CONT'D	CONTINUED
CU.	CUBIC
DIA.	DIAMETER
E	EAST / EASTING
ELEV.	ELEVATION
EX.	EXISTING
FL	FLOW LINE
FT	FOOT, FEET
HV	HORIZONTAL VERTICAL
HDPE	HIGH DENSITY POLYETHYLENE
INV.	INVERT ELEVATION
LF	LINEAR FEET
MAX	MAXIMUM
MIN	MINIMUM
N	NORTH / NORTHING
NE	NORTHEAST
NO.	NUMBER

ABBREVIATIONS (CONT'D)

NW	NORTHWEST
O.C.	ON CENTER
OD	OUTER DIAMETER
OZ	OUNCE
PSF	POUNDS PER SQUARE FOOT
PVC	POLYVINYL CHLORIDE
R	RANGE
REV	REVISION
S	SOUTH
SDR	STANDARD DIMENSION RATIO
SE	SOUTHEAST
SEC	SECOND
SS	SANITARY SEWER
STD.	STANDARD
S.S.	STAINLESS STEEL
SW	SOUTHWEST
SY	SQUARE YARD
T	TOWNSHIP
TYP.	TYPICAL
W	WEST
W/	WITH
WDEQ	WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WYDOT	WYOMING DEPARTMENT OF TRANSPORTATION
YD	YARDS

LEGEND

- PROPERTY BOUNDARY
- EXISTING PAVEMENT
- EXISTING EDGE OF GRAVEL ROAD
- EXISTING CHAIN LINK FENCE
- EXISTING BARBED WIRE FENCE
- EXISTING 2' CONTOUR
- 4350 EXISTING 10' CONTOUR
- EXISTING CULVERT
- EXISTING POWER POLE
- EXISTING WATER WELL
- EXISTING METEOROLOGICAL TOWER
- EXISTING CONTROL POINT
- EXISTING WIND TURBINE
- EXISTING SHRUB
- EXISTING TREE
- EXISTING BUILDING
- EXISTING VEGETATION
- W EXISTING WATER LINE
- E EXISTING UNDERGROUND ELECTRIC
- OHU EXISTING OVERHEAD ELECTRIC UTILITY
- COMM EXISTING UNDER GROUND CABLE LINE
- DEMOLITION AND REMOVAL AREA
- NEW PAVEMENT
- NEW BUILDING
- RELOCATED SCALE
- W NEW WATERLINE
- S NEW SEWER LINE
- NEW BOLLARD

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9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	S WOOD
designed	checked
S WOOD	J LEE

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

GENERAL NOTES, LEGEND AND ABBREVIATIONS

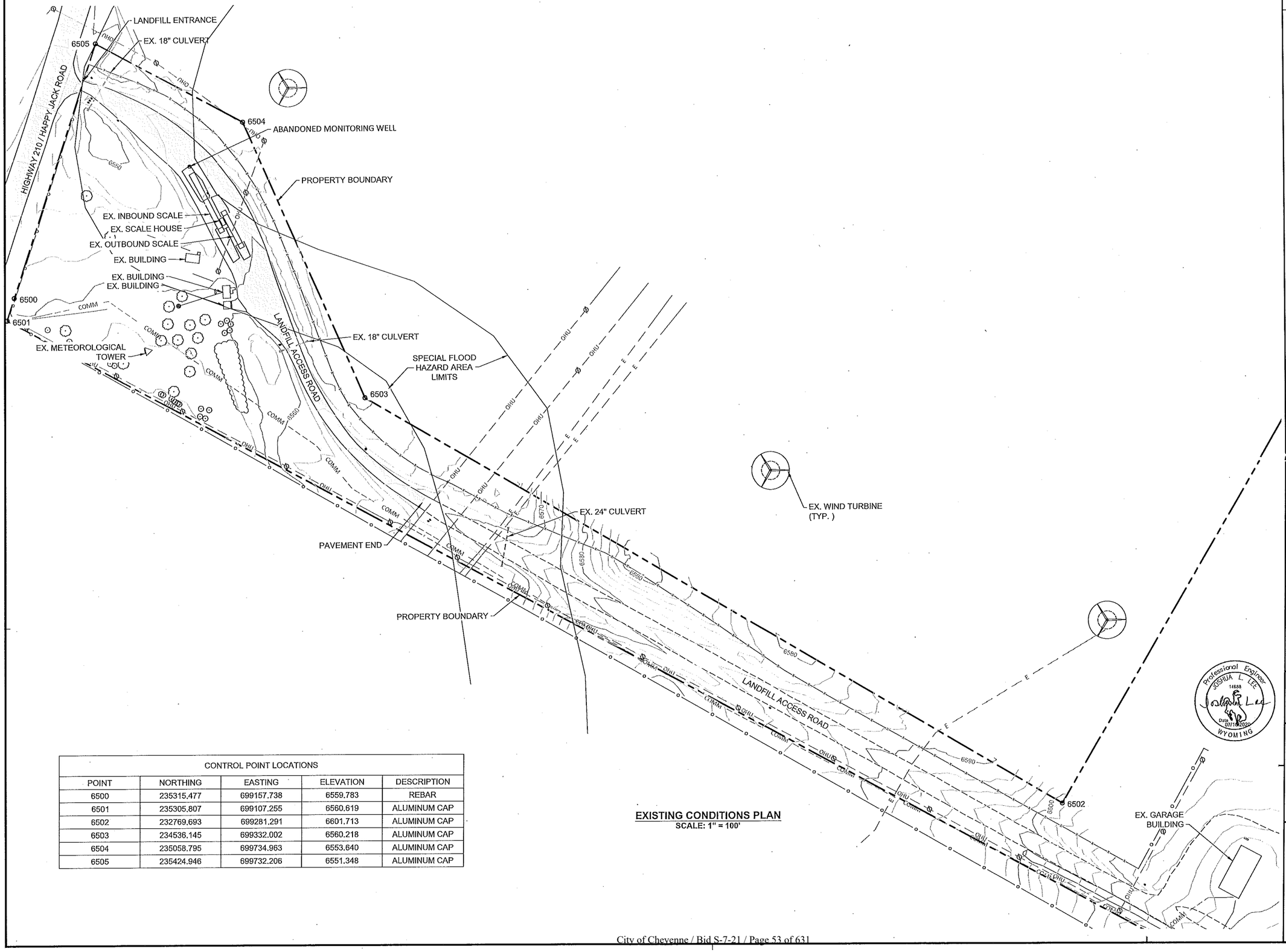
project	contract
118706	

drawing **C001** — rev. **0**

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Professional Engineer JOSHUA L. LEE 14888 WYOMING Date 07/10/2020



EXISTING CONDITIONS PLAN
SCALE: 1" = 100'

CONTROL POINT LOCATIONS

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
6500	235315.477	699157.738	6559.783	REBAR
6501	235305.807	699107.255	6560.619	ALUMINUM CAP
6502	232769.693	699281.291	6601.713	ALUMINUM CAP
6503	234536.145	699332.002	6560.218	ALUMINUM CAP
6504	235058.795	699734.963	6553.640	ALUMINUM CAP
6505	235424.946	699732.206	6551.348	ALUMINUM CAP

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NOTES:

1. FIELD SURVEY COMPLETED BY INBERG-MILLER ENGINEERS ON AUGUST 23 AND SEPTEMBER 5, 2019. CONTOURS ARE SHOWN AT AN INTERVAL OF 2 FEET.
2. THE SURVEY PROVIDED IS BASED ON THE STATE PLANE COORDINATE SYSTEM, WYOMING EAST ZONE, NAD 83. ALL LINEAR UNITS ARE DEPICTED FROM SURVEY DATA IN US SURVEY FEET.
3. UTILITY LOCATIONS SHOWN ARE AS MARKED BY THEIR OWNER, FROM THE OWNER'S RECORD, OR FROM FIELD EVIDENCE.
4. DATA PROVIDED FOR INFORMATION ONLY. CONTRACTOR SHALL FIELD VERIFY ALL FEATURES SHOWN ON THIS DRAWING.

NORTH

0 100' 200'
SCALE IN FEET

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Professional Engineer
JOSHUA L. LEE
14638
WYOMING
DATE 07/10/2020

date	detailed
JULY 2020	S WOOD
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S WOOD	J LEE

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

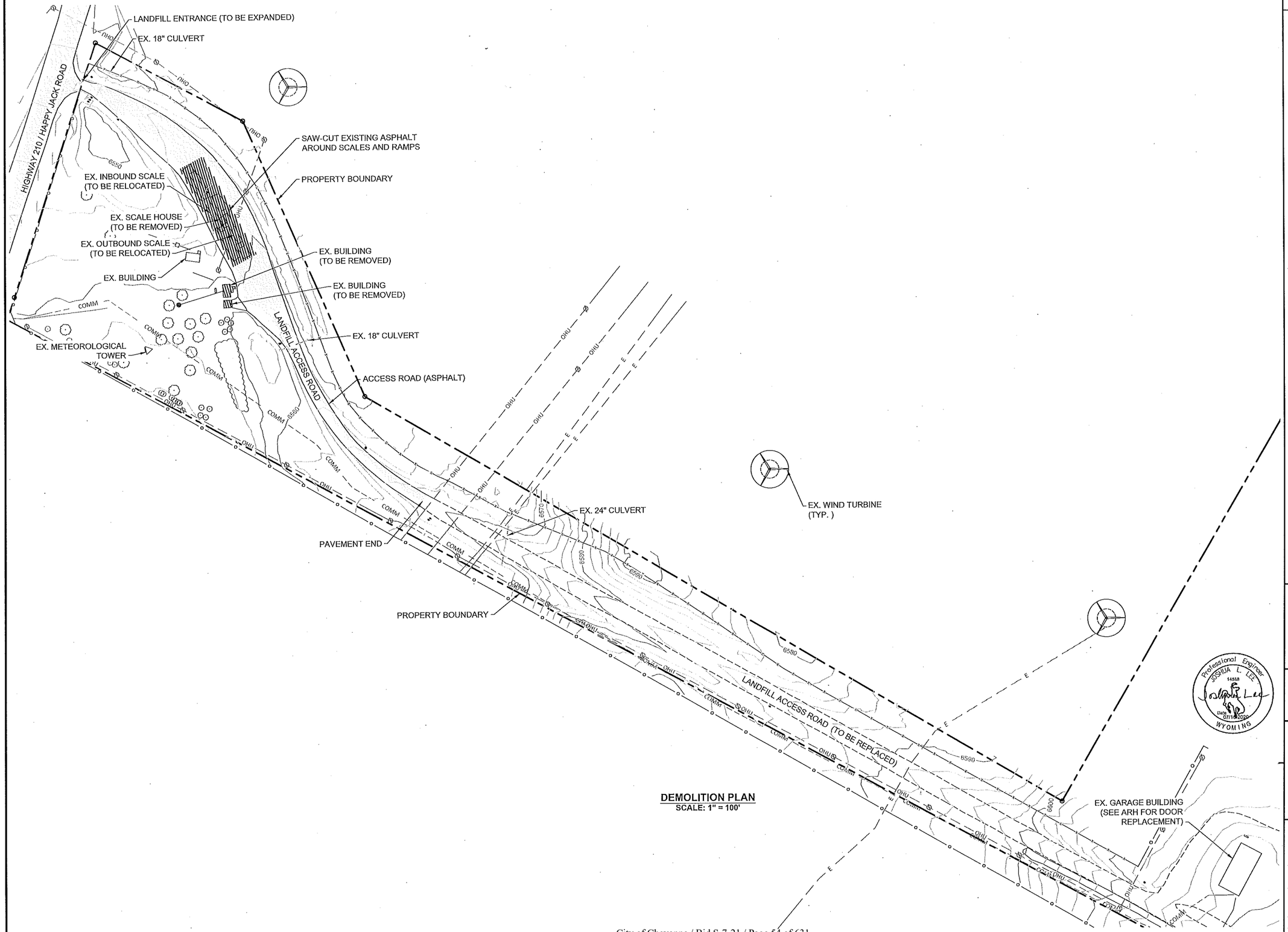
EXISTING CONDITIONS PLAN

project	contract
118706	7042

drawing CX101 — rev. 0

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DEMOLITION PLAN
SCALE: 1" = 100'

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NOTES:

1. EXISTING SCALES SHALL BE RELOCATED TO NEW SCALE LOCATIONS SHOWN ON DRAWING CS105. CONTRACTOR SHALL COORDINATE RELOCATION SCHEDULE WITH OWNER AND SHALL MAINTAIN ONE OPERATIONAL SCALE AT ALL TIMES.
2. DEMOLITION OF SCALE FOUNDATIONS, SCALEHOUSE, AND BUILDINGS SHALL BE TO THE FULL EXTENT BELOW GRADE IN ACCORDANCE WITH SPECIFICATIONS.

NORTH

100'
SCALE IN FEET

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Professional Engineer
JOSHUA L. LEE
14558
WYOMING
DATE 07/10/2020

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designed	checked
S WOOD	J LEE

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

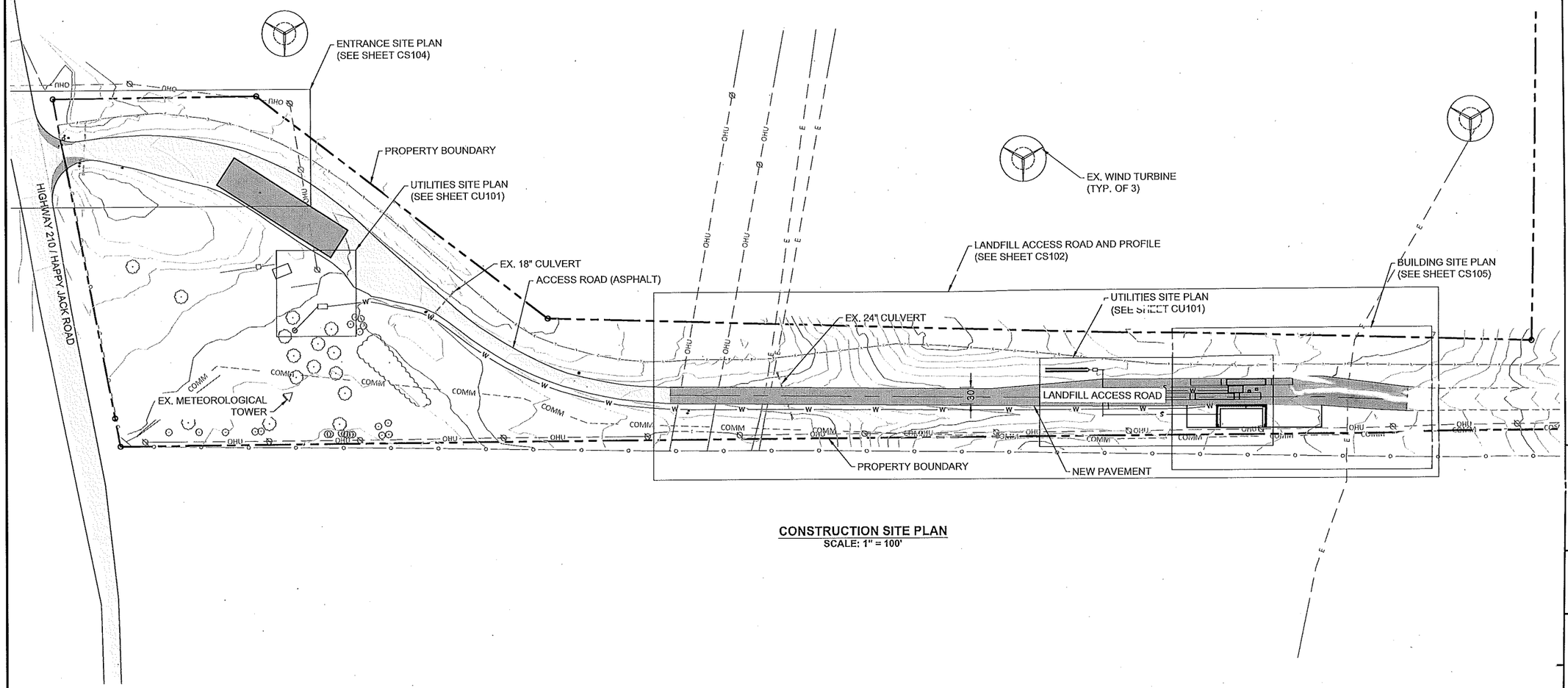
DEMOLITION PLAN

project	contract
118706	7042

drawing **CD101** — rev. **0**

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file 118706CD101DEMO.DWG



CONSTRUCTION SITE PLAN
SCALE: 1" = 100'

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NORTH

0 100' 200'
SCALE IN FEET

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LARAMIE COUNTY, WYOMING

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FRONT ENTRANCE AND SCALE HOUSE

CONSTRUCTION SITE PLAN

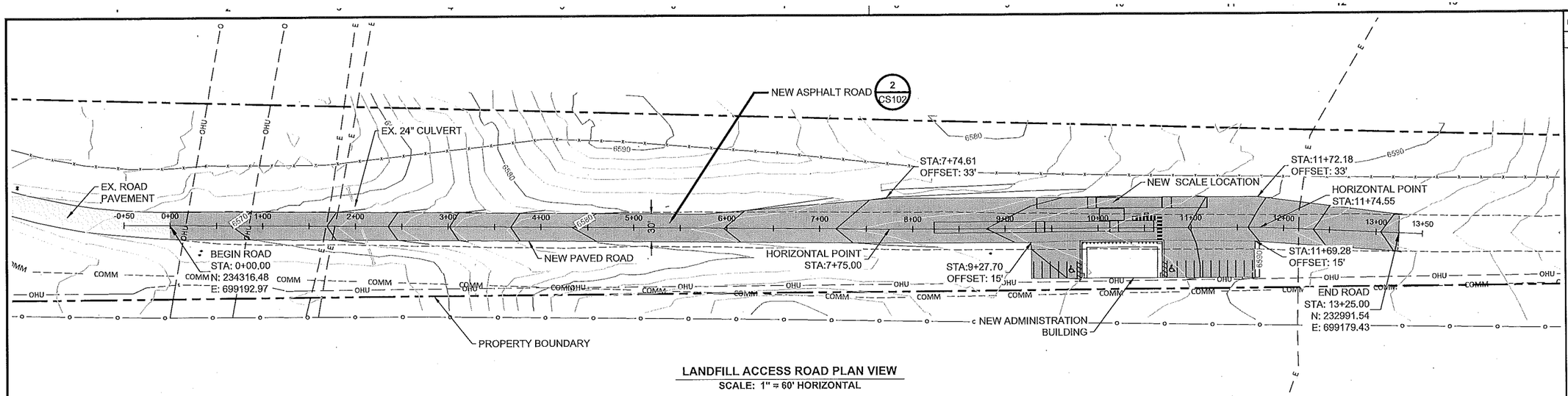
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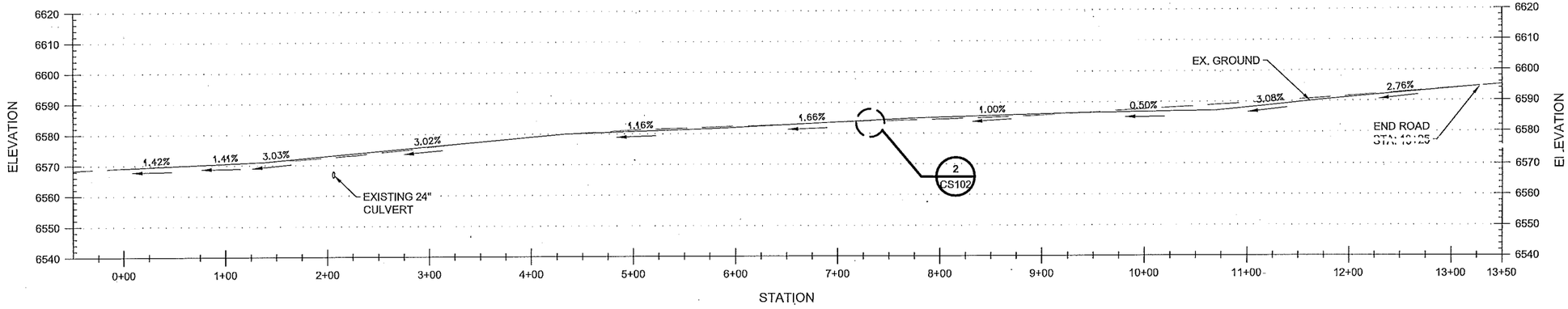
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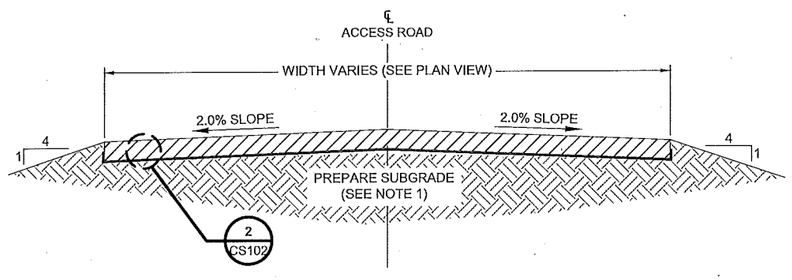
Professional Engineer
JOSHUA L. LEE
14088
STATE OF WYOMING
Date 07/10/2020



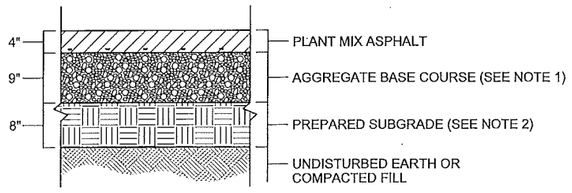
LANDFILL ACCESS ROAD PLAN VIEW
SCALE: 1" = 60' HORIZONTAL



LANDFILL ACCESS ROAD PROFILE VIEW
SCALE: 1" = 60' HORIZONTAL
1" = 20' VERTICAL



ACCESS ROAD
NOT TO SCALE
1
CS102



ROAD ASPHALT PAVEMENT SECTION
NOT TO SCALE
2
CS102

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NOTE:

1. AGGREGATE BASE COURSE TO BE WYDOT GRADING W BASE.
2. PREPARED SUBGRADE TO BE RECONDITIONED NATIVE SUBGRADE, SCARIFIED TO A MINIMUM DEPTH OF 8-IN AND PROOF ROLLED PRIOR TO PLACEMENT OF AGGREGATE BASE UNLESS OTHERWISE NOTED.



0 60' 120'
SCALE IN FEET

0 20' 40'
SCALE IN FEET

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LANDFILL ACCESS ROAD AND PROFILE

project	contract
118706	7042

drawing **CS102** rev. **0**

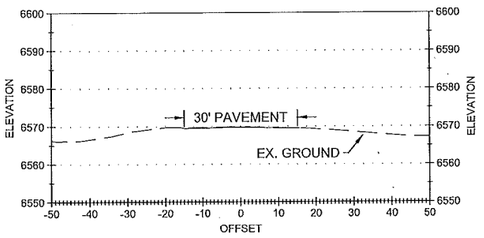
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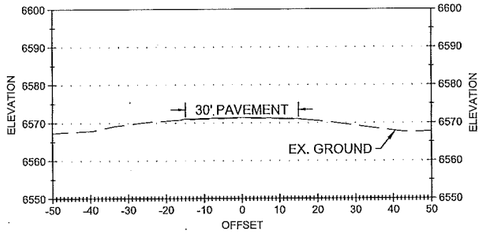


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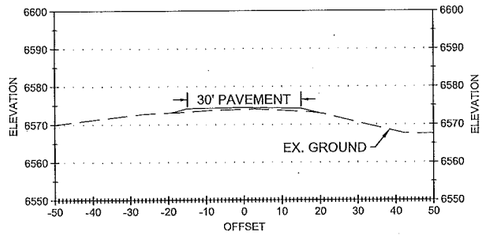
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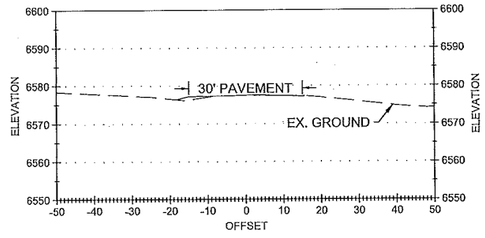
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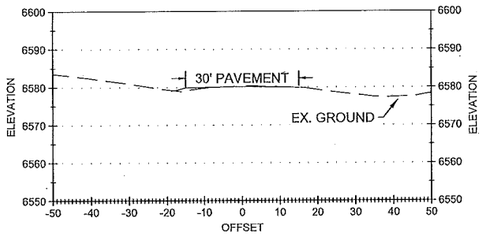
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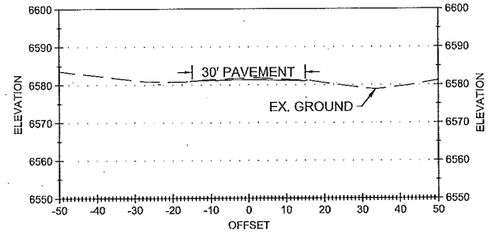
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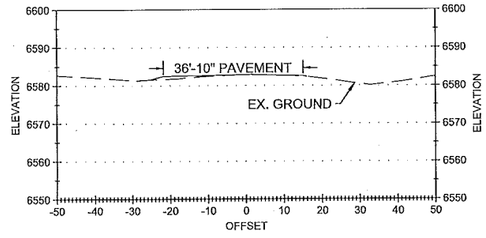
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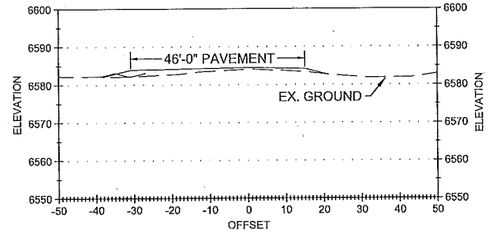
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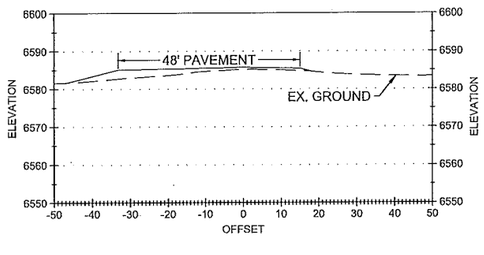
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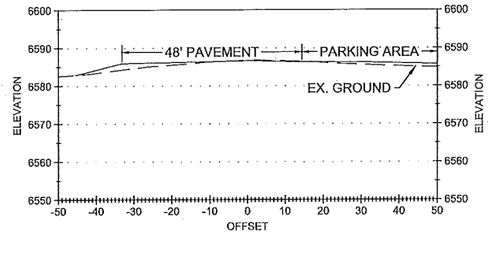
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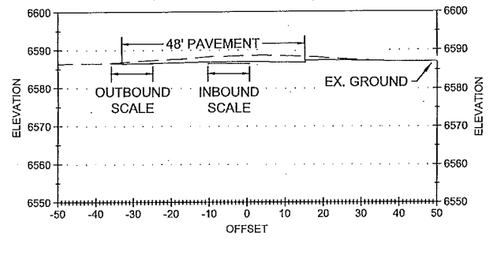
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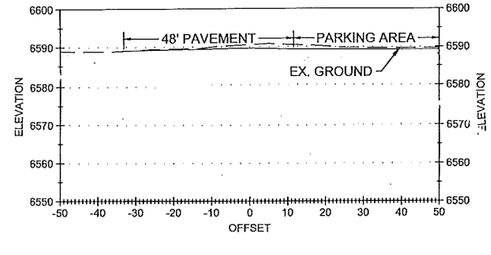
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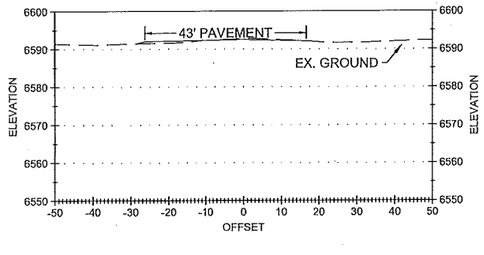
10+50



11+50



12+50



0 20' 40'
SCALE IN FEET

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Centennial, CO 80112
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date	detailed
JULY 2020	S WOOD
designed	checked
S WOOD	J LEE

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

LANDFILL ACCESS ROAD
CROSS SECTIONS

project	contract
118706	7042

drawing **CS103** — rev. **0**

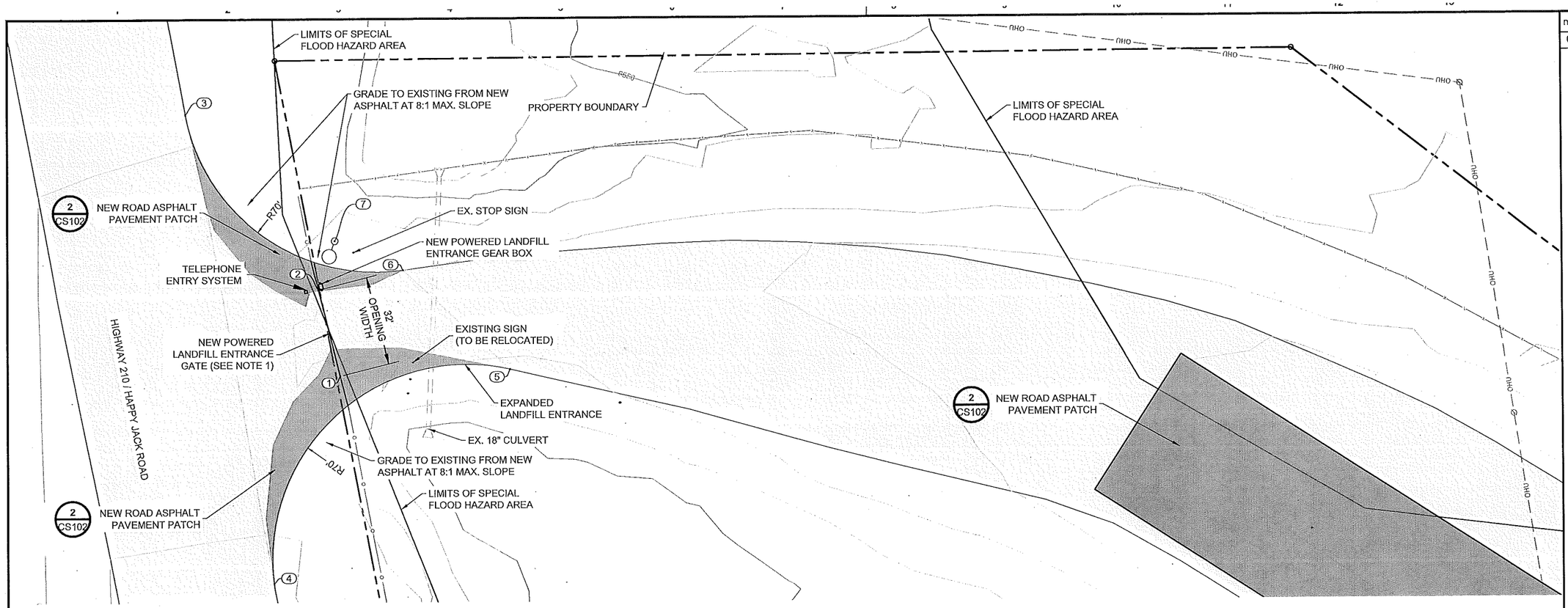
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file 118706CS103ROAD.DWG

Professional Engineer
JOSHUA L LEE
14888
Date 07/13/2020
WYOMING

Scale For Microfilming
Millimeters
Inches

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ENTRANCE SITE PLAN
SCALE: 1" = 20'

POINT TABLE				
POINT #	ELEVATION	NORTHING	EASTING	DESCRIPTION
1	6554.30	235401.79	699618.44	GATE POST
2	6554.24	235409.59	699649.47	GATE POST
3	6551.80	235457.23	699712.88	EDGE OF PAVEMENT
4	6554.28	235425.88	699543.81	EDGE OF PAVEMENT
5	6553.82	235340.60	699620.68	EDGE OF PAVEMENT
6	6554.00	235379.16	699656.49	EDGE OF PAVEMENT
7	6552.60	235403.63	699667.15	LIGHT BASE

no.	date	by	ckd	description
0	3/9/20	SW	JL	ISSUED FOR BID

NOTE:

1. NEW POWERED LANDFILL ENTRANCE GATE TO BE LIFTMASTER MODEL SL595 WITH 1 ½ HP MOTOR OR ENGINEER APPROVED ALTERNATIVE.

NORTH

0 20' 40'
SCALE IN FEET

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designed	checked
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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ENTRANCE PLAN

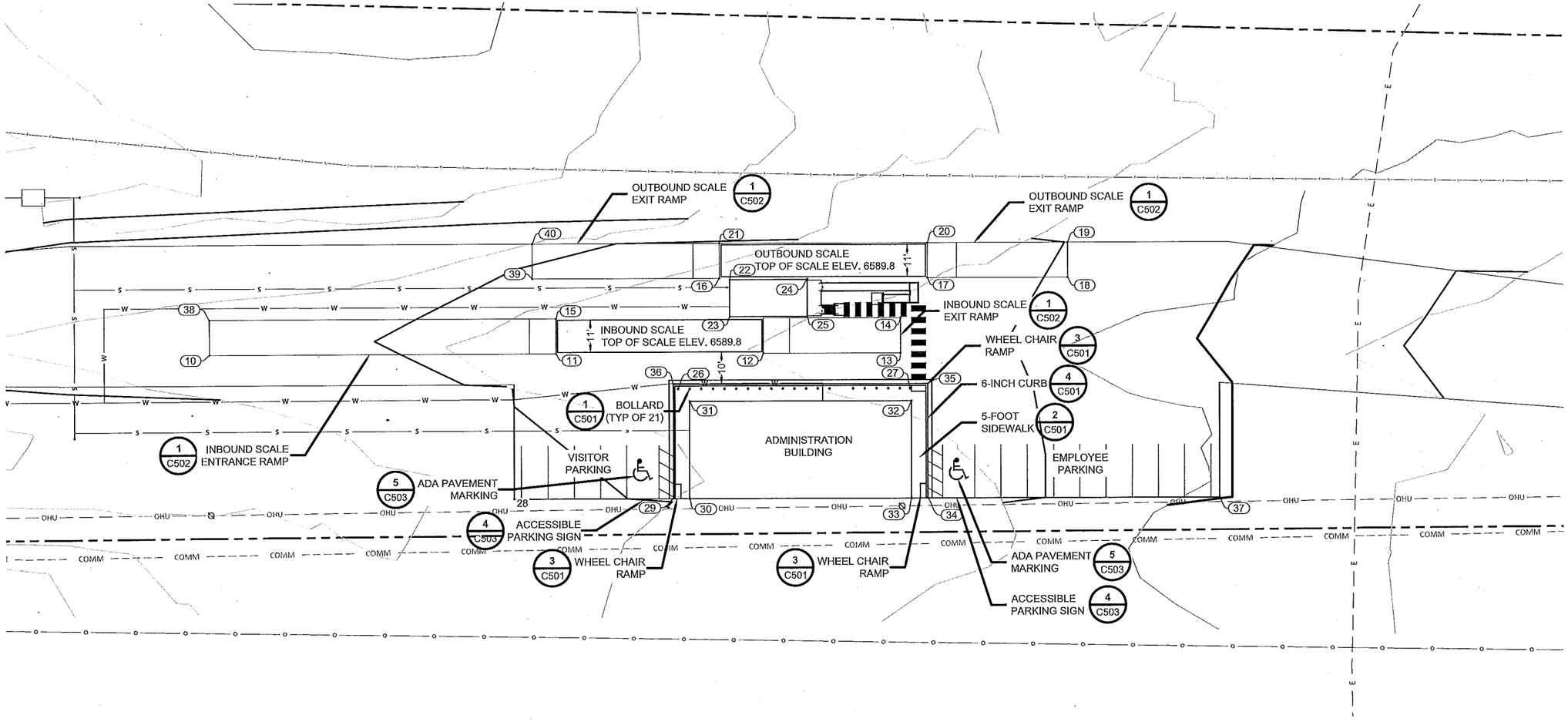
project	contract
118706	7042

drawing **CS104** – rev. **0**

sheet --- of --- sheets

file 118706CS103ENTR.DWG

Professional Engineer JOSHUA L. LEE 14868 WYOMING Date 07/16/2020



BUILDING AND SCALEHOUSE SITE PLAN

SCALE: 1" = 20'

0 20' 40'

SCALE IN FEET

POINT TABLE				
POINT #	ELEVATION	NORTHING	EASTING	DESCRIPTION
10	6585.34	233493.50	699181.05	EDGE OF PAVEMENT
11	6586.47	233374.50	699181.05	EDGE OF PAVEMENT
12	6586.83	233303.50	699181.05	EDGE OF PAVEMENT
13	6587.07	233256.50	699181.05	RAMP CORNER
14	6586.99	233256.50	699193.05	RAMP CORNER
15	6586.40	233374.50	699193.05	EDGE OF ASPHALT
16	6586.41	233318.51	699206.72	EDGE OF ASPHALT
17	6586.77	233247.34	699206.72	EDGE OF ASPHALT
18	6588.25	233199.34	699206.72	RAMP CORNER
19	6588.04	233199.34	699218.72	RAMP CORNER
20	6586.55	233247.34	699218.72	EDGE OF ASPHALT
21	6586.17	233318.51	699218.72	EDGE OF ASPHALT
22	6586.44	233315.00	699206.22	BUILDING CORNER

POINT TABLE				
POINT #	ELEVATION	NORTHING	EASTING	DESCRIPTION
23	6586.82	233288.33	699193.55	BULIDING CORNER
24	6587.09	233332.82	699168.92	BULIDING CORNER
25	6587.42	233253.35	699168.92	BOLLARD
26	6585.28	233388.82	699131.33	EDGE OF PAVEMENT
27	6586.29	233334.41	699131.33	CURB FLOWLINE
28	6587.00	233328.82	699131.33	BULIDING CORNER
29	6587.50	233328.82	699164.67	BULIDING CORNER
30	6587.50	233252.82	699164.67	BULIDING CORNER
31	6587.00	233252.82	699131.33	BULIDING CORNER
32	6586.76	233247.24	699131.33	CURB FLOWLINE
33	6587.00	233247.24	699170.50	CURB FLOWLINE
34	6586.49	233334.40	699170.50	CURB FLOWLINE
35	6589.87	233147.24	699131.33	EDGE OF PAVEMENT

POINT TABLE				
POINT #	ELEVATION	NORTHING	EASTING	DESCRIPTION
36	6585.86	233382.50	699218.71	RAMP CORNER

no.	date	by	ckd	description
0	3/9/20	TS	JL	ISSUED FOR BID

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

BUILDING AND SCALEHOUSE SITE PLAN

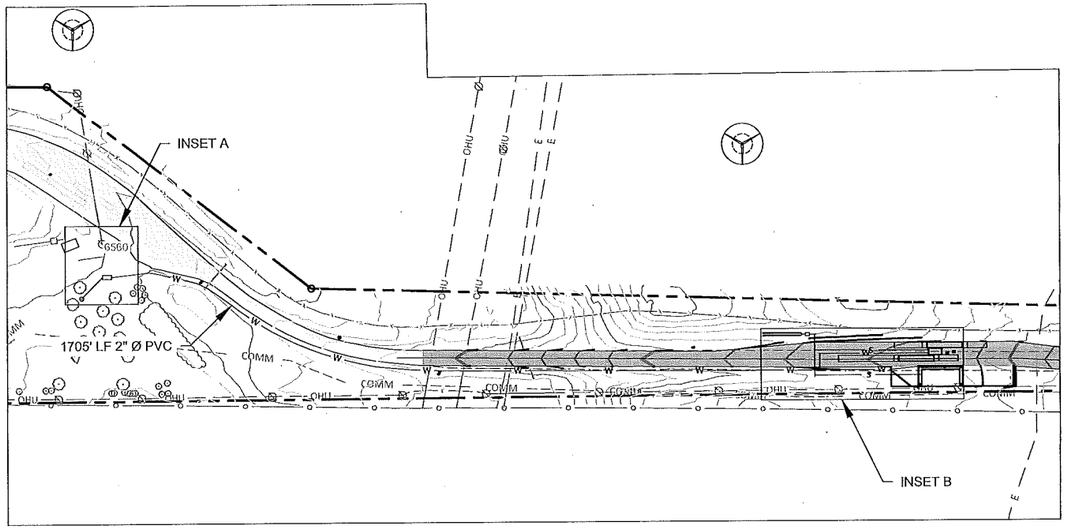
project	contract
118706	7042

drawing CS105 — rev. 0

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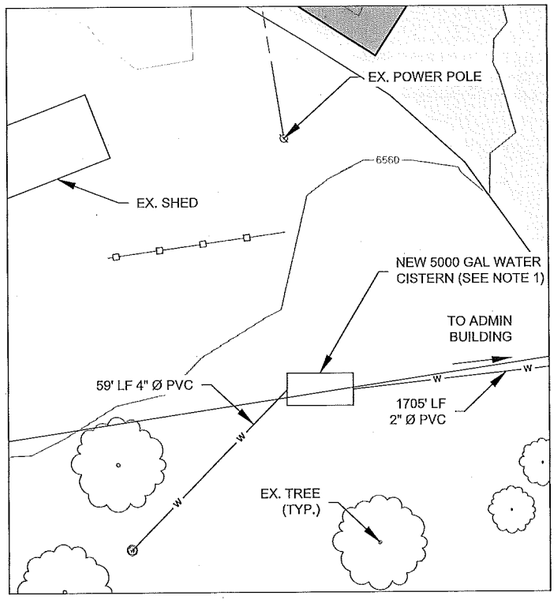
Professional Engineer JOSHUA L. LEE 14688 Date 07/10/2020 WYOMING



UTILITIES SITE PLAN
SCALE: 1" = 150

NORTH

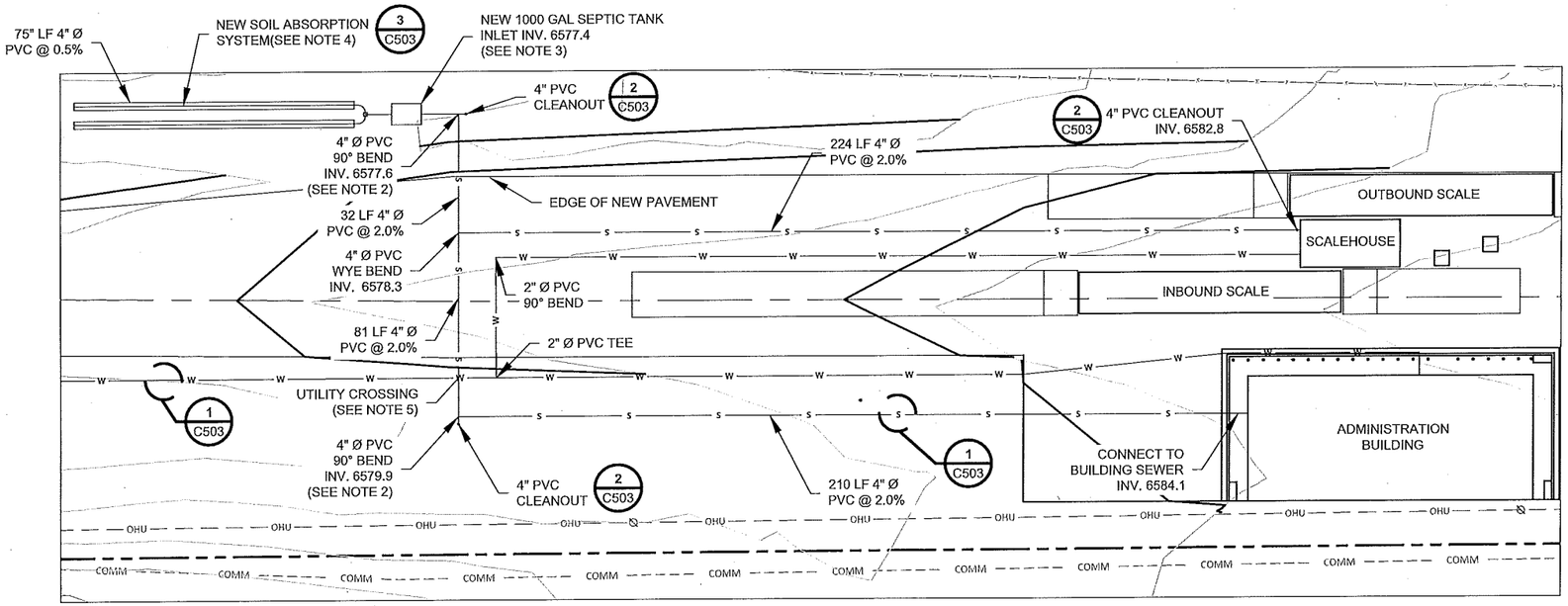
0 150' 300'
SCALE IN FEET



INSET A
SCALE: 1" = 20'

NORTH

0 20' 40'
SCALE IN FEET



INSET B
SCALE: 1" = 20'

NORTH

0 20' 40'
SCALE IN FEET

no.	date	by	ckd	description
0	3/9/20	TS	JL	ISSUED FOR BID

NOTE:

1. CONTRACTOR TO PROVIDE A MINIMUM 5000 GALLON CISTERN DESIGN WITH INTEGRATED PUMP TO PROVIDE A MINIMUM DYNAMIC HEAD OF 155 FT AND TO ALLOW A MINIMUM OF 44 GPM FLOW TO THE SCALEHOUSE.
2. SEWAGE DRAIN LINE 90° BEND TO BE CONSTRUCTED USING TWO 45° BENDS.
3. SEPTIC TANK TO BE VAUGHN 1000 GALLON PRECAST CONCRETE TWO PIECE SEPTIC TANK OR ENGINEER APPROVED ALTERNATIVE.
4. NEW SEPTIC SYSTEM AND SOIL ABSORPTION BED TO BE INSTALLED IN ACCORDANCE WITH LARAMIE COUNTY SMALL WASTEWATER SYSTEMS REGULATIONS. SOIL ADSORPTION SYSTEM TO BE A TWO LEGGED STANDARD TRENCH SYSTEM. TRENCHES ARE TO BE 2-FEET WIDE, WITH A SIDEWALL DEPTH OF 1-FOOT, BURIED A MINIMUM OF 12-INCHES BELOW GROUND SURFACE.
5. UTILITY CROSSING TO BE 2-INCH PVC WATERLINE INSTALLED A MINIMUM OF 18-INCHES ABOVE 4-INCH PVC SANITARY SEWER LINE.

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S WOOD	J LEE

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

UTILITIES SITE PLAN

project	contract
118706	7042

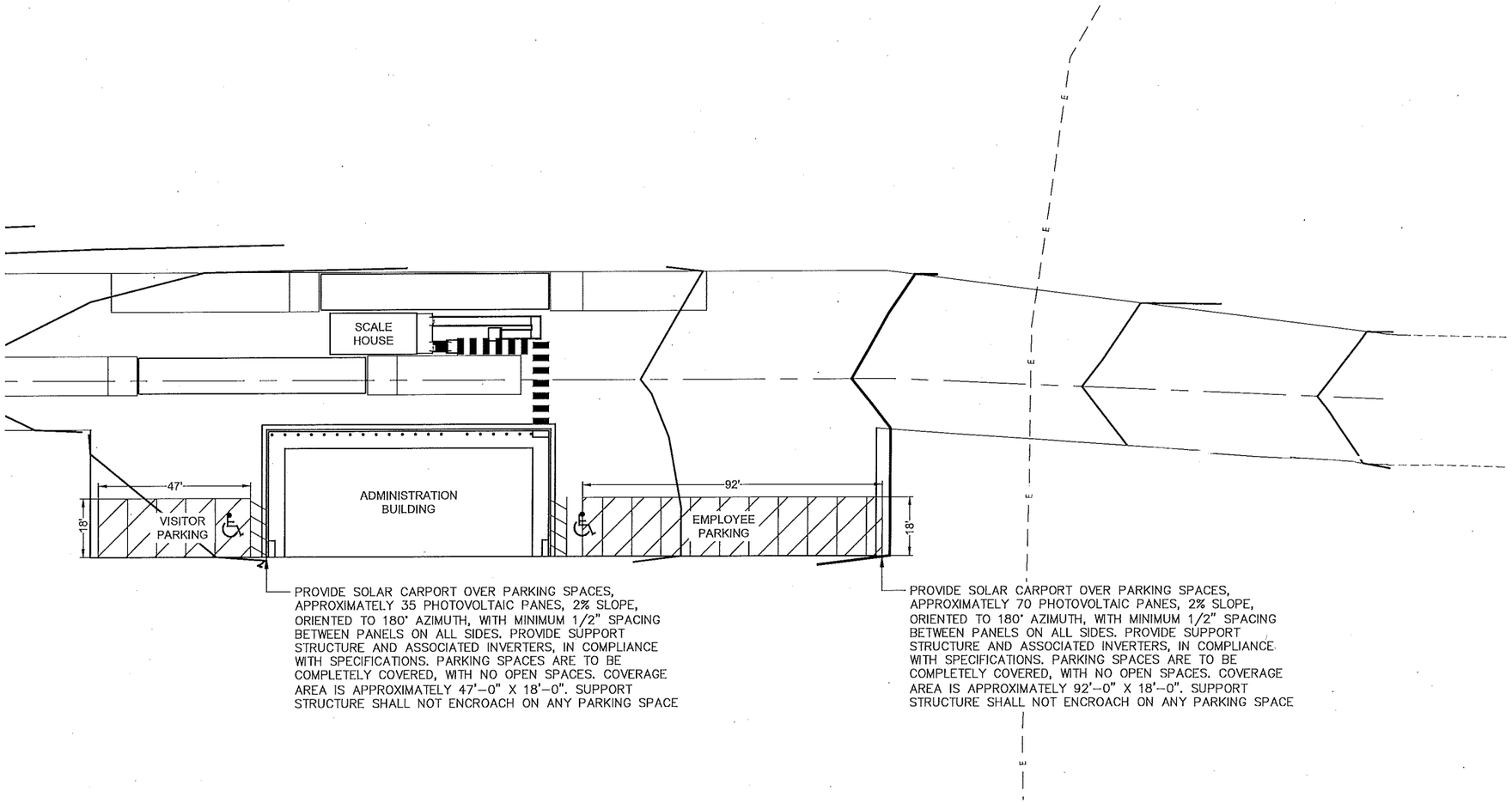
drawing **CU101** rev. **0**

sheet --- of --- sheets

file 118706CU101PLAN.DWG

Professional Engineer JOSHUA L. LEE 14688 WYOMING Date: 07/10/2020

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SOLAR SITE PLAN
SCALE: 1" = 20'

no.	date	by	ckd	description
0	3/9/20	GJ	DK	ISSUED FOR BID

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date	detailed
MARCH 2020	G JOHNSON
designed	checked
G JOHNSON	D KUVAAS

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

SOLAR SITE PLAN

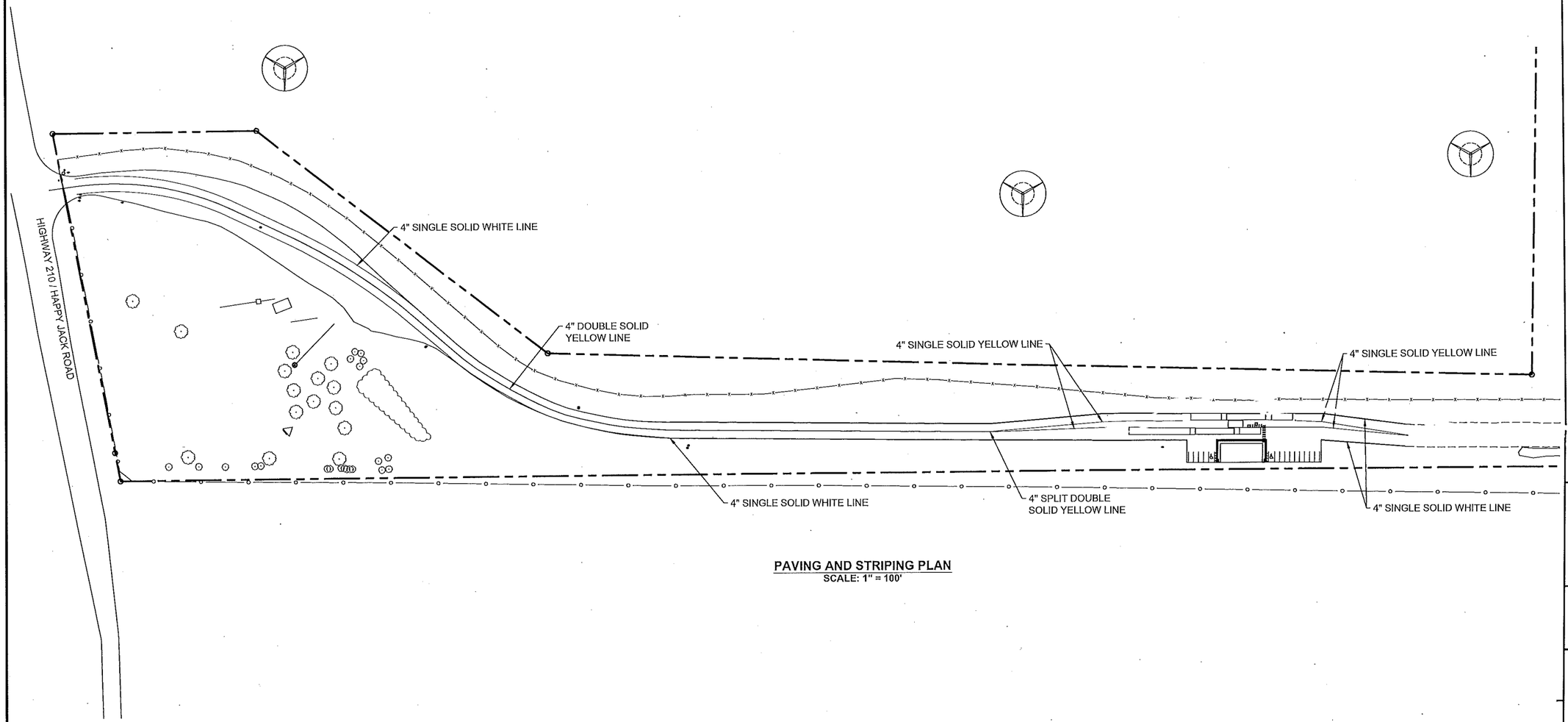
project	contract
118706	7042

drawing CU102 — rev. 0

sheet — of — sheets

file 118706PV101.DWG

Professional Engineer JOSHUA L. LEE 14588 Date 07/10/2020 WYOMING



PAVING AND STRIPING PLAN
SCALE: 1" = 100'

no.	date	by	ckd	description
0	3/9/20	SW	JL	ISSUED FOR BID

NOTE:

1. PAVING AND STRIPING TO BE PERFORMED IN ACCORDANCE WITH THE US DOT MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

NORTH

0 100' 200'
SCALE IN FEET

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date	detailed
JULY 2020	S WOOD
designed	checked
S WOOD	J LEE

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

PAVING AND STRIPING PLAN

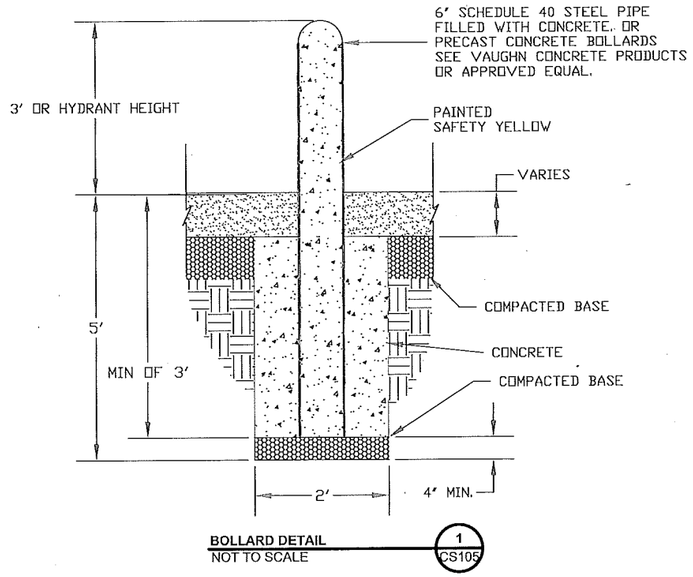
project	contract
118706	7042

drawing **CP101** – rev. **0**

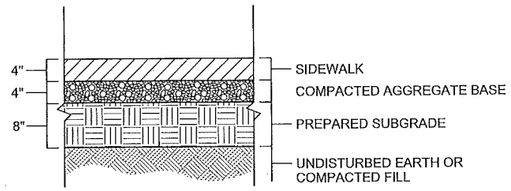
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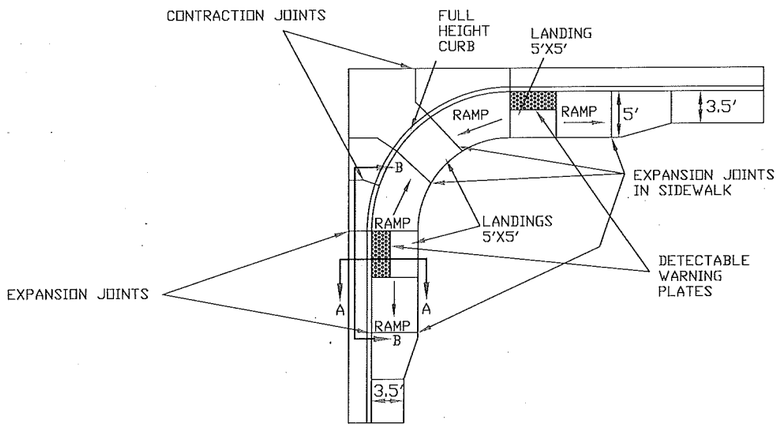
Professional Engineer JOSHUA L. LEE 14689 WYOMING Date 07/10/2020



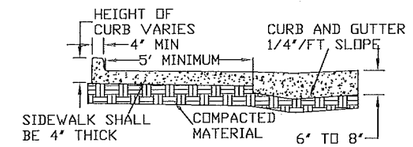
BOLLARD DETAIL — NOT TO SCALE — 1 / CS105



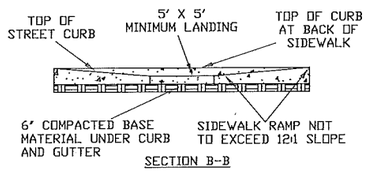
SIDEWALK DETAIL — NOT TO SCALE — 2 / CS105



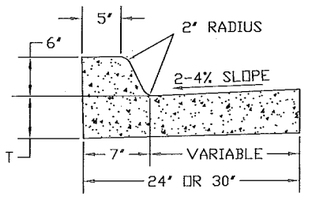
WHEEL CHAIR RAMP — NOT TO SCALE — 3 / CS105



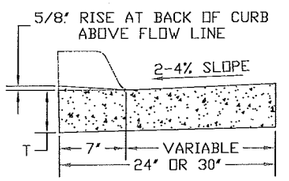
SECTION A-A



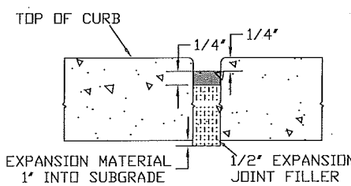
SECTION B-B



INFLOW CURB



TYPE A CURB MODIFICATION AT WHEELCHAIR RAMP



PREFORMED EXPANSION JOINT FILLER DETAIL

CURB AND GUTTER DETAIL — NOT TO SCALE — 4 / CS105

no.	date	by	ckd	description
0	3/9/20	TS	JL	ISSUED FOR BID

NOTE:

1. CONTRACTOR SHALL COMPACT FILL IN ACCORDANCE WITH PROJECT SPECIFICATIONS.
2. SLIGHTLY MOUND BACKFILL OVER TRENCH TO ALLOW FOR MINOR SETTLEMENT IN NON-ROADWAY AREAS.

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JULY 2020	T SCHMIDT
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J LEE	B COLEMAN

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

DETAILS

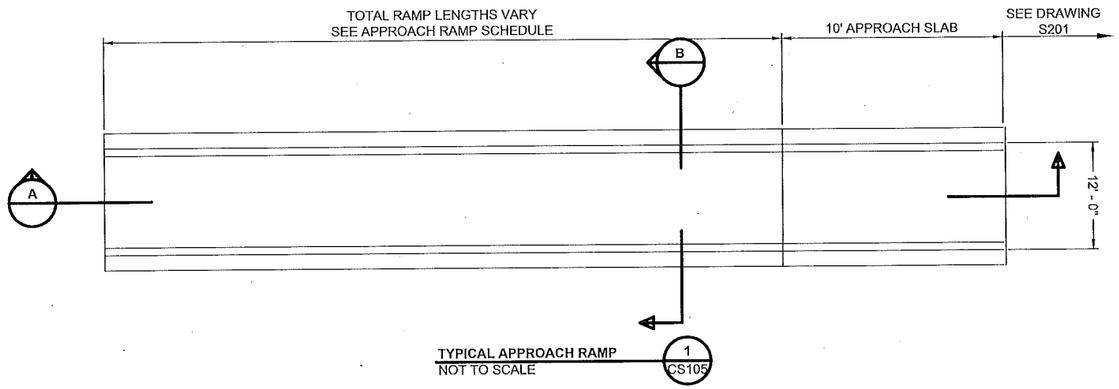
project	contract
118706	7042

drawing **C501 – 0** (rev.)

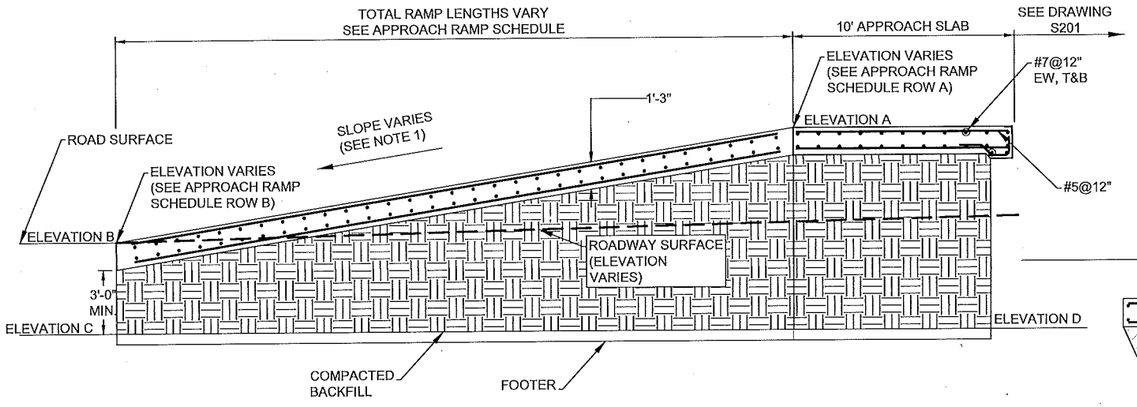
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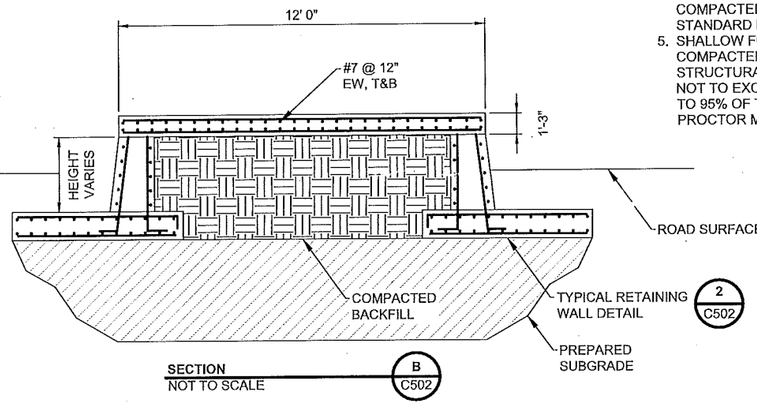
Professional Engineer JOSHUA L. LEE 14688 WYOMING Date 07/10/2020



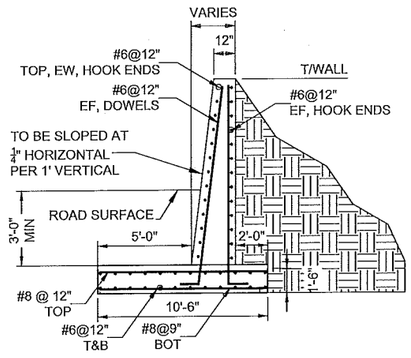
TYPICAL APPROACH RAMP
NOT TO SCALE
1 CS105



SECTION
NOT TO SCALE
A C502



SECTION
NOT TO SCALE
B C502



TYPICAL RETAINING
WALL DETAIL
NOT TO SCALE
2 CS105

APPROACH RAMP SCHEDULE						
	APPROACH RAMP DIMENTIONS					
DESIGNATION	ELEVATION A (FT)	ELEVATION B (FT)	ELEVATION C (FT)	ELEVATION D (FT)	APPROACH LENGTH (FT)	GRADE %
NW	6589.79	6583.94	6580.94	6580.94	110	-4
SW	6589.79	6587.02	6584.02	6584.02	38	-7
NE	6589.79	6584.93	6581.93	6581.93	55	-7
SE	6589.79	6588.08	6585.08	6585.08	40	-4

NOTES:

1. ALL INFORMATION CONTAINED ON THE FOUNDATION DRAWINGS IS BASED ON A REPORT ENTITLED "HAPPY JACK LANDFILL ENTRANCE, CHEYENNE WYOMING" PREPARED BY INGBER-MILLER ENGINEERS PROJECT NO. 21125 HX, FEBRUARY 12, 2020. THE ABOVE DOCUMENT IS NOT PART OF THE CONTRACT. IN THE EVENT OF DISCREPANCIES BETWEEN THE ABOVE DOCUMENT AND THE FOUNDATION DRAWINGS, THE FOUNDATION DRAWINGS SHALL GOVERN.
2. EXPOSED SUBGRADE BELOW FOUNDATIONS, CONCRETE SLABS, AND PAVEMENTS SHALL BE PROOFROLLED TO AID IN ASSESSING SUBGRADE CONDITIONS. PROOFROLLING SHOULD BE PERFORMED WITH A WHEELED VEHICLE EXERTING RELATIVELY HIGH SOIL-CONTACT PRESSURE SUCH AS A DUMP-TRUCK OR END-LOADER. SUBGRADE TO RECEIVE STRUCTURES, PAVEMENT OR FILL MATERIAL SHALL BE FREE OF ORGANIC MATERIALS, PROTRUDING ROCKS, AND DEBRIS. WEAK OR YIELDING SUBGRADE SHALL BE REMOVED AND REPLACED WITH IMPORTED WYDOT GRADING W, ENVELOPE A TYPE STRUCTURAL FILL.
3. AT SHALLOW FOUNDATIONS, OVEREXCAVATION SHALL BE PERFORMED TO A DEPTH OF 12 INCHES BELOW BEARING ELEVATION AND 12 INCHES OUTSIDE THE FOOTING PERIMETER.
4. ALL INTERIOR SLABS ON GRADE SHALL BE PLACED OVER A MOISTURE BARRIER ON TOP OF 8 INCHES OF COMPACTED GRANULAR FILL. IMPORTED 'ENVELOPE A' FILL BELOW THE AGGREGATE BASE SHOULD BE PLACED IN LOOSE LIFTS NOT TO EXCEED 8 INCHES, WITH A MOISTURE CONTENT RANGING FROM 4 PERCENT BELOW TO 2 PERCENT ABOVE OPTIMUM MOISTURE CONTENT AND COMPACTED TO 95% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY.
5. SHALLOW FOUNDATIONS SHALL BE PLACED ON COMPACTED IN-PLACE SOIL OR ON APPROVED STRUCTURAL FILL PLACED IN LOOSE LIFTS NOT TO EXCEED 6 INCHES AND COMPACTED TO 95% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY.

no.	date	by	ckd	description
0	3/9/20	SW	JL	ISSUED FOR BID

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Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	S WOOD
designed	checked
S WOOD	J LEE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

SCALE RAMP DETAILS

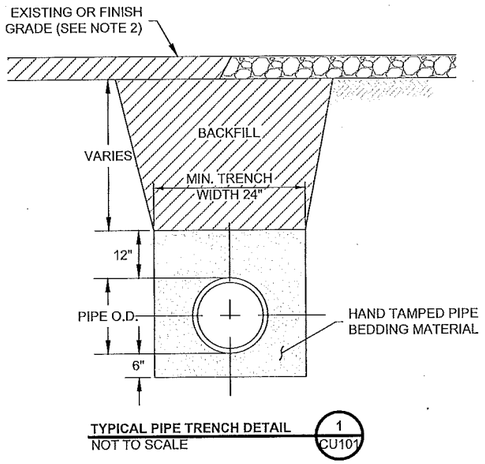
project	contract
118706	7042

drawing **C502** rev. **0**

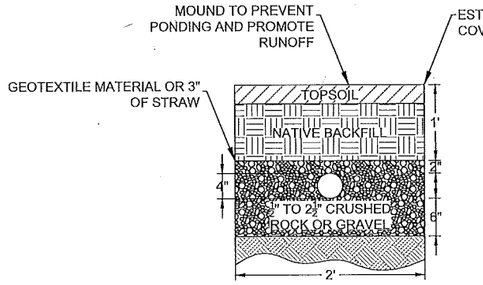
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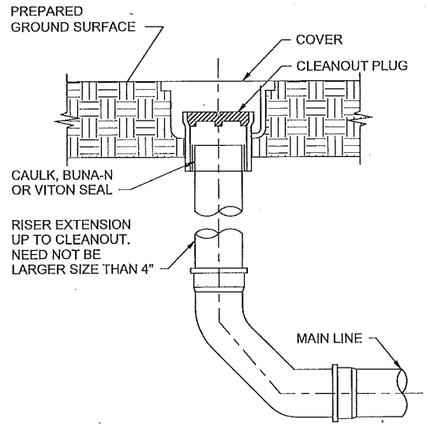
Professional Engineer
JOSHUA L. LEE
14688
WYOMING
Date 07/10/2020



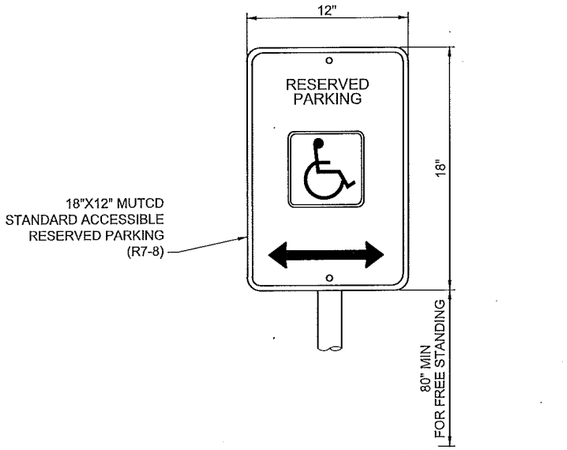
TYPICAL PIPE TRENCH DETAIL 1 CU101
NOT TO SCALE



SEPTIC LEACH FIELD SECTION 2 CU101
NOT TO SCALE



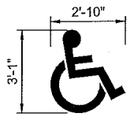
CLEANOUT DETAIL 3 CU101
NOT TO SCALE



NOTES:

1. WHITE DISABLED SYMBOL AND PERIMETER LINE SHALL BE APPLIED AS DECALS. BACKGROUND IS ON ALUMINUM SIGN PANEL WITH 3M BLUE VINYL COLOR.
2. INTERNATIONAL SYMBOL OF ACCESSIBILITY FOR THE DISABLED SHALL BE 7" HIGH, CENTERED.
3. MOUNT ON SQUARE STEEL UNISTRUT 2" TELSPAR POST, POWDER COATED TIGER DRY LAC # RAL 8012 BROWN FINISH, WITH ⅜" GALVANIZED CARRIAGE BOLTS.
4. SIGN SHALL BE CENTERED AT THE INTERIOR END OF PARKING SPACE.

ACCESSIBLE PARKING SIGN DETAIL 4 CS105
NOT TO SCALE



ADA PAVEMENT MARKING 5 CS105
NOT TO SCALE

no.	date	by	ckd	description
0	3/9/20	TS	JL	ISSUED FOR BID

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Centennial, CO 80112
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date	detailed
JULY 2020	S WOOD
designed	checked
S WOOD	J LEE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

UTILITY DETAILS

project	contract
118706	7042

drawing **C503** rev. **0**

sheet — of — sheets

file 118706C-503CDET.DWG

Professional Engineer JOSHUA L LEE 14588 WYOMING Date 07/10/2020

Scale For Microfilming
Millimeters
Inches
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STANDARD ABBREVIATIONS

AA	- ALUMINUM ASSOCIATION
AB	- ANCHOR BOLT
ABT	- ABOUT
ACI	- AMERICAN CONCRETE INSTITUTE
ADH	- ADHESIVE
AGGR	- AGGREGATE
AHR	- ANCHOR
AISI	- AMERICAN IRON AND STEEL INSTITUTE
AISC	- AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AL, ALUM	- ALUMINUM
ALTN	- ALTERNATE
ANSI	- AMERICAN NATIONAL STANDARDS INSTITUTE
ARCH	- ARCHITECT
ASTM	- AMERICAN SOCIETY FOR TESTING OF MATERIALS
AWS	- AMERICAN WELDING SOCIETY
(B)	- BOTTOM
BC	- BOLT CIRCLE
BETW	- BETWEEN
BLDG	- BUILDING
BM	- BEAM
BO	- BOTTOM OF
BOC	- BOTTOM OF CONCRETE
BOS	- BOTTOM OF STEEL
BOT	- BOTTOM
B/P	- BASE OF PIER
BRG	- BEARING
BRKT	- BRACKET
C/C	- CENTER TO CENTER
CL	- CENTER LINE
CF	- CUBIC FEET
CHKR	- CHECKER
CIR	- CIRCLE
CJ	- CONSTRUCTION JOINT
CLR	- CLEAR
CLJ	- CONTROL JOINT
CMU	- CONCRETE MASONRY UNIT
CO	- CONCRETE OPENING
CONC	- CONCRETE
CONT	- CONTINUOUS
COL	- COLUMN
COTR	- CONTRACTING OFFICER
COR	- CORNER
COORD	- COORDINATE
CRSI	- CONCRETE REINFORCING STEEL INSTITUTE
CTR	- CENTER
CTRD	- CENTERED
CY	- CUBIC YARD
DBL	- DOUBLE
DET	- DETAIL
DIAG	- DIAGONAL
DIA	- DIAMETER
DIM	- DIMENSION
DK	- DECKING
DL	- DEAD LOAD
DN	- DOWN
DWL	- DOWEL
DWG	- DRAWING
E	- EAST
EA	- EACH
EF	- EACH FACE
EJ	- EXPANSION JOINT
EL	- ELEVATION
ELEC	- ELECTRICAL
EMBED	- EMBEDMENT
EQ	- EQUAL
EQUIV	- EQUIVALENT
EQ SP	- EQUALLY SPACED
EQUIP	- EQUIPMENT
EXIST	- EXISTING
EW	- EACH WAY
FD	- FLOOR DRAIN
FDN	- FOUNDATION
FTG	- FOOTING
FF	- FAR FACE
FL	- FLOOR
FNSH	- FINISH
FS	- FAR SIDE
FT	- FEET
GA	- GAGE
GALV	- GALVANIZE
GB	- GRADE BEAM
GND	- GROUND
GR	- GRADE
GRTG	- GRATING
HG	- HIGH
HR	- HANDRAIL
HPT	- HIGH POINT
HORIZ	- HORIZONTAL
HS	- HIGH STRENGTH
IBC	- INTERNATIONAL BUILDING CODE
ID	- INSIDE DIAMETER
IF	- INSIDE FACE
IJ	- ISOLATION JOINT
IN	- INCHES
JT	- JOINT
KSI	- KIPS PER SQUARE INCH
L	- ANGLE
LB	- POUND
LD	- DEVELOPMENT LENGTH
LG	- LONG
LL	- LIVE LOAD
LLH	- LONG LEG HORIZONTAL
LLO	- LONG LEG OUTSTANDING
LLV	- LONG LEG VERTICAL
LONG	- LONGITUDINAL
LPT	- LOW POINT
LS	- LAP SPLICE
MATL	- MATERIAL
MAX	- MAXIMUM
MC	- MOMENT CONNECTION
MECH	- MECHANICAL
MFR	- MANUFACTURER
MH	- MANHOLE
MIN	- MINIMUM
MISC	- MISCELLANEOUS
MK	- MARK
NA	- NOT APPLICABLE
NF	- NEAR FACE
NOM	- NOMINAL
NIC	- NOT IN CONTRACT
NTS	- NOT TO SCALE
NO	- NUMBER
NS	- NEAR SIDE
OC	- ON CENTER
OD	- OUTSIDE DIAMETER
OF	- OUTSIDE FACE
OPNG	- OPENING
OPP	- OPPOSITE
OSHA	- OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OZ	- OUNCE
PCF	- POUNDS PER CUBIC FOOT
PERP	- PERPENDICULAR
PL	- PLATE
PLC	- PLACES
PLF	- POUNDS PER LINEAR FOOT
PREFAB	- PREFABRICATED
PS	- PIPE SUPPORT
PSF	- POUNDS PER SQUARE FOOT
PSI	- POUNDS PER SQUARE INCH
PVC	- POLYVINYL CHLORIDE
RAD	- RADIUS
RD	- ROOF DRAIN
REF	- REFERENCE
REINF	- REINFORCE
REQD	- REQUIRED
REV	- REVISION
RM	- ROOM
S	- SOUTH
SB	- SHEAR BAR
SCHED	- SCHEDULE
SH	- SHEET
SIM	- SIMILAR
SLP	- SLOPE
SP	- SPACE
SPEC	- SPECIFICATION
SQ	- SQUARE
SST	- STAINLESS STEEL
STD	- STANDARD
STL	- STEEL
STIF	- STIFFENER
STR	- STRAIGHT
STRL	- STRUCTURAL
STRUC	- STRUCTURE
SYMM	- SYMMETRICAL
T	- TON
TEMP	- TEMPORARY
THK	- THICK
THRU	- THROUGH
(T)	- TOP
T/	- TOP OF
TOA	- TOP OF ALUMINUM
TOB	- TOP OF BOLT
TOC	- TOP OF CONCRETE
TOG	- TOP OF GRATING
TOM	- TOP OF MASONRY
TOS	- TOP OF STEEL
T/P	- TOP OF PIER
T&B	- TOP AND BOTTOM
TYP	- TYPICAL
UNO	- UNLESS NOTED OTHERWISE
VAR	- VARIES
VERT	- VERTICAL
VEF	- VERTICAL EACH FACE
WD	- WIDE
W/	- WITH
W/O	- WITHOUT
WP	- WORK POINT
WS	- WATERSTOP
WT	- WEIGHT
WWF	- WELDED WIRE FABRIC
#	- POUNDS OR NUMBER
%	- PERCENT

MATERIAL LEGEND

EARTH

COMPACTED FILL

ROCK

GRANULAR FILL

SAND

CONCRETE

GROUT

CONCRETE MASONRY UNITS (PLAN/SECTION)

CONCRETE MASONRY UNIT (ELEVATION)

BRICK (COMMON/FACE)

WATER

STEEL (LARGE SCALE)

GRATING

ALUMINUM

CHECKERED PLATE

VOID FORM

STRUCTURAL STEEL (SMALL SCALE)

CONCRETE W/ REINFORCING BAR

ADHESIVE/EPOXY ANCHOR

EXPANSION ANCHOR

CLJT

TYPICAL BOND BEAM

CONTINUOUS BOND BEAM

NOTES:

1. STATEMENT OF SPECIAL INSPECTIONS
   - A. THIS "STATEMENT OF SPECIAL INSPECTIONS" HAS BEEN PREPARED IN ACCORDANCE WITH IBC 2018, SECTION 1704.
   - B. OWNER SHALL RETAIN PRE-COORDINATED AND GOVERNMENT-APPROVED THIRD-PARTY QUALITY ASSURANCE AGENCIES TO PROVIDE SPECIAL INSPECTIONS DURING CONSTRUCTION IN ACCORDANCE WITH IBC 2018, CHAPTER 17.
   - C. EACH SPECIAL INSPECTOR SHALL BE A QUALIFIED PERSON WHO SHALL DEMONSTRATE COMPETENCE, TO THE SATISFACTION OF THE CONTRACTING OFFICER'S REPRESENTATIVE, FOR INSPECTION OF THE PARTICULAR TYPE OF CONSTRUCTION OR OPERATION REQUIRING SPECIAL INSPECTION.
   - D. SPECIAL INSPECTION AGENCY SHALL SUBMIT INSPECTION REPORTS DURING CONSTRUCTION FOR VERIFICATION, INCLUDING FINAL REPORTS IN ACCORDANCE WITH IBC 2018 SECTION 1704.2.4.
   - E. SPECIAL INSPECTOR SHALL USE THE LATEST ISSUE OF THE STRUCTURAL DRAWINGS FOR ALL INSPECTIONS. SHOP FABRICATION DRAWINGS SHALL NOT BE USED FOR SUCH PURPOSES.
   - F. THE FOLLOWING TABLE IDENTIFIES THE MATERIALS, SYSTEMS, AND COMPONENTS FOR WHICH SPECIAL INSPECTION IS REQUIRED.
2. TESTING REQUIREMENTS
   - A. CONTRACTOR SHALL RETAIN PRE-COORDINATED AND GOVERNMENT-APPROVED THIRD-PARTY TESTING AGENCIES TO PROVIDE STRUCTURAL TESTING DURING CONSTRUCTION IN ACCORDANCE WITH IBC 2018, CHAPTER 17.
   - B. TESTING AGENCY SHALL SUBMIT TEST RESULTS DURING CONSTRUCTION FOR VERIFICATION INCLUDING A FINAL REPORT IN ACCORDANCE WITH IBC 2018, 1704.2.4.
   - C. THE TABLE ON THIS SHEET IDENTIFIES THE STRUCTURAL TESTS REQUIRED FOR THIS PROJECT.
3. STRUCTURAL OBSERVATIONS
   - A. A REGISTERED DESIGN PROFESSIONAL SHALL PROVIDE STRUCTURAL OBSERVATIONS DURING CONSTRUCTION IN ACCORDANCE WITH IBC 2018, CHAPTER 17.
   - B. EACH STRUCTURAL OBSERVER SHALL SUBMIT WRITTEN STATEMENTS IDENTIFYING FREQUENCY AND EXTENT OF STRUCTURAL OBSERVATIONS AND ANY REPORTED DEFICIENCIES WHICH, TO THE BEST OF THE STRUCTURAL OBSERVER'S KNOWLEDGE, HAVE NOT BEEN RESOLVED.

SPECIAL INSPECTION REQUIREMENTS

MATERIAL/SYSTEM	TYPE & EXTENT OF SPECIAL INSPECTION	CONT/PERIODIC INSPECTION	TYPE & EXTENT OF TESTING	CODE REFERENCE
SUBGRADE PREPARATION	VERIFY DEPTH, MATERIALS AND COMPACTION	P	DENSITY TEST ON COMPACTED FILL, PROOFROLL UNDISTRUBED NATIVE MATERIAL	
MATERIAL VERIFICATION OF WELD FILLER MAT'LS	IDENTIFICATION OF AWS MARKINGS, MFR'S CERTIFICATE OF COMPLIANCE			AISC 360, SECTION A3.5
FILLET WELDS<= 5/16"	VISUAL INSPECTION	P		AWS D1.1
MATERAIL VERIFICATION OF COLD-FORMED STEEL DECK	IDENTIFICATION OF ASTM MARKINGS, MFR'S CERTIFICATE OF COMPLIANCE			ASTM
COLD-FORMED ROOF DECK WELDS	VISUAL INSPECTION	P		AWS D1.3
CONCRETE FORM WORK	SHAPE, LOCATION, AND DIMENSIONS OF CONCRETE MEMBER	P		
REINFORCEMENT	SIZE AND PLACEMENT	P		ACI 318
CONCRETE MIX DESIGN	VERIFICATON OF PROPERTIES	P		ACI 318
CAST-IN-PLACE CONCRETE	PLACEMENT OF CONCRETE	C	TEMPERATURE, STRENGTH, SLUMP, AIR ENTRAINMENT	ACI 318
CONCRETE CURING	MAINTENANCE OF CURING TEMPURATURE AND TECHNIQUES	P		ACI 318
ANCHORS CAST IN CONCRETE	SIZE AND PLACEMENT	P		ACI 318
ANCHORS POST INSTALLED IN HARDENED CONCRETE	SIZE, PLACEMENT, AND CONFORMANCE TO MFR'S INSTALLATION PROCEDURES	C		ACI 318
MASONRY CONSTRUCTION	COMPLIANCE WITH CONSTRUCTION DOCUMENTS AND APPROVED SUBMITTALS	P	MORTAR JOINTS, HOT AND COLD WEATHER PLACEMENT	TMS 402
MASONRY STRENGTH	VERIFICATION OF f'm	P	PRIOR TO CONSTRUCTION AND EVERY 5000 SQ FT	TMS 402
PREMIXED MORTAR AND GROUT	VERIFICATION OF PROPERTIES	P		TMS 402
SITE PREPARED MORTAR AND GROUT	VERIFICATION OF PROPERTIES	P		TMS 402
MASONRY CONSTRUCTION	SIZE, PLACEMENT AND CONDITIONS	P	MORTAR JOINTS, HOT AND COLD WEATHER PLACEMENT	TMS 402
GROUT	GROUT SPACE PRIOR TO GROUT, PLACEMENT OF GROUT	C		TMS 402
OPEN WEB STEEL JOISTS	END CONNECTIONS & BRIDGING INSTALLATION	P		SJI 100

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date	detailed
JULY 2020	N. ARYAN
designed	checked
S. DALGLISH	K. THURMAN

CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

SPECIAL INSPECTIONS, STRUCTURAL NOTES AND LEGENDS

project	contract
118706	

drawing S001 — rev. 0

sheet of sheets

file

Professional Engineer
KEENAN D. THURMAN
PE 16429
Date 07/09/2020
WYOMING

7/9/2020 5:04:00 PM

GENERAL NOTES

1. CONTRACTOR SHALL COORDINATE ALL STRUCTURAL WORK WITH WORK SHOWN ON ALL OTHER DRAWINGS.
2. CONTRACTOR SHALL VERIFY ALL DIMENSIONS OF EXISTING CONSTRUCTION AND REPORT ANY DISCREPANCIES FROM THE CONTRACT OR REFERENCE DRAWINGS TO THE ENGINEER PRIOR TO COMMENCING WITH WORK. IN NO CASE SHALL WORKING DIMENSIONS BE SCALED FROM THE STRUCTURAL DRAWINGS.
3. THE CONTRACT DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE. CONTRACTOR SHALL BE RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION INCLUDING, BUT NOT LIMITED TO, SHORING AND TEMPORARY BRACING TO PROVIDE STRUCTURAL STABILITY DURING CONSTRUCTION.
4. IF CERTAIN FEATURES ARE NOT FULLY SHOWN OR CALLED FOR ON THE CONTRACT DRAWINGS OR SPECIFICATIONS, THEIR CONSTRUCTION SHALL BE OF THE SAME CHARACTER AS FOR SIMILAR CONDITIONS THAT ARE SHOWN OR CALLED FOR, WITH THE APPROVAL OF THE ENGINEER. WHERE SECTIONS VARY, CONTRACTOR SHALL PROVIDE FOR SMOOTH TRANSITIONS BETWEEN THEM, UNLESS NOTED OTHERWISE.
5. ALL PRODUCTS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS WRITTEN INSTRUCTIONS AND RECOMMENDATIONS, UNLESS NOTED OTHERWISE.

CONCRETE AND REINFORCING

1. SEE DRAWING S003 FOR CONCRETE AND CONCRETE REINFORCING DETAILS.

CAST-IN-PLACE CONCRETE

1. ALL CONCRETE SHALL BE DESIGNED AND PLACED IN ACCORDANCE WITH ACI 318 & ACI 350.
2. ALL CONCRETE SHALL MEET THE FOLLOWING REQUIREMENTS:
   - f'c: 4500 PSI AT 28 DAYS
   - SLUMP: 4"-6"
   - AIR: 6%±1.5%
3. BEFORE CONCRETE WORK BEGINS, THE PROPOSED CONCRETE MIX DESIGN, ALONG WITH COLLABORATING DATA SHOWING COMPLIANCE WITH THESE REQUIREMENTS, SHALL BE SUBMITTED FOR APPROVAL.
4. ALL EXPOSED CORNERS SHALL BE CHAMFERED 3/4", UNO
5. ALL ALUMINUM SURFACES IN CONTACT WITH CONCRETE SHALL HAVE A BITUMASTIC COATING.

PROTECTION FOR REINFORCEMENT

1. THE FOLLOWING CONCRETE COVER SHALL BE PROVIDED FOR REINFORCEMENT (UNLESS OTHERWISE NOTED). SEE ACI 117 FOR CONSTRUCTION TOLERANCES:

   CONCRETE CAST AGAINST & PERMANENTLY EXPOSED TO EARTH = 3"

   CONCRETE EXPOSED TO EARTH, LIQUID, WEATHER OR CAST AGAINST A CONCRETE WORK MAT:
   SLABS, WALLS & FOOTINGS = 2"
   BEAMS & COLUMNS:
   STIRRUPS, SPIRALS & TIES = 2"
   PRIMARY REINFORCEMENT = 2 1/2"

   CONDITIONS NOT COVERED ABOVE:
   SLABS AND WALLS = 1 1/2"
   BEAMS AND COLUMNS:
   STIRRUPS, SPIRALS & TIES = 1 1/2"
   PRIMARY REINFORCEMENT = 2"

REINFORCING

1. ALL REINFORCING BARS SHALL BE ASTM A615, GRADE 60.
2. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A1064 AND SHALL BE FLAT SHEET. ROLLED FABRIC WILL NOT BE ALLOWED.
3. UNLESS OTHERWISE INDICATED, THE MINIMUM LENGTH OF LAP SPLICES AND EMBEDMENTS SHALL BE AS NOTED IN THE TABLE ON SHEET S003 .
4. NO WELDED OR MECHANICAL SPLICES SHALL BE ALLOWED.
5. HEATING OF REINFORCING BARS SHALL NOT BE ALLOWED.
6. POSITION OF REINFORCING STEEL SHALL BE MAINTAINED BY BOLSTERS, CHAIRS AND ACCESSORIES IN ACCORDANCE WITH ACI-117 AND THE CRSI MANUAL OF STANDARD PRACTICE.
7. REPOSITIONING OF REINFORCING TO AVOID INTERFERENCE WITH EMBEDDED ITEMS SHALL BE APPROVED BY THE ENGINEER PRIOR TO WORK.

JOINTS

1. EXPANSION, CONSTRUCTION, AND CRACK CONTROL JOINTS SHALL BE PROVIDED IN ACCORDANCE WITH STANDARD DETAILS AND AS LOCATED OR DETAILED ON THE DRAWINGS. ANY OTHERS DEEMED NECESSARY SHALL BE APPROVED BY THE ENGINEER PRIOR TO WORK.
2. CONCRETE EDGES THAT ARE TO RECEIVE JOINT SEALANT SHALL BE PLACED AGAINST NON-OILED FORMS. THE NON-OILED PORTION SHALL EXTEND A MINIMUM OF 2 1/2" FROM THE EDGE TO BE SEALED.
3. JOINTS RECEIVING SEALANT SHALL BE COATED WITH PRIMER, IF REQUIRED BY THE SEALANT MANUFACTURER. JOINT PREPARATION AND APPLICATION PRIMER AND SEALANT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

POST-INSTALLED ANCHORS

1. POST INSTALLED CONCRETE ANCHOR MANUFACTURERS AND ADHESIVES FOR POST INSTALLED REINFORCING BARS SHALL BE THOSE LISTED IN SPECIFICATION 05 05 19. ALTERNATE PRODUCTS MUST BE APPROVED IN WRITING BY THE STRUCTURAL ENGINEER OF RECORD PRIOR TO USE. SUBSTITUTIONS REQUIRE STAMPED CALCULATIONS SEE SPECIFICATIONS.
2. ALL PERSONNEL INSTALLING ADHESIVE ANCHORS SHALL BE ACI ADHESIVE ANCHOR CERTIFIED.
3. INSTALL ANCHORS PER THE MANUFACTURER INSTRUCTIONS, AS INCLUDED IN THE ANCHOR PACKAGING.
4. THE CONTRACTOR SHALL ARRANGE AN ANCHOR MANUFACTURER'S REPRESENTATIVE TO PROVIDE ONSITE INSTALLATION TRAINING FOR ALL OF THEIR ANCHORING PRODUCTS SPECIFIED. THE STRUCTURAL ENGINEER OF RECORD MUST RECEIVE DOCUMENTED CONFIRMATION THAT ALL OF THE CONTRACTOR'S PERSONNEL WHO INSTALL ANCHORS ARE TRAINED PRIOR TO THE COMMENCEMENT OF INSTALLING ANCHORS.
5. ANCHOR CAPACITY IS DEPENDANT UPON SPACING BETWEEN ADJACENT ANCHORS AND PROXIMITY OF ANCHORS TO EDGE OF CONCRETE. INSTALL ANCHORS IN ACCORDANCE WITH SPACING AND EDGE CLEARANCES INDICATED ON THE DRAWINGS.
6. EXISTING REINFORCING BARS IN THE CONCRETE STRUCTURE MAY CONFLICT WITH SPECIFIC ANCHOR LOCATIONS. REINFORCING BARS SHALL NOT BE CUT UNLESS NOTED ON THE DRAWINGS THAT THE BARS CAN BE CUT. CONTRACTOR SHALL CONTACT THE ENGINEER OF RECORD WHEN INTERFERENCES OCCUR.
7. ADHESIVE ANCHORS SHALL BE INSTALLED IN CONCRETE HAVING A MINIMUM AGE OF 21 DAYS AT TIME OF ANCHOR INSTALLATION.

MASONRY

1. SEE DRAWING S004 FOR MASONRY DETAILS AND DESIGN NOTES.

VAPOR BARRIER

1. SEE SPECIFICATION 03 15 50 FOR VAPOR BARRIER PRODUCT DATA AND INSTALLATION INSTRUCTIONS.

STEEL DECK

1. ALL STEEL DECK SHALL BE DESIGNED, FABRICATED, AND INSTALLED IN ACCORDANCE WITH SDI SPECIFICATIONS.
2. ALL STEEL DECK SHALL CROSS A MINIMUM OF TWO SPANS.
3. END LAPS AND BEARING LENGTH AT ALL SUPPORTS SHALL NOT BE LESS THAN 2".
4. ALL STEEL DECK SHALL BE SUPPORTED AT EDGES OF PENETRATIONS AND AROUND COLUMNS. ADDITIONAL SUPPORT STEEL SHALL BE PROVIDED BY CONTRACTOR AS REQUIRED.
5. STEEL DECK SHALL BE (G60 GALVANIZED).

STEEL JOIST

1. JOISTS, BRIDGING, AND OTHER ACCESSORIES SHALL BE DESIGNED, FABRICATED, AND ERECTED IN ACCORDANCE WITH SJI SPECIFICATIONS.
2. JOISTS SHALL BE FURTHER DESIGNED AND MODIFIED AS REQUIRED FOR ALL ADDITIONAL WIND AND ROOF LOADS AND CONCENTRATED LOADS PROVIDED BY THE CONTRACTOR AND/OR EQUIPMENT VENDORS. DEPTHS INDICATED SHALL NOT BE CHANGED WITHOUT THE APPROVAL OF THE ENGINEER.
3. ALL JOISTS SHALL BE CAPABLE OF SUPPORTING 100 LB CONCENTRATED LOAD AT ANY POINT ALONG THE TOP OR BOTTOM CHORD IN ADDITION TO ALL OTHER LOADS INDICATED OR SPECIFIED.
4. UNLESS NOTED OTHERWISE, JOISTS SHALL BE ATTACHED TO SUPPORTING STRUCTURAL MEMBERS OR BEARING PLATES USING A MINIMUM 1/8"x1" LONG FIELD FILLET WELD ON EACH SIDE OF THE JOIST SEAT.

FOUNDATION EXCAVATION

1. EXPOSED SUBGRADE BELOW FOUNDATIONS, CONCRETE SLABS, AND PAVEMENTS SHALL BE PROOFROLLED TO AID IN ASSESSING SUBGRADE CONDITIONS. PROOFROLLING SHOULD BE PERFORMED WITH A WHEELED VEHICLE EXERTING RELATIVELY HIGH SOIL-CONTACT PRESSURE SUCH AS A DUMP-TRUCK OR END-LOADER. SUBGRADE TO RECEIVE STRUCTURES, PAVEMENT OR FILL MATERIAL SHALL BE FREE OF ORGANIC MATERIALS, PROTRUDING ROCKS, AND DEBRIS. WEAK OR YIELDING SUBGRADE SHALL BE REMOVED AND REPLACED WITH IMPORTED WYDOT GRADING W, ENVELOPE A TYPE STRUCTURAL FILL.
2. AT SHALLOW FOUNDATIONS, OVEREXCAVATION SHALL BE PERFORMED TO A DEPTH OF 12 INCHES BELOW BEARING ELEVATION AND 12 INCHES OUTSIDE THE FOOTING PERIMETER.
3. ALL INTERIOR SLABS ON GRADE SHALL BE PLACED OVER A MOISTURE BARRIER ON TOP OF 8 INCHES OF COMPACTED GRANULAR FILL. IMPORTED 'ENVELOPE A' FILL BELOW THE AGGREGATE BASE SHOULD BE PLACED IN LOOSE LIFTS NOT TO EXCEED 8 INCHES, WITH A MOISTURE CONTENT RANGING FROM 4 PERCENT BELOW TO 2 PERCENT ABOVE OPTIMUM MOISTURE CONTENT AND COMPACTED TO 95% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY.
4. SHALLOW FOUNDATIONS SHALL BE PLACED ON COMPACTED IN-PLACE SOIL OR ON APPROVED STRUCTURAL FILL PLACED IN LOOSE LIFTS NOT TO EXCEED 6 INCHES AND COMPACTED TO 95% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY.

DESIGN NOTES:

A. STRUCTURAL DESIGN WAS PREPARED USING THE FOLLOWING CODES AND DATA:
   1. INTERNATIONAL BUILDING CODE, 2018 EDITION
   2. ACI 318 BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
   3. AISC MANUAL FOR STEEL CONSTRUCTION
   4. TMS 402 BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES
   5. ASCE 7 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES

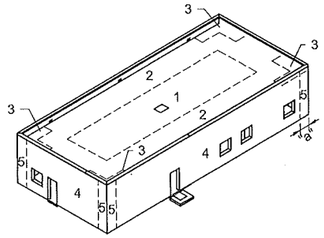
B. LIVE LOADS:
   1. ADMIN AREA AND SCALE HOUSE FLOOR - 100 PSF (UNREDUCIBLE)
   2. SCALE HOUSE FLOOR - 50 PSF
   3. ROOF LIVE - 20 PSF

C. SNOW LOADS:
   1. GROUND SNOW LOAD (P_g) - 30 PSF
   2. FLAT-ROOF SNOW LOAD (P_f) - 18.9 PSF
   3. SNOW EXPOSURE FACTOR (C_e) - 0.9
   4. SNOW LOAD IMPORTANCE FACTOR (I_s) - 1.0
   5. THERMAL FACTOR (C_t) - 1.0
   6. DRIFT SURCHARGE LOADS (P_d) - SEE JOIST SCHEDULE S006

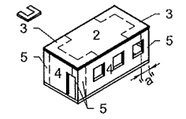
D. WIND DESIGN DATA:
   1. ULTIMATE DESIGN WIND SPEED (V_{ult}) - 115 MPH
   2. NOMINAL DESIGN WIND SPEED (V_{asd}) - 91 MPH
   3. RISK CATEGORY II
   4. EXPOSURE CATEGORY C
   5. INTERNAL PRESSURE COEFFICIENT - ±0.18
   6. COMPONENTS AND CLADDING LOADS - SEE DIAGRAM(S) THIS SHEET

E. SEISMIC DESIGN DATA:
   1. RISK CATEGORY II
   2. SEISMIC IMPORTANCE FACTOR (I_e) - 1.0
   3. MAPPED SPECTRAL RESPONSE PARAMETERS:
      a. S_S = 0.194
      b. S_1 = 0.055
   4. SOIL SITE CLASS C
   5. DESIGN SPECTRAL RESPONSE PARAMETERS:
      a. S_{DS} = 0.207
      b. S_{D1} = 0.089
   6. SEISMIC DESIGN CATEGORY B
   7. BASIC SEISMIC FORCE RESISTING SYSTEM(S):
      a. INTERMEDIATE REINFORCED MASONRY SHEAR WALLS
   8. DESIGN BASE SHEARS(S): 32.27 KIPS
   9. SEISMIC RESPONSE COEFFICIENT(S) (C_S) - 0.0591
   10. RESPONSE MODIFICATION COEFFICIENT(S) (R) - 3.5
   11. ANALYSIS PROCEDURE USED: EQUIVALENT LATERAL FORCE

F. GEOTECHNICAL INFORMATION & SOIL PROPERTIES:
   a. SOIL ALLOWABLE BEARING PRESSURE (UNO): 2,000 PSF
   b. EQUIVALENT LATERAL EARTH PRESSURES:
      a. ACTIVE: 44 PCF
      b. AT-REST: 65 PCF
      c. PASSIVE: 363 PCF



ADMINISTRATION BUILDING			
EXTERNAL LOADS ON COMPONENTS & CLADDING (PSF)			
ZONE	PRESSURE	SUCTION	a (FT)
1	16	44	3.33
2	16	57	
3	16	77	
4	26	28	
5	25	29	



SCALE HOUSE			
EXTERNAL LOADS ON COMPONENTS & CLADDING (PSF)			
ZONE	PRESSURE	SUCTION	a (ft)
1	16	16	3
2	16	16	
3	16	16	
4	25	26	
5	25	33	

no.	date	by	ckd	description
0	7/10/20	STD	KDT	ISSUED FOR BID

BURNS McDONNELL
9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	checked
S. DALGLISH	K. THURMAN

CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

STRUCTURAL NOTES

project	contract
118706	

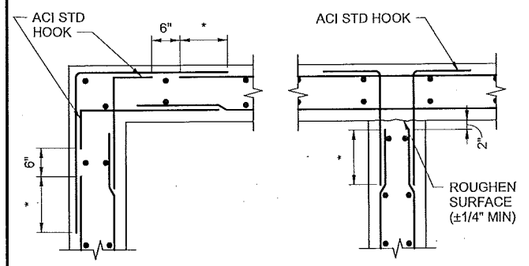
drawing	rev.
S002 —	0

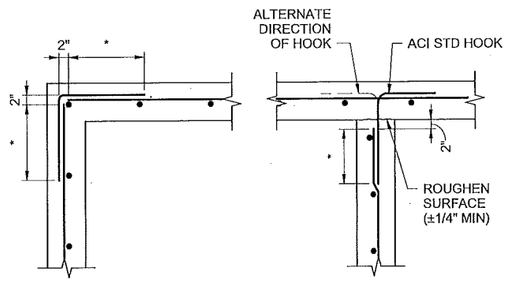
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file

Professional Engineer
KEVIN D. THURMAN
PE 16429
Date 07/09/2020
WYOMING

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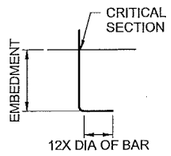
1. USE AT ALL CORNERS FOR ALL CONCRETE MEMBERS INCLUDING THICKENED SLAB ON GRADE, WALLS, CURBS, BEAMS, GRADE BEAMS AND SLABS, UNLESS INDICATED OTHERWISE.
2. *TYPICAL CONCRETE REINFORCEMENT LAP SLICE PER TABLE (THIS SHEET) UNLESS INDICATED OTHERWISE.

CONC - CORNER BAR DETAILS
NOT TO SCALE

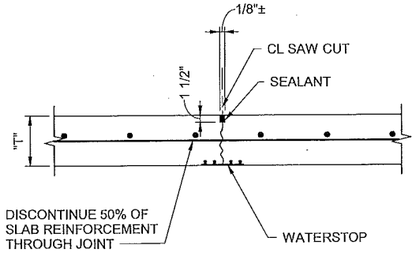
CONCRETE REINFORCEMENT SPLICE AND EMBEDMENT TABLE
(f'c = 4500 PSI)

BAR SIZE	SPLICES (IN)		EMBEDMENT (IN)		
	TOP BARS	OTHER BARS	TOP BARS	OTHER BARS	HOOKED BARS
3	15	12	12	12	5
4	20	15	15	12	7
5	25	19	19	15	9
6	29	23	23	18	10
7	48	37	37	29	12
8	61	47	47	36	14
9	75	58	58	44	15
10	91	70	70	54	17
11	109	84	84	65	19
14	NOT ALLOWED		113	87	33
18			180	138	43

REINFORCING SPLICE AND EMBEDMENT TABLE NOTES:
1. LAP SPLICES REQUIRED FOR MASONRY ARE INDICATED ON DRAWING S004.
2. REINFORCING BAR EMBEDMENT AND LAP SPLICE LENGTHS SHALL BE AS SHOWN IN THE ABOVE TABLE UNLESS NOTED OTHERWISE ON THE DRAWINGS.
3. THE LENGTHS SHOWN IN THE TABLE ARE BASED ON THE FOLLOWING CONCRETE COVERAGE AND REINFORCING C-C SPACING:
   A. BEAMS OR COLUMNS: COVER ≥ 1.0bd (BAR DIAMETER)
      CENTER TO CENTER (C-C) SPACING ≥ 2.0bd
   B. ALL OTHERS: COVER ≥ 1.0bd
      CENTER TO CENTER SPACING ≥ 3.0 bd
4. TOP BARS ARE DEFINED AS HORIZONTAL REINFORCEMENT PLACED SUCH THAT MORE THAN 12" OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE DEVELOPMENT LENGTH OR SPLICE.
5. THE DEVELOPMENT AND SPLICE LENGTHS SHOWN SHALL NOT APPLY IF ANY OF THE FOLLOWING CONDITIONS OCCUR:
   A. f'c < 4,500 psi
   B. fy > 60,000 psi
   C. THE COVER OR C-C BAR SPACING IS NOT AS LISTED ABOVE.
   D. THE REINFORCING STEEL IS EPOXY COATED.
   E. LIGHT WEIGHT CONCRETE IS USED.
6. WHERE BAR SPLICES ARE STAGGERED SUCH THAT ONE-HALF OR LESS OF TOTAL REINFORCEMENT IS SPLICED WITHIN REQUIRED LAP LENGTH, SPLICE LENGTH MAY EQUAL EMBEDMENT LENGTH.

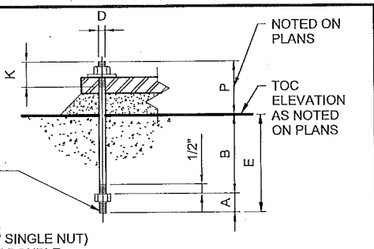


CONC - LAP SPLICE TABLE
NOT TO SCALE



CJ-5 WITH WATERSTOP
CJ-6 WITHOUT WATERSTOP

CJ-5/CJ-6, SAWCUT JOINT IN SLAB-ON-GROUND
NOT TO SCALE



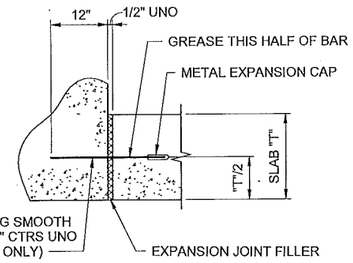
D = BOLT DIAMETER
K = THREADS (2D+2" SINGLE NUT)
THREADS (3D+2" DOUBLE NUTS)
P = BOLT PROJECTION

NOTES:
1. * NOT REQUIRED FOR MACHINE BOLTS.
2. CONTRACTOR HAS THE OPTION OF USING HEADED MACHINE BOLTS IN LIEU OF THREADED RODS.
3. FULLY THREADED RODS ARE NOT PERMITTED.
4. MACHINE BOLTS SHALL BE A307.

SCHEDULE

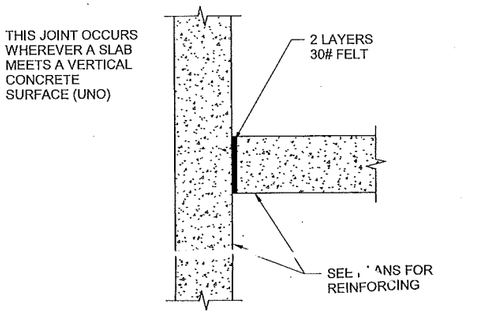
D	A*	E	REMARKS
3/8"	2"	6"	
1/2"	2"	7"	
5/8"	2"	10"	
3/4"	2"	1'-0"	
7/8"	3"	1'-2"	
1"	3"	1'-4"	

TYPE VII ANCHOR BOLTS
NOT TO SCALE

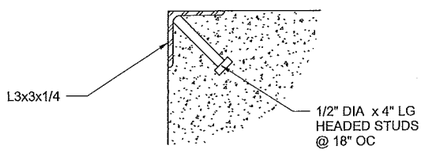


EJ-1 WITHOUT DOWEL
EJ-2 WITH DOWEL

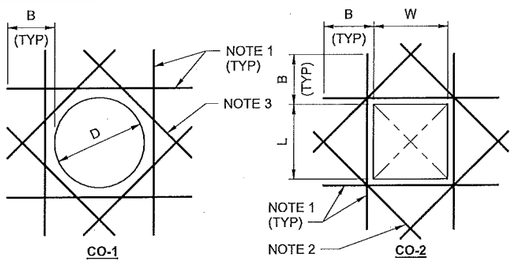
EJ-1/EJ-2, EXPANSION JOINT
NOT TO SCALE



IJ-1, ISOLATION JOINT
NOT TO SCALE



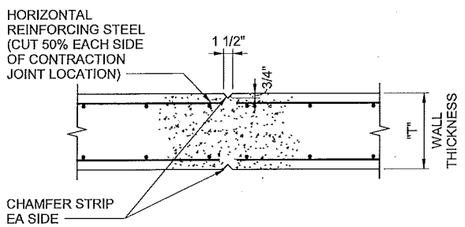
CE-3
NOT TO SCALE



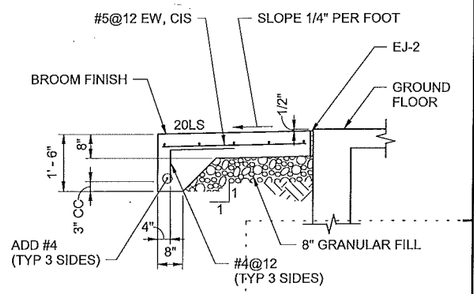
CO-1 **CO-2**

OPENING REINFORCING NOTES:
1. ADD BARS EQUAL TO THE TOTAL AREA OF REGULAR REINFORCING CUT BY THE OPENING EACH MAT. PLACE ONE HALF TOTAL AREA EACH SIDE OF OPENING EACH MAT.
2. (1) #5 BAR x 3'-0" EACH CORNER EACH MAT FOR CONCRETE THICKNESS < 18"; (1) #6 BAR x 4'-0" EACH CORNER EACH MAT FOR CONCRETE THICKNESS ≥ 18".
3. (4) #5 BARS x D + 12" @ 45° TO REGULAR REINFORCING EACH MAT FOR CONCRETE THICKNESS < 18"; (4) #6 BARS x D + 12" @ 45° TO REGULAR REINFORCING EACH MAT FOR CONCRETE THICKNESS ≥ 18"
4. B = TOP BAR LAP SPLICE
5. CENTER ALL BARS ON OPENING.
6. FOR OPENINGS (W, L, D) LESS THAN 12" NO ADD BARS REQUIRED IF NO REGULAR REINFORCING IS CUT BY THE OPENING, OTHERWISE SEE NOTE 1.
7. REINFORCE OPENINGS WITH W, L, OR D LARGER THAN 54" AS INDICATED ON THE DRAWINGS. IF NOT INDICATED CONTACT THE ENGINEER.

CO-1/CO-2
NOT TO SCALE



CTJ-5
NOT TO SCALE



TYPICAL DOOR STOOP DETAIL
NOT TO SCALE

no.	date	by	ckd	description
0	7/10/20	STD	KDT	ISSUED FOR BID

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9785 Maroon Circle, Suite 400
Centennial, CO 80112
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date: JULY 2020	detailed: N. ARYAN
designed: S. DALGLISH	checked: K. THURMAN

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

STANDARD CONCRETE DETAILS

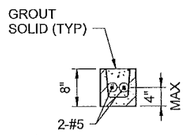
project	contract
118706	

drawing **S003** — rev. **0**

sheet of sheets
file

Professional Engineer KEVIN D. THURMAN PE 16429 Date 07/09/2020 WYOMING

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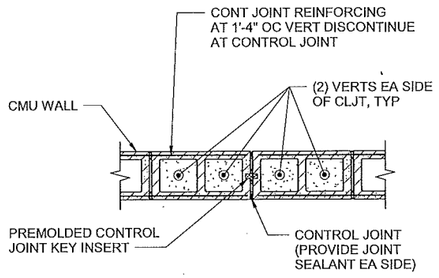


L1

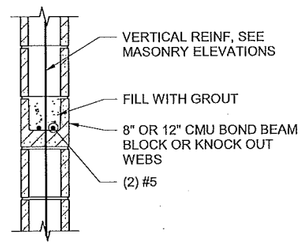
NOTES:

1. LINTELS SHALL EXTEND A MINIMUM OF 8" BEYOND EACH SIDE OF OPENING.
2. VERTICAL BARS ABOVE LINTELS SHALL BE EMBEDDED IN LINTELS WITH A STANDARD HOOK.

TYPICAL CMU LINTEL
NOT TO SCALE



TYPICAL CONTROL JOINT DETAIL
NOT TO SCALE



TYPICAL BOND BEAM
NOT TO SCALE

MASONRY NOTES

1. MATERIALS: CMU: LIGHT WEIGHT MASONRY WITH TYPE S MORTAR (f'm 2000psi) AND REINFORCING (Fy=60ksi)
2. ALL WALLS SHALL BE RUNNING BOND TYPE CONSTRUCTION.
3. ALL CMU CELLS WITH REINFORCING OR ANCHORS SHALL BE FILLED WITH GROUT.
4. ALL VERTICAL CMU WALL REINFORCING SHALL HAVE FULL CONTACT LAP SPLICES WITH DOWELS FROM FOUNDATION.
5. INSERTING DOWELS INTO FRESH OR PARTIALLY HARDENED CONCRETE OR GROUT IS PROHIBITED.
6. ALL CMU BOND BEAMS SHALL BE KNOCKOUT TYPE.
7. CMU IS DESIGNED FOR FULL STRESSES. SPECIAL INSPECTION IS REQUIRED PER IBC 2018.
8. VERTICAL CMU REINFORCEMENT SHALL BE CONTINUOUS THROUGH LINTELS AND SHALL EXTEND THE ENTIRE HEIGHT OF THE WALL.
9. BOND BEAMS LOCATED BELOW BEARING ELEVATIONS, ABOVE DECK, AND TOP OF WALLS ARE STRUCTURAL BOND BEAMS AND SHALL HAVE REINFORCEMENT CONTINUOUS THROUGH CONTROL JOINTS.
10. JOINT REINFORCING AND INTERMEDIATE BOND BEAM (THOSE NOT INCLUDED IN NOTE 9 ABOVE) REINFORCING SHALL BE DISCONTINUOUS AT CONTROL JOINTS.
11. FOR TYPICAL CONNECTION OF CMU TO CONCRETE AT THE BASE OF INTERIOR WALLS, SEE DETAIL THIS SHEET.
12. MASONRY/GROUT BEARING SUPPORT FOR STEEL JOISTS SHALL BE SMOOTH AND LEVEL TO PROVIDE FULL BEARING CONTACT BELOW STEEL BEAM.
13. REINFORCING LAP SPLICE LENGTHS (UNO):

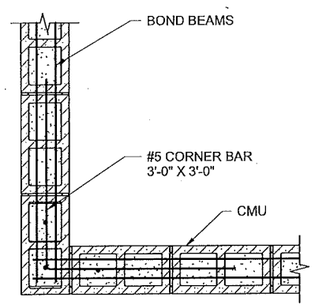
MASONRY REINFORCEMENT TABLE	
BAR SIZE	LAP SPLICES (IN)
3	18
4	24
5	30
6	36
7	42
8	48

INTERIOR AND EXTERIOR WALL REINFORCEMENT NOTES:

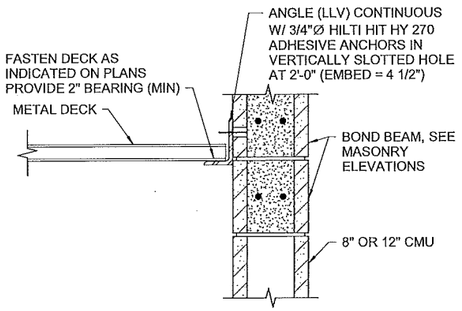
A. BOND BEAM:
   a. REINFORCING:
      • 2-#5
   b. LOCATION:
      • TOP OF WALL, FIRST COURSE ABOVE FOUNDATION, FIRST COURSE ABOVE AND BELOW ALL OPENINGS, AND 4'-0" OC MAX FOR HEIGHT OF WALL.
B. HORIZONTAL JOINTS:
   a. REINFORCING:
      • SINGLE PAIR OF 9 GAUGE SIDE RODS X 9 GAUGE CROSS RODS.
   b. TYPE:
      • LADDER TYPE
   c. LOCATION:
      • 16"OC AND AS SPECIFIED
C. CORNERS:
   a. REINFORCING:
      • 1-#5 CENTERED IN CELL
   b. LOCATION:
      • ONE BAR IN CORNER CELL AND ONE BAR IN THE TWO (2) ADJACENT CELLS, UNO.
D. CONTROL JOINTS:
   a. SPACING:
      • AS SHOWN ON ARCH ELEVATIONS
   b. REINFORCING:
      • 1 BAR TO MATCH ADJACENT WALL REINF CENTERED IN CELL.
   c. LOCATION:
      • FIRST TWO CELLS ON EACH SIDE OF CONTROL JOINT.
E. WALLS:
   a. REINFORCING:
      • 1-#5 CENTERED IN CELL
   b. LOCATION:
      • AT 48" OC MAX, UNO
F. OPENINGS:
   a. REINFORCING:
      • SEE OPENING REINFORCING DETAIL ON THIS SHEET

no.	date	by	ckd	description
0	7/10/20	STD	KDT	ISSUED FOR BID

NOTES:
SEE MASONRY NOTES FOR VERTICAL REINFORCEMENT

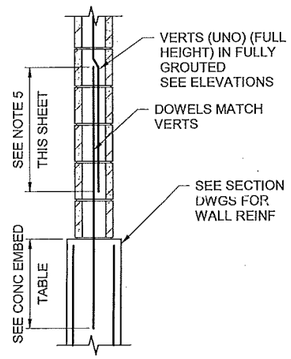


TYPICAL CMU BOND BEAM CORNER DETAIL
NOT TO SCALE

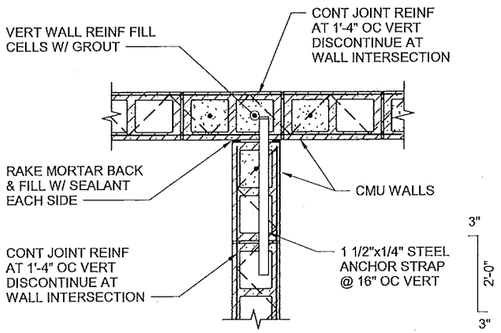


* SEE ROOF FRAMING PLAN FOR ANGLE SIZES

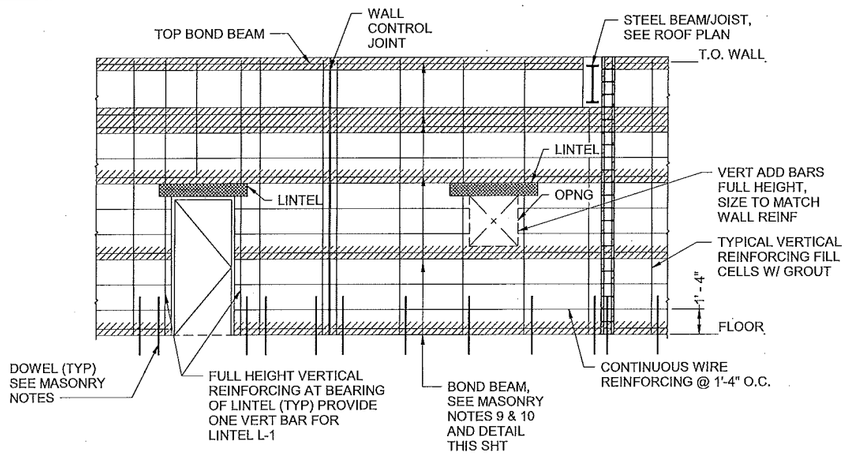
MASONRY - TYPICAL LEDGER ANGLE DETAIL
NOT TO SCALE



MASONRY - MS-2
NOT TO SCALE



TYPICAL CMU WALL INTERSECTION DETAIL
NOT TO SCALE



TYPICAL CMU WALL ELEVATION
NOT TO SCALE

BURNS McDONNELL
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STANDARD MASONRY DETAILS

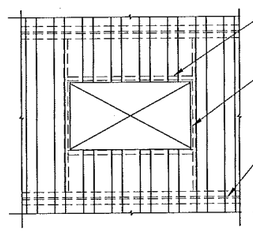
project	contract
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Professional Engineer
KEVIN D. THURMAN
PE 16429
Date 07/09/2020
WYOMING

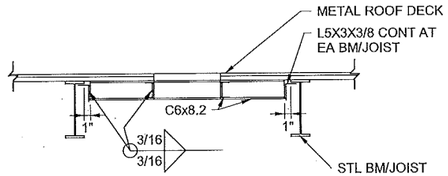
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OPENING GREATER THAN 24" AND UP TO 60", AND AT ROOF CURB LOCATIONS (FRAMED OPENING)

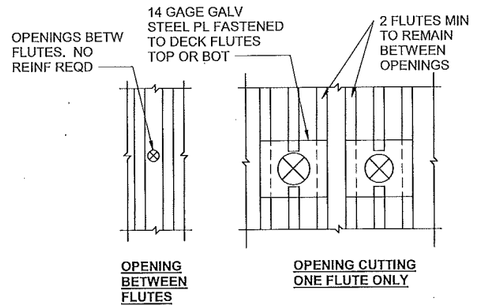
NOTES:

1. SEE ARCH, MECH, AND ELEC DWGS FOR LOCATIONS AND SIZES OF OPENINGS.
2. SEE PLANS FOR FRAMING AT OPENINGS GREATER THAN 5'-0" IN ANY DIRECTION.
3. CONTRACTOR SHALL COORDINATE DECK OPENING SIZES/LOCATIONS WITH OTHER DRAWINGS.



STANDARD OPENING SECTION

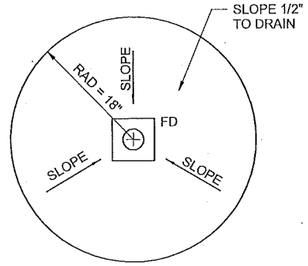
DECK - OPENING DETAILS
NOT TO SCALE



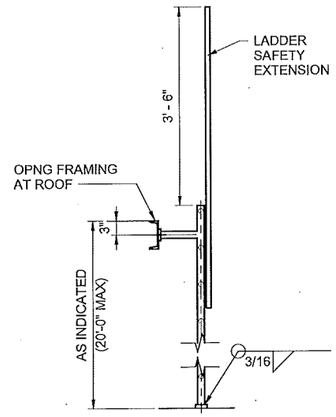
OPENING BETWEEN FLUTES

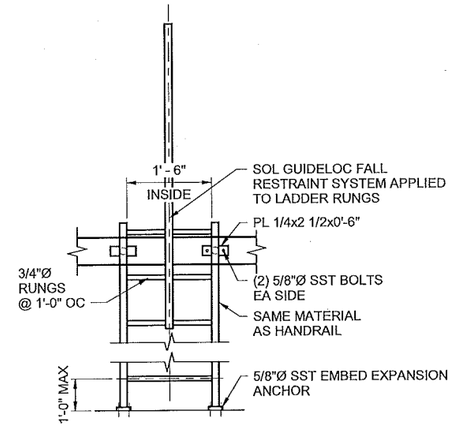
OPENING CUTTING ONE FLUTE ONLY

DECK - FLUTE OPENING DETAILS
NOT TO SCALE



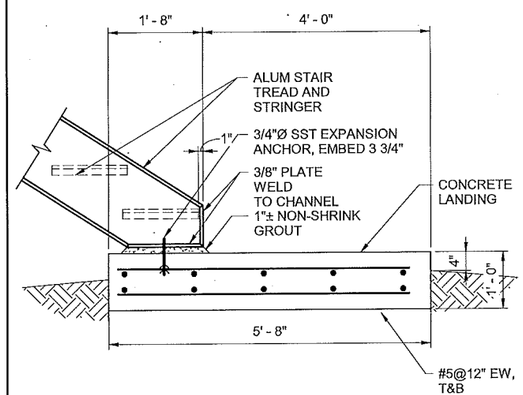
FD-1
NOT TO SCALE



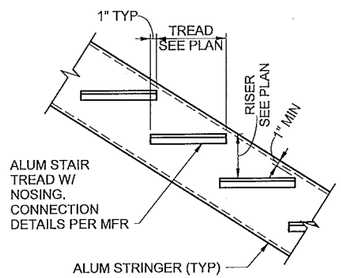


WITH LADDER SAFETY EXTENSION

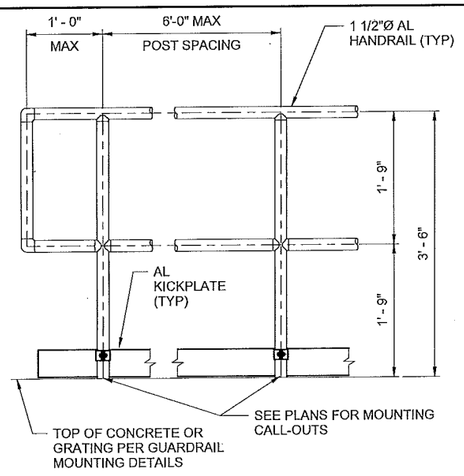
L-3B
NOT TO SCALE



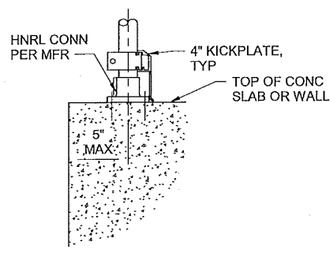
SR-1
NOT TO SCALE



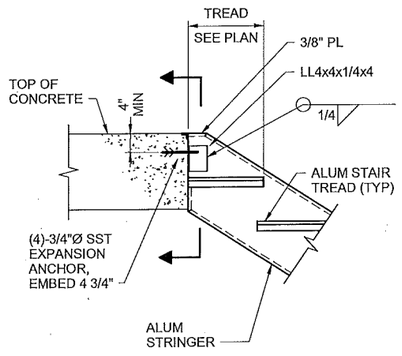
SR-11
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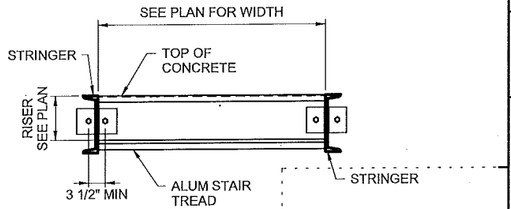


GR-1A
NOT TO SCALE



CE-18A
NOT TO SCALE





SECTION

SR-13
NOT TO SCALE

no.	date	by	ckd	description
0	7/10/20	STD	KDT	ISSUED FOR BID

BURNS McDONNELL
9785 Maroon Circle, Suite 400
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303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	**checked**
S. DALGLISH	K. THURMAN

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

MISCELLANEOUS STANDARD DETAILS

project	contract
118706	

drawing **S005** — rev. **0**

sheet of sheets

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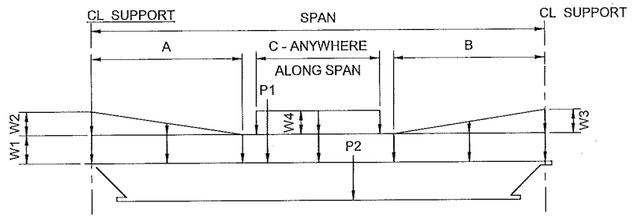
Professional Engineer KEVAN D. THURMAN PE 16429 Date 07/09/2020 WYOMING

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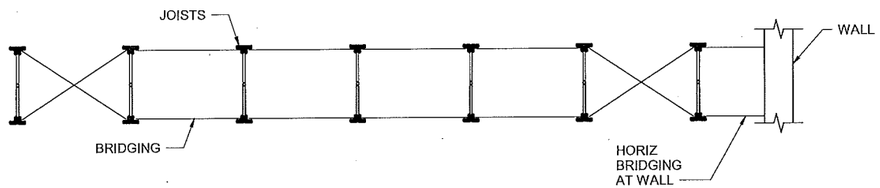
JOIST SCHEDULE														
		W1				SNOW DRIFT		W4 - LOAD TYPE (PSF)						
JOIST TYPE	SPAN (MAX)	DEAD LOAD (PSF)	LIVE LOAD (PSF)	COLLATERAL LOAD (PSF)	SNOW LOAD (PSF)	W2 SNOW LOAD (PSF)	W3 SNOW LOAD (PSF)		P1 (LB)	P2 (LB)	"A" (FT)	"B" (FT)	"C" (FT)	DOWNWARD W (+) (PSF)	NET UPLIFT (-) (PSF)
24K8	33'-4"	20	20	10	18.9	26.6	26.6	-	1000	100	6	6		16	30.8

JOIST SCHEDULE NOTES:

1. DEAD LOADS TABULATED DO NOT INCLUDE AN ALLOWANCE FOR JOIST SELF-WEIGHT.
2. DISTRIBUTED LOAD VALUES ARE PER UNIT AREA. CONTRACTOR SHALL DETERMINE TRIBUTARY WIDTH AND CORRESPONDING LOAD PER UNIT LENGTH FOR EACH JOIST SHOWN ON DRAWINGS AND SHALL DESIGN JOISTS ACCORDINGLY.
3. DESIGN JOISTS FOR "P1" AND "P2" CONCENTRATED LOADS AT ANY LOCATION ALONG THE CHORD. COORDINATE LOCATION OF MECHANICAL EQUIPMENT WITH MECHANICAL DRAWINGS.

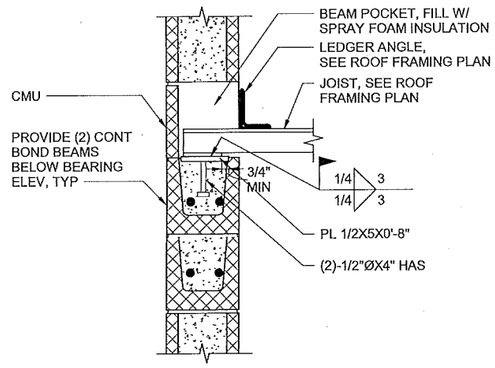


LOADING DIAGRAM FOR K SERIES JOISTS
NOT TO SCALE

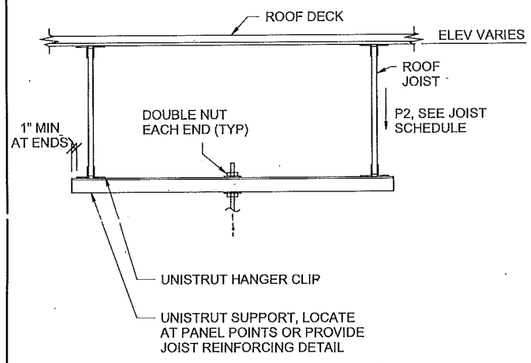


NOTE:
1. BRIDGING SHALL NOT BE WELDED TO WEB MEMBERS.
2. ATTACHMENT OR HANGING OF MECHANICAL, ELECTRICAL EQUIPMENT, ETC. IS NOT PERMITTED.
3. INSTALL ALL BRIDGING PER STEEL JOIST INSTITUTE SPECIFICATIONS.

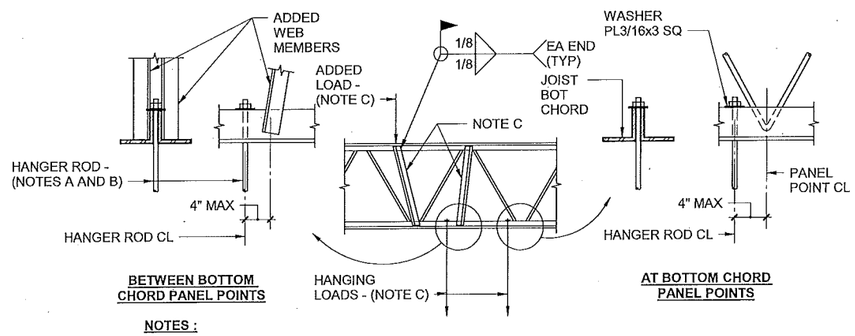
BRIDGING CONDITIONS
NOT TO SCALE



JOIST BEARING DETAIL
NOT TO SCALE



JOIST HANGER DETAIL
NOT TO SCALE



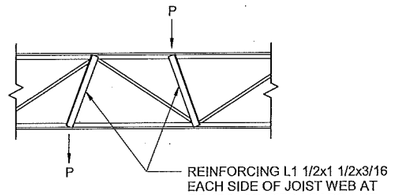
BETWEEN BOTTOM CHORD PANEL POINTS

AT BOTTOM CHORD PANEL POINTS

NOTES :

A. HANGER RODS - REFER TO ARCHITECTURAL, MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS.
B. POSITION HANGER RODS ON JOIST CENTERLINES BETWEEN BOTTOM CHORD JOIST MEMBERS. DO NOT USE C-CLAMPS TO CHORD ANGLE LEGS.
C. WHERE A SINGLE OR THE SUM OF MULTIPLE CONCENTRATED LOADS APPLIED BETWEEN PANEL POINTS EXCEEDS 100 LBS, SEE TYPICAL JOIST REINFORCING DETAIL.

SUPPORTING ARCH, MECH, ELEC OR FIRE PROTECTION EQUIPMENT
NOT TO SCALE



NOTE:
USE FOR LOADS FROM BRACING, PIPING, MECH DUCTS, MECH UNITS, ETC, WHEN "P" IS GREATER THAN 100 LBS

REINFORCING DETAIL
NOT TO SCALE

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9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	checked
S. DALGLISH	K. THURMAN

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

STANDARD JOIST DETAILS

project	contract
118706	

drawing S006 — rev. 0

sheet of sheets

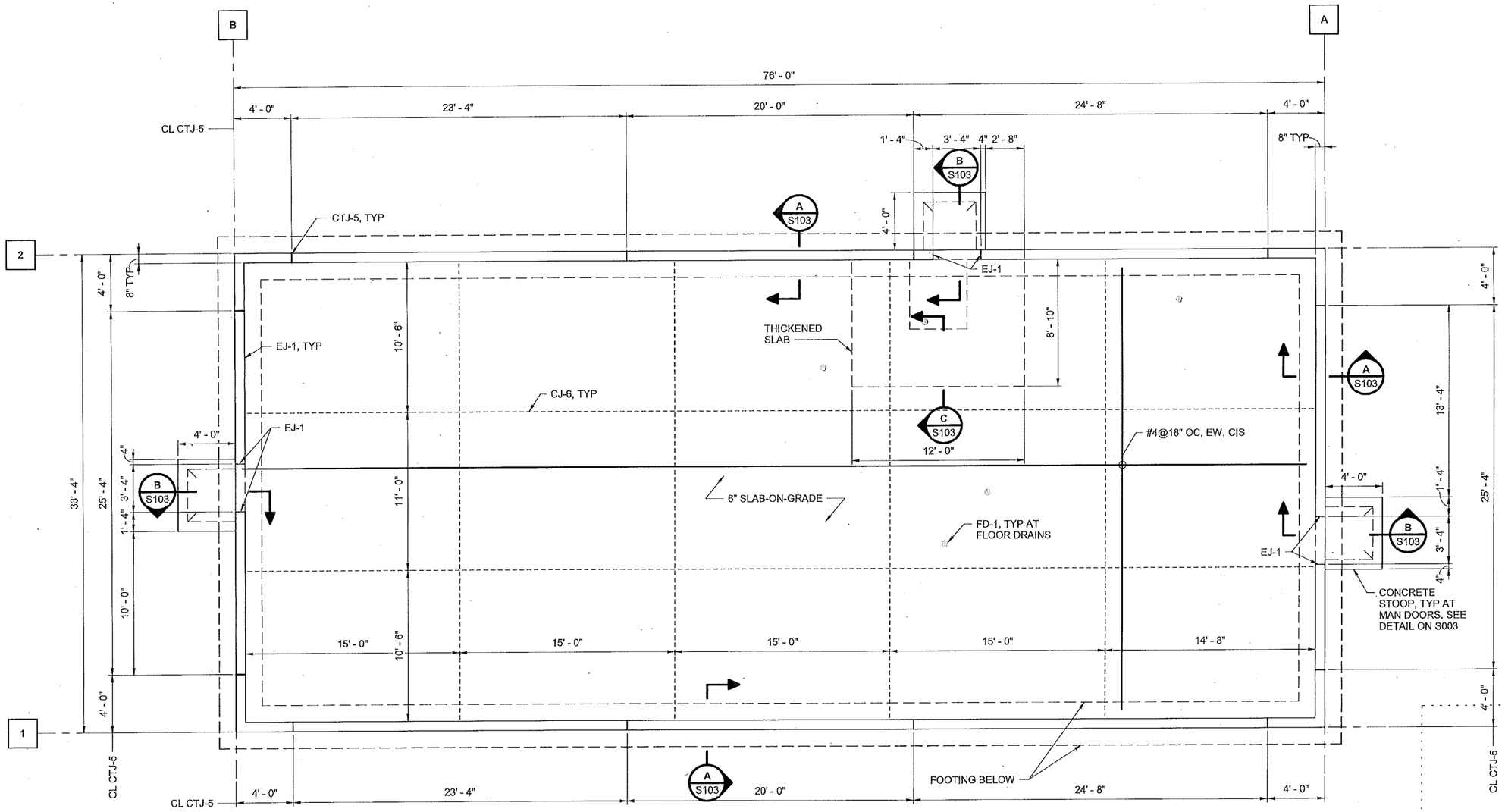
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Professional Engineer
KEVIN D. THURMAN
PE 16429
Date 07/09/2020
WYOMING

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NOTES:

1. SEE S001 AND S002 FOR ABBREVIATIONS, SPECIAL INSPECTION REQUIREMENTS, AND GENERAL STRUCTURAL NOTES.
2. SEE S003 FOR CONCRETE DETAILS.
3. SEE S004 FOR MASONRY DETAILS AND REINFORCEMENT REQUIREMENTS.



ADMINISTRATION BUILDING FOUNDATION PLAN

0 2' 4' 8'
SCALE IN FEET

NORTH

no.	date	by	ckd	description
0	7/10/20	STD	KDT	ISSUED FOR BID

N

ADMIN BLDG

SCALE BLDG

KEY PLAN

BURNS McDONNELL

9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	checked
S. DALGLISH	K. THURMAN

CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING FOUNDATION PLAN

project	contract
118706	
drawing	rev.
S101	0
sheet	of sheets
file	

Professional Engineer
KEVIN D. THURMAN
PE 16429
Date 07/09/2020
WYOMING

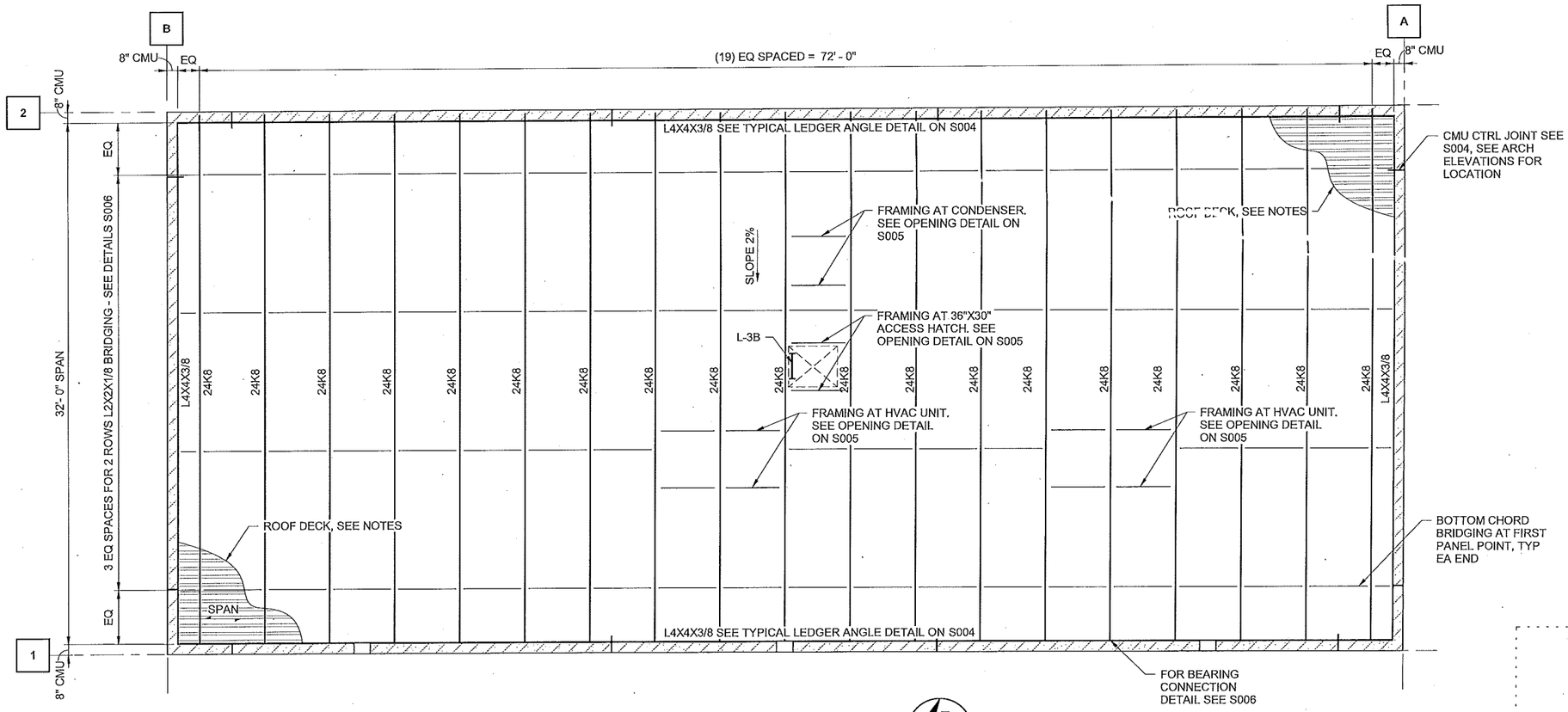
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NOTES:

1. SEE S001 AND S002 FOR ABBREVIATIONS, SPECIAL INSPECTION REQUIREMENTS, AND GENERAL STRUCTURAL NOTES.
2. SEE S006 FOR JOIST LOADING INFORMATION.
3. SEE TYPICAL DECK OPENING DETAIL ON S008. COORDINATE OPENING SIZE WITH RTU SUBMITTAL.
4. SEE ARCHITECTURAL DRAWINGS FOR MASONRY TOP-OF-WALL AND JOIST BEARING ELEVATIONS.

METAL DECK NOTES:

- STYLE: 1.5B
  - PROFILE DEPTH: 1.5"
- MINIMUM UNCOATED THICKNESS: 22ga
- FASTENERS:
  - PRIMARY: 5/8" PUDDLE WELDS 36/4 PATTERN
  - SIDELAP: (4) #10 TEK SCREWS
  - SHEAR CAPACITY = 555 LB/FT (ASD)

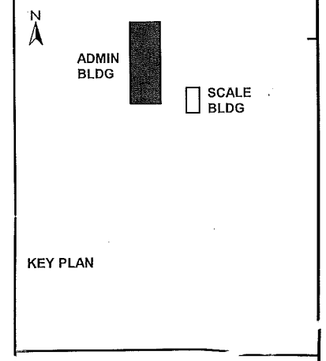


ROOF FRAMING PLAN

0 2' 4' 8'
SCALE IN FEET

NORTH

no.	date	by	ckd	description
0	7/10/20	STD	KDT	ISSUED FOR BID



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FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING ROOF PLAN

project	contract
118706	

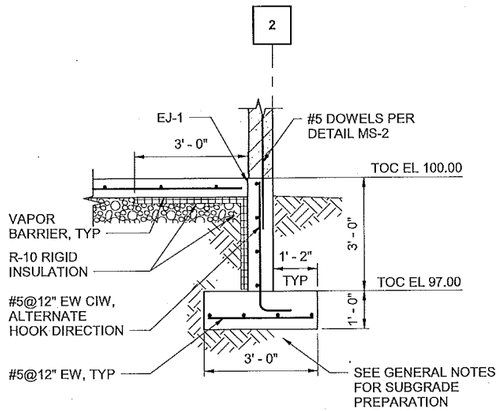
drawing **S102** — rev. **0**

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KEVIN D. THURMAN
PE 16429
Date 07/09/2020
WYOMING

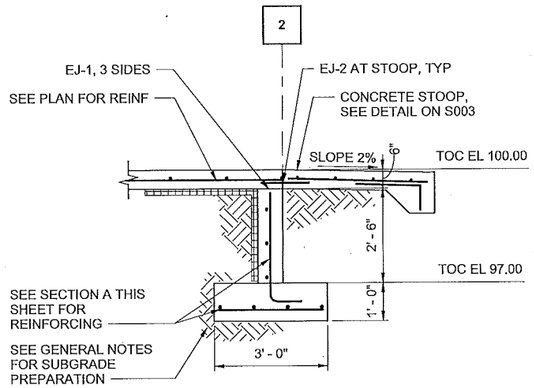
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SECTION A S101

0 1' 2' 4'

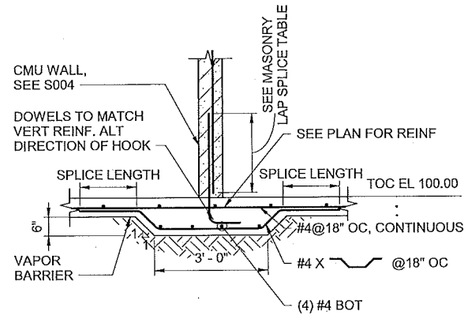
SCALE IN FEET



SECTION B S101

0 1' 2' 4'

SCALE IN FEET



SECTION C S101

0 1' 2' 4'

SCALE IN FEET

no.	date	by	ckd	description
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CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING FOUNDATION SECTIONS AND DETAILS

project	contract
118706	

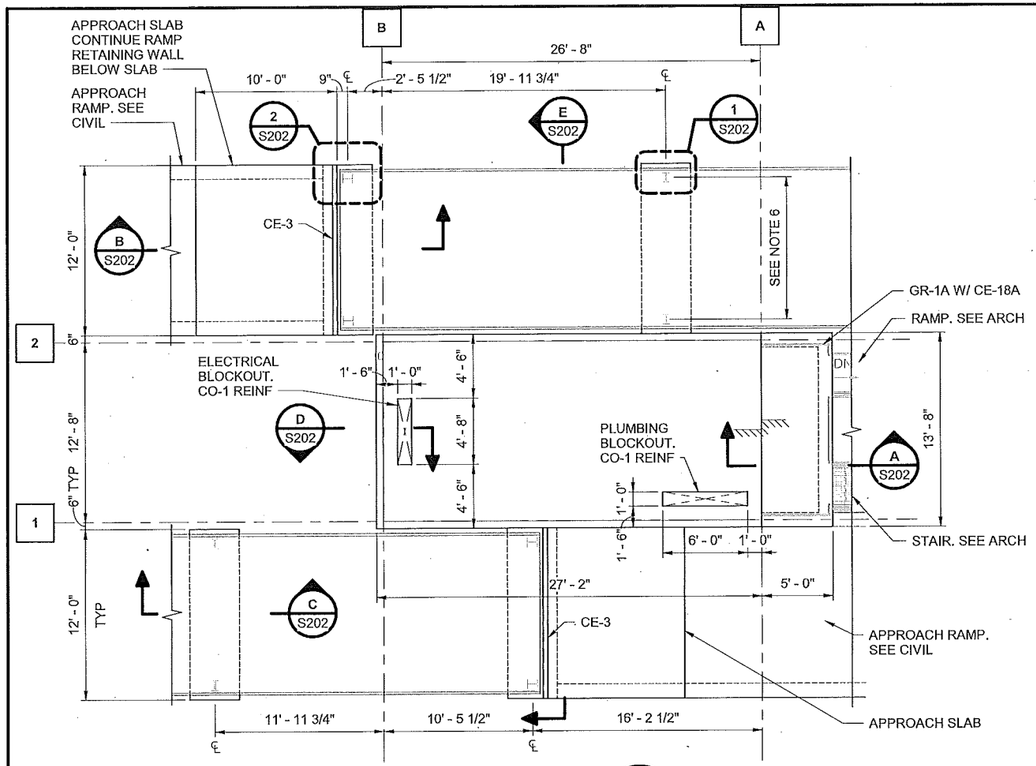
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KEVIN D. THURMAN
PE 16429
Date 07/09/2020
WYOMING

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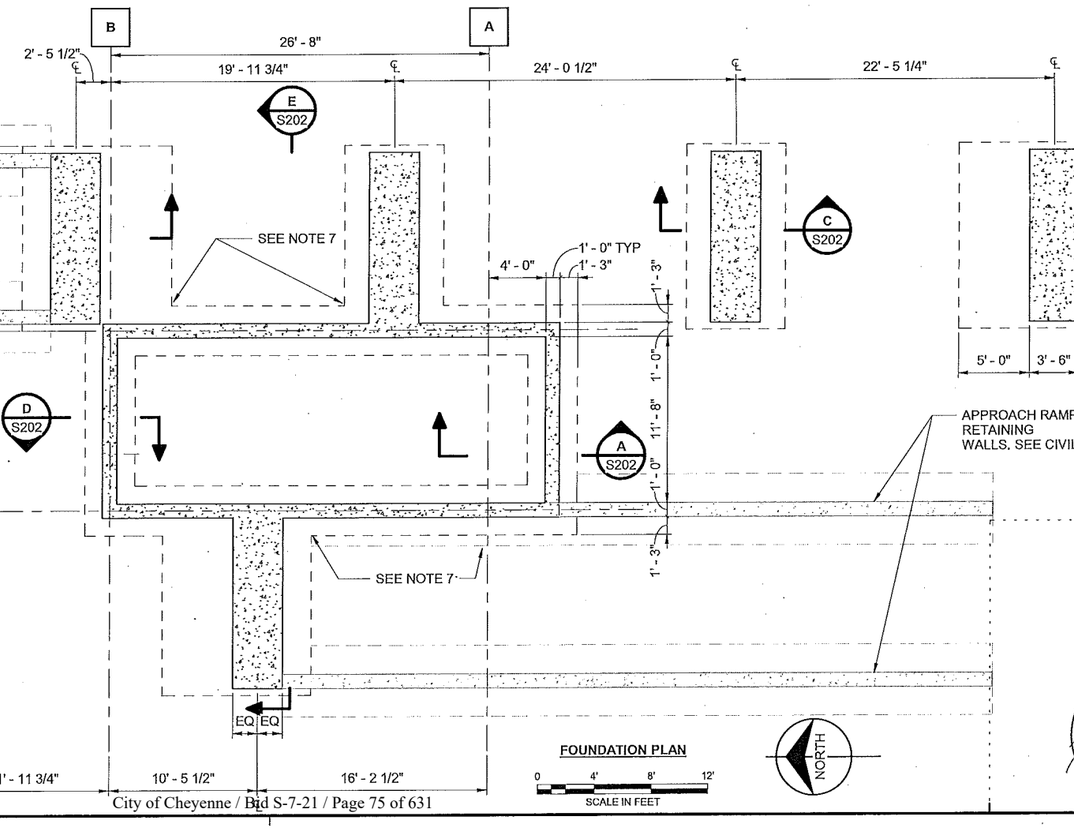


TOP SLAB PLAN

0 4' 8' 12'

SCALE IN FEET

NORTH



FOUNDATION PLAN

0 4' 8' 12'

SCALE IN FEET

NORTH

NOTES:

1. SEE S001 AND S002 FOR ABBREVIATIONS, SPECIAL INSPECTIONS AND GENERAL STRUCTURAL NOTES.
2. SEE S003 FOR TYPICAL CONCRETE DETAILS.
3. SEE CIVIL DRAWINGS FOR LOCATION OF SCALE HOUSE BUILDING AND SCALES.
4. SCALE FOOTING ARRANGEMENT SHOWN IS FOR EXISTING CARDINAL 70'X11', 100TON, 60 TON CLC SCALES TO BE RELOCATED. USE OF OTHER SCALES IS NOT PERMITTED WITHOUT APPROVAL OF THE ENGINEER.
5. CONTRACTOR SHALL CONSULT A LOCAL CARDINAL SCALES REPRESENTATIVE FOR BUMPER INSTALLATION REQUIREMENTS.
6. EXISTING LOAD CELL ANCHOR LOCATIONS SHALL BE DETERMINED BY THE CONTRACTOR IN THE FIELD. LOCATE AND INSTALL NEW ANCHORS PER FIELD MEASURED DIMENSIONS.
7. SCALE FOOTINGS MAY BE POURED MONOLITHICALLY WITH SCALE HOUSE FOOTINGS WHERE THE TWO INTERSECT. ALL REINFORCING SHALL BE PROVIDED AS INDICATED ON DRAWINGS.

no.	date	by	ckd	description
0	7/10/20	KDT	JJZ	ISSUED FOR BID

N

ADMIN BLDG

SCALE BLDG

KEY PLAN

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9785 Maroon Circle, Suite 400
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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

SCALE HOUSE BUILDING FOUNDATION PLAN

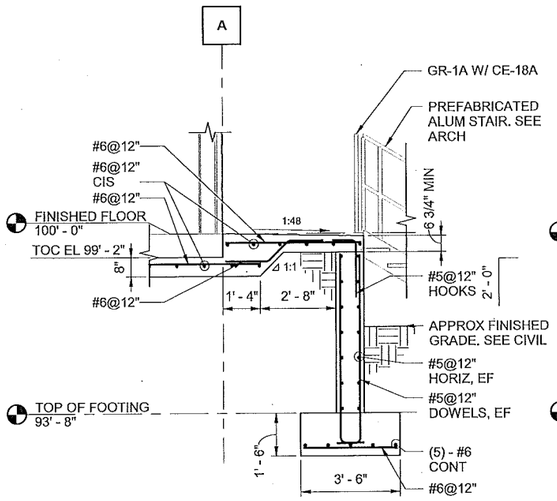
project	contract
118706	
drawing	rev.
S201	0
sheet	of sheets
file	

Professional Engineer KEVIN D. THURMAN PE 16429 Date 07/09/2020 WYOMING

7/9/2020 5:07:54 PM

NOTES:
1. SEE S003 FOR TYPICAL CONCRETE DETAILS.
2. SEE S005 FOR RAILING DETAILS.
3. CONTRACTOR SHALL CONSULT A LOCAL CARDINAL SCALES REPRESENTATIVE FOR BUMPER INSTALLATION REQUIREMENTS.

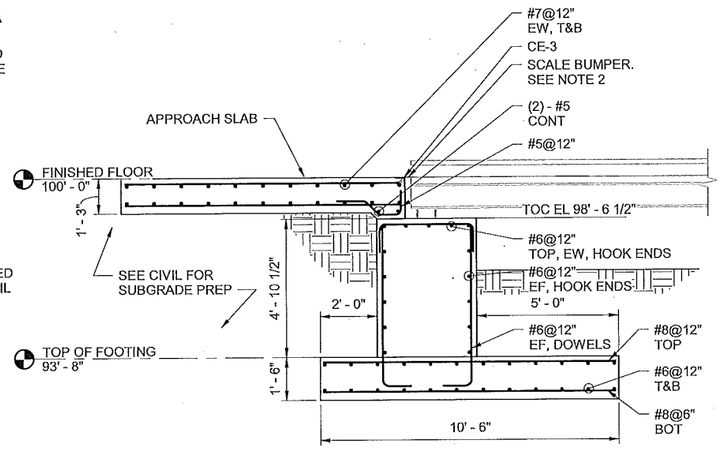
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STOOP SECTION A S201

0 2' 4' 6'

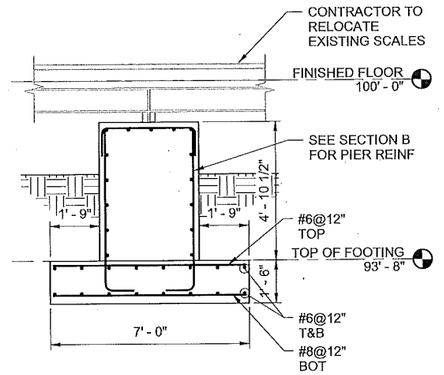
SCALE IN FEET



ABUTMENT SECTION B S201

0 2' 4' 6'

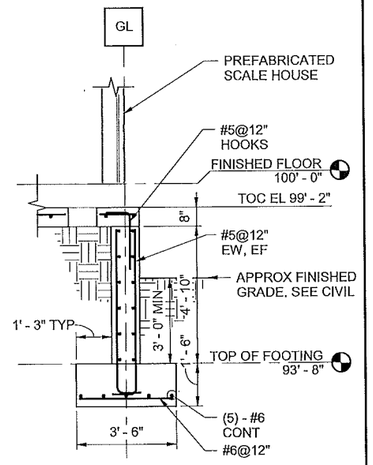
SCALE IN FEET



PIER SECTION C S201

0 2' 4' 6'

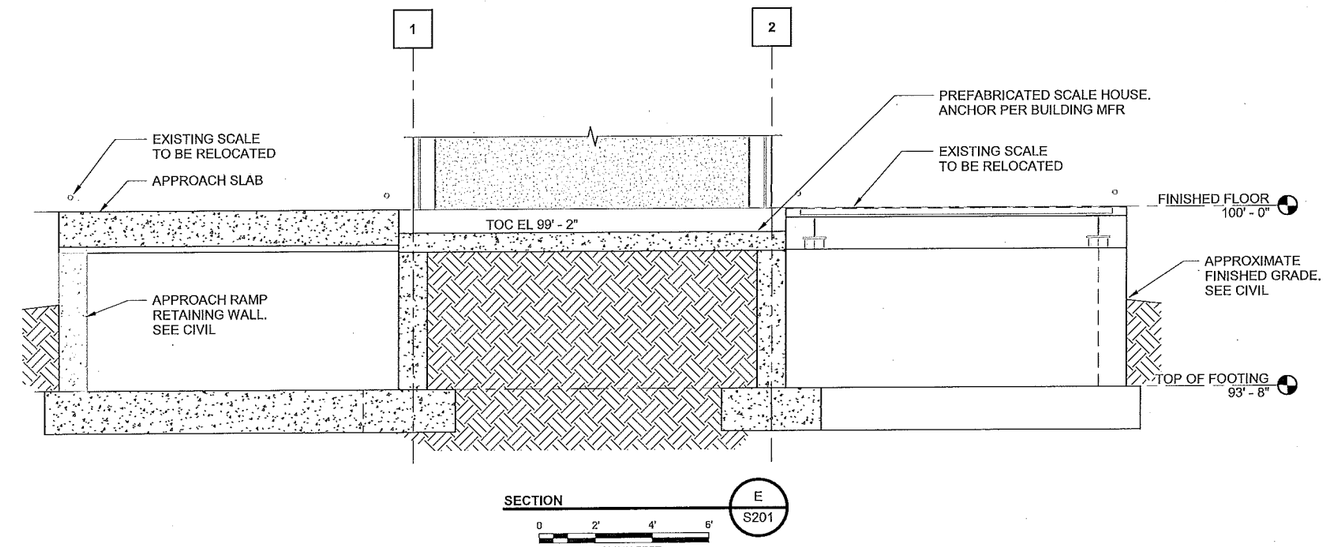
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WALL FOOTING SECTION D S201

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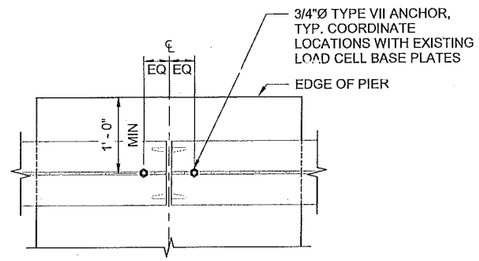
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SECTION E S201

0 2' 4' 6'

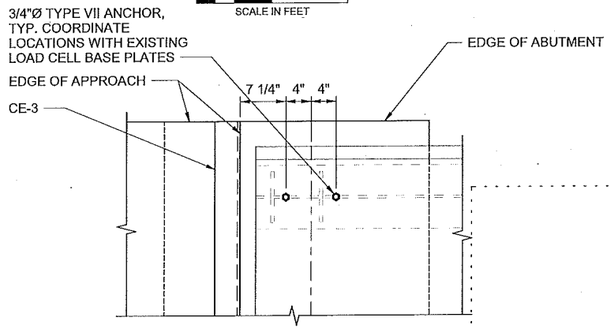
SCALE IN FEET



PIER LOAD CELL ANCHORS 1 S201

0 1/2' 1' 2'

SCALE IN FEET



ABUTMENT LOAD CELL ANCHORS 2 S201

0 1/2' 1' 2'

SCALE IN FEET

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

SCALE HOUSE FOUNDATION SECTIONS AND DETAILS

project	contract
118706	

drawing **S202** — rev. **0**

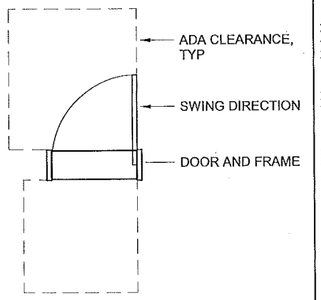
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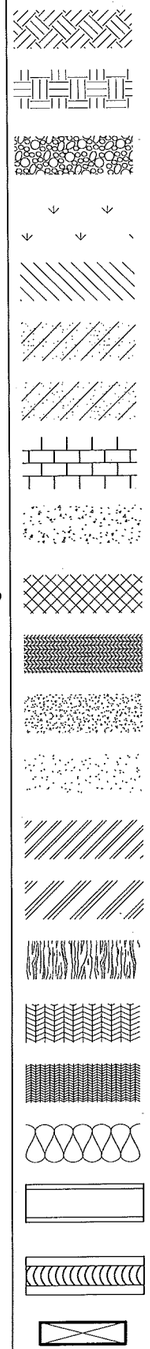
Professional Engineer KEVIN D. THURMAN PE 16429 Date 07/09/2020 WYOMING

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PLAN LEGEND



MATERIAL SYMBOLS



ABBREVIATIONS

	-A-
A/E	ARCHITECT/ENGINEER
ACOUST	ACOUSTICAL
ADJ	ADJACENT, ADJUSTABLE
AFF	ABOVE FINISH FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
ALT	ALTERNATE
ALUM	ALUMINUM
APPROX	APPROXIMATE
ARCH	ARCHITECTURE, ARCHITECT
	-B-
BD	BOARD
BITUM	BITUMINOUS
BLDG	BUILDING
BLKG	BLOCKING
BO	BOTTOM OF, AS IN "BO STEEL"
BTWN	BETWEEN
	-C-
CAB	CABINET
CCTV	CLOSED CIRCUIT TELEVISION
CID	COMPREHENSIVE INTERIOR DESIGN
CJ	CONTROL JOINT, CONSTRUCTION JOINT
CL	CENTER LINE
CLG	CEILING
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
COMM	COMMUNICATION
CONC	CONCRETE
CONSTR	CONSTRUCTION
CONT	CONTINUOUS
CONTR	CONTRACT, CONTRACTOR
COORD	COORDINATE
CORR	CORRUGATED OR CORRIDOR
CU	CUBIC
°C	CELSIUS
	-D-
DBL	DOUBLE
DEMO	DEMOLITION
DESCR	DESCRIPTION
DET	DETAIL
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DN	DOWN
DR	DOOR
DS	DOWNSPOUT
DWG	DRAWING
	-E-
E	EAST
EA	EACH
EEW	EMERGENCY EYEWASH
EEWS	EMERGENCY EYEWASH & SHOWER
EF	EXHAUST FAN
EJ	EXPANSION JOINT
EL	ELEVATION, AS IN HEIGHT
ELAST	ELASTOMERIC
ELEC	ELECTRIC / ELECTRICAL
ELEV	ELEVATOR, OR ELEVATION AS IN NORTH ELEV
EQ	EQUAL
EQUIP	EQUIPMENT
ETC	AND SO FORTH (ETCETERA)
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EXH	EXHAUST
EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERIOR
	-F-
FD	FLOOR DRAIN
FDN	FOUNDATION
FE	FIRE EXTINGUISHER WITH WALL BRACKET
FEC	FIRE EXTINGUISHER CABINET
FF	FINISH FLOOR
FF&E	FURNITURE, FIXTURES & EQUIPMENT
FHC	FIRE HOSE CABINET (WITH EXTINGUISHER & BRACKET)
FHR	FIRE HOSE REEL (WITH EXTINGUISHER & BRACKET)
FIN	FINISHED, FINISH
FLR	FLOOR
FT	FEET / FOOT
FV	FIELD VERIFY
°F	FAHRENHEIT
	-G-
GA	GAUGE
GALV	GALVANIZED
GL	GIRT LINE
GRTG	GRATING
GYP	GYPSUM
GYP BD	GYPSUM BOARD
	-H-
H	HIGH
HD	HAND
HDWR	HARDWARE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HT	HEIGHT
HVAC	HEATING, VENTILATION & AIR CONDITIONING
	-I-
ID	INSIDE DIAMETER
IN	INCH
INSUL	INSULATION
INT	INTERIOR
	-J-
JAN	JANITOR'S CLOSET
	-L-
L	LEFT, LONG, LENGTH
LAB	LABORATORY
LAT	LATITUDE
LAV	LAVATORY
LB or #	POUND
LH	LEFT HAND
LONG	LONGITUDE
LVR	LOUVER
	-M-
M	METER
MACH	MACHINE
MAINT	MAINTENANCE
MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MECH	MECHANICAL
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MOVEMENT JOINT
MM	MILLIMETER
MO	MASONRY OPENING
MTD	MOUNTED
MTL	METAL
	-N-
N	NORTH
N/A	NOT APPLICABLE
NIC	NOT IN CONTRACT
NO	NUMBER
NOM	NOMINAL
NTP	NOTICE TO PROCEED
NTS	NOT TO SCALE
	-O-
OC	ON CENTER
OD	OUTSIDE DIAMETER
OFF	OFFICE
OPNG	OPENING
OPP	OPPOSITE
	-P-
PA	PUBLIC ADDRESS
PEMB	PRE ENGINEERED METAL BUILDING
PERIM	PERIMETER
PKG	PACKAGE
PL	PLATE
PLMB	PLUMBING
PLYWD	PLYWOOD
PROJ	PROJECT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
	-R-
R	RADIUS
R/A	RETURN AIR
RCP	REFLECTIVE CEILING PLAN
RD	ROOF DRAIN
RECP	RECEPTACLE
REFER	REFERENCE
REINF	REINFORCED
REQ'D	REQUIRED
REV	REVISION
RH	RIGHT HAND
RO	ROUGH OPENING
	-S-
S	SOUTH
S/A	SUPPLY AIR
SCHED	SCHEDULE
SECT	SECTION
SF	SQUARE FOOT
SID	STRUCTURAL INTERIOR DESIGN
SIM	SIMILAR
SPEC	SPECIFICATION
SQ	SQUARE, AS IN "SQ FT"
STC	SOUND TRANSMISSION COEFFICIENT
STD	STANDARD
STOR	STORAGE
STRUCT	STRUCTURAL
SUPP	SUPPORT
SUSP	SUSPENDED
SYS	SYSTEM
	-T-
TD	TRENCH DRAIN
TECH	TECHNICAL
THRU	THROUGH
TLT	TOILET
TO	TOP OF, AS IN "TO STEEL"
TYP	TYPICAL
	-U-
UL	UNDERWRITERS LABORATORY
UNO	UNLESS NOTED OTHERWISE
UTIL	UTILITY
	-V-
VENT	VENTILATE, VENTILATOR
VERT	VERTICAL
VOL	VOLUME
	-W-
W	WEST, WIDTH
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WD	WOOD
WH	WATER HEATER
WT	WEIGHT

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9785 Maroon Circle, Suite 400
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date	detailed
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designed	checked
K. THURMAN	R. LANG

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ABBREVIATIONS/LEGEND/SYMBOLS

project	contract
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A001 —	0

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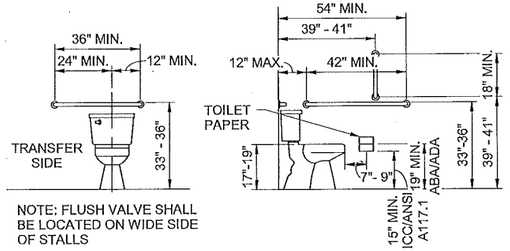
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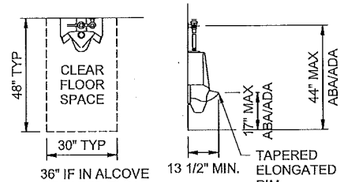
GENERAL NOTES

1. ALL WORK SHALL COMPLY WITH ALL APPLICABLE CODES AND STANDARDS AS LISTED OR REFERENCED ON LIFE SAFETY PLAN AND LIFE SAFETY CRITERIA.
2. DIMENSIONS SHALL GOVERN. DETAILS SHALL GOVERN OVER PLANS AND ELEVATIONS. LARGE SCALE DETAILS OR PLANS SHALL GOVERN OVER SMALL SCALE DETAILS OR PLANS. DO NOT SCALE DRAWINGS.
3. THE GENERAL CONTRACTOR SHALL PROVIDE AND INSTALL ALL EXIT SIGNS, EMERGENCY LIGHTING SYSTEMS, ALARM SYSTEMS AND AUTOMATIC SPRINKLER SYSTEMS AS REQUIRED BY APPLICABLE CODES AND STANDARDS.
4. ALL FLOORS SHALL BE INSPECTED FOR DAMAGE, WARPING OR OTHER NOTICEABLE DEVIATIONS AND PATCHED AND LEVELED PRIOR TO COVERING WITH FLOOR FINISHES.
5. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL MANUFACTURER'S RECOMMENDED MAINTENANCE PROCEDURES AND SCHEDULES.
6. ANY MANUFACTURER'S OR BRAND NAME PRODUCTS INDICATED OR SPECIFIED ARE DONE SO TO ESTABLISH A MINIMUM LEVEL OF QUALITY.
7. ALL CONSTRUCTION SHALL MEET OR EXCEED LOCAL INDUSTRY STANDARDS. DETAILS ARE PROVIDED TO INDICATE MINIMUM QUALITY AND TO GIVE STANDARDS OF CONSTRUCTION. IF A CONDITION IS NOT SPECIFICALLY DETAILED, SUBMIT A SIMILAR DETAIL FOR GUIDE AND APPROVAL.
8. THE LETTERS I, O, AND Q ARE NOT USED TO INDICATE DETAILS, SECTIONS OR ELEVATIONS.
9. PROVIDE PRESERVATIVE-TREATED WOOD AT ALL LOCATIONS WHERE WOOD IS IN DIRECT CONTACT WITH CONCRETE OR MASONRY.
10. PROVIDE 3/4" FIRE-RETARDANT TREATED PLYWOOD BACKING AT ALL ELECTRICAL, PHONE, AND SECURITY SYSTEM PANELS.
11. PROVIDE FIRE-RESISTANT TREATED WOOD BLOCKING FOR SECURE ANCHORAGE OF ALL SHELVES, RUNNING TRIM, RAILINGS, SUSPENDED ITEMS, DOOR-STOPS, GRAB-BARS, AND OTHER SIMILAR WOODWORK, HARDWARE, SPECIALTIES, ACCESSORIES, FIXTURES, OR EQUIPMENT.
12. PROVIDE CEMENT BOARD SHEATHING AT ALL AREAS WHERE A TILE SURFACE IS TO BE INSTALLED ON METAL STUD WALL.
13. PROVIDE WATER-RESISTANT GYPSUM BOARD AT ALL WET OR UNCONDITIONED AREAS INCLUDING, BUT NOT LIMITED TO BATHROOMS AND MOP SINKS.
14. PAINT, STAIN, OR COAT ALL EXPOSED SURFACES OF CONSTRUCTION UNLESS NOTED OTHERWISE OR IF SURFACES ARE PRE-FINISHED.
15. ALL OPENING DIMENSIONS ARE NOMINAL. THE CONTRACTOR SHALL FIELD MEASURE ALL OPENINGS AND COORDINATE WITH THE APPROPRIATE SUPPLIER FOR ALL DOORS AND WINDOWS.
16. ALL CONDUITS, PLUMBING, PIPING, DUCTWORK, AND OTHER EQUIPMENT EXPOSED TO VIEW SHALL BE LOCATED PARALLEL OR PERPENDICULAR TO THE STRUCTURAL FRAMING SYSTEM.
17. PROVIDE GALVANIC PROTECTION BETWEEN DISSIMILAR MATERIALS, WHERE REQUIRED.
18. CERAMIC TILE TO BE INSTALLED 4'-0" ABOVE FINISH FLOOR AND 1'-0" TO EITHER SIDE AT MOP SINK.
19. ARCHITECTURAL DETAILS ARE APPLICABLE WHERE INDICATED BY SECTION CUT, BY NOTE, OR BY DETAIL TITLE. PROVIDE SIMILAR DETAILS AT SIMILAR CONDITIONS UNLESS NOTED OTHERWISE. THE CONTRACTOR MAY REQUEST A CLARIFICATION IF REQUIRED, OTHERWISE THE MORE STRINGENT REQUIREMENTS SHALL CONTROL.
20. PROVIDE FIRE-STOPPING SYSTEMS AT TOP OF AND AT ALL PENETRATIONS THROUGH FIRE-RATED PARTITIONS.
21. SEAL ALL EXTERIOR BUILDING JOINTS AT BOTH THE EXTERIOR AND INTERIOR SURFACES AGAINST MOISTURE AND AIR INFILTRATION.
22. SEAL AROUND ALL DOOR AND WINDOW FRAMES, COUNTERTOPS, WALL-MOUNTED FIXTURES AND EQUIPMENT TO ADJACENT WALL SURFACES.
23. THE CONTRACTOR SHALL REVIEW THE DIMENSIONS OF ALL EQUIPMENT IN THE PROJECT REGARDLESS OF THE SOURCE AND COORDINATE ACCESS TO THE SPACE AND VERIFY CLEAR FLOOR SPACE IS PROVIDED AS REQUIRED TO ENSURE EASE OF INSTALLATION.
24. ALL WORK MUST BE OF GOOD QUALITY, FREE FROM DEFECTS, AND IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONSTRUCTION DOCUMENTS.
25. THE CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF ALL PENETRATIONS IN THE STRUCTURE FOR THE PROPER INSTALLATION OF THE WORK. REFER TO STRUCTURAL DRAWING FOR SECONDARY FRAMING AND OR REINFORCING REQUIRED AT PENETRATIONS IN STEEL, CONCRETE OR MASONRY.
26. THE CONTRACTOR SHALL PROVIDE ACCESS DOORS OR PANELS AS REQUIRED FOR SERVICING OF PIPING, DUCTWORK, CABLE TRAYS, FIRE DAMPERS AND SIMILAR APPLICATIONS. ALL PROPOSED ACCESS DOOR LOCATIONS TO BE SUBMITTED FOR APPROVAL PRIOR TO INSTALLATION.
27. PROVIDE ALL HVAC, PLUMBING, GAS OR ELECTRIC SERVICE CONNECTIONS TO CASEWORK, FIXTURES, SIGNAGE, OR EQUIPMENT INDICATED (WHETHER UNITS ARE INSTALLED BY CONTRACTOR OR BY OTHERS).
28. BRACE PARTITIONS, SUSPENDED CEILINGS, SOFFITS, SUSPENDED ITEMS, ETC. ONLY TO STRUCTURAL ELEMENTS ABOVE. DO NOT ANCHOR TO ROOF DECK, PLUMBING / SPRINKLER PIPES, DUCTWORK, ELECTRICAL CONDUIT OR SIMILAR ELEMENTS.
29. EXTEND ALL FLOORING AND WALL-BASE COMPLETELY INTO RECESSES, UNDER OPEN COUNTERTOPS, AND BEHIND ALL EQUIPMENT.
30. ALL BUILDING SYSTEMS AND COMPONENTS SHOULD BE REVIEWED AGAINST LOCAL CLI MATE, LOCAL BUILDING CODE, AND ANY SPECIAL REQUIREMENTS.
31. THE CONTRACTOR SHALL BECOME FULLY ACQUAINTED WITH CONDITIONS RELATED TO THE WORK. ANY DISCREPANCIES BETWEEN THE DRAWINGS AND THE ACTUAL CONDITIONS SHALL BE REPORTED TO THE DESIGN PROFESSIONALS FOR RESOLUTION PRIOR TO PROCEEDING WITH THE WORK.
32. DRAWINGS CONTAINED IN THIS SET SHALL NOT BE REPRODUCED FOR SHOP DRAWINGS. COPIES OF THESE DRAWINGS SUBMITTED AS SHOP DRAWINGS WILL BE REJECTED AND RETURNED TO THE CONTRACTOR.
33. EACH INSTALLER MUST EXAMINE SUBSTRATE AND/OR CONDITIONS UNDER WHICH THE WORK WILL BE INSTALLED AND REPORT OT THE CONTRACTOR IN WRITING ANY CONDITIONS DETRIMENTAL TO THE PROPER AND TIMELY EXECUTION OF THE INSTALLERS WORK. DO NOT PROCEED UNTIL UNSATISFACTORY CONDITIONS ARE CORRECTED. INSTALLATION SHALL CONSTITUTE ACCEPTANCE OF THE SUBSTRATE AND/OR CONDITIONS.
34. "TYPICAL" AS USED IN THESE DOCUMENTS SHALL MEAN THAT THE CONDITIONS OR DIMENSION IS THE SAME OR REPRESENTATIVE FOR SIMILAR CONDITIONS THROUGHOUT.
35. CONTROL JOINTS (CJ) SHALL BE INSTALLED AT ALL PARTITIONS. CJ AT GYPSUM PARTITIONS SHALL BE MAXIMUM 30'-0" OC. CJ AT CONCRETE MASONRY UNIT PARTITIONS SHALL BE MAXIMUM 20'-0" OC. UNLESS OTHERWISE NOTED ON DRAWINGS REFER TO ELEVATION DRAWINGS FOR EXTERIOR CONTROL JOINT LOCATIONS. REVIEW CJ LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.
36. NON-BEARING PARTITIONS SHALL BE ISOLATED FROM THE BUILDING STRUCTURE TO PREVENT TRANSFER OF BUILDING LOADS FROM THE STRUCTURE TO THE PARTITIONS.

ADA INFORMATION



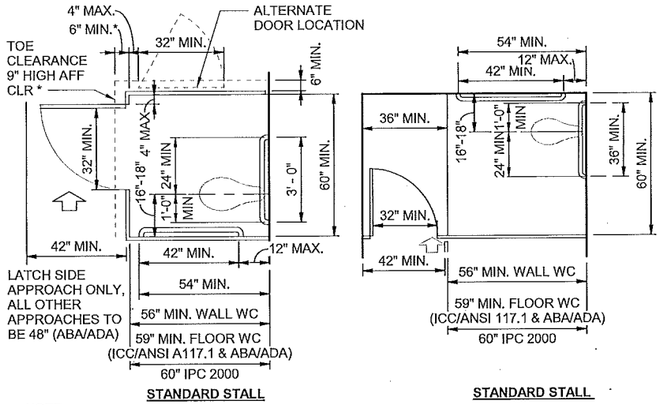
NOTE: FLUSH VALVE SHALL BE LOCATED ON WIDE SIDE OF STALLS



36" IF IN ALCOVE GREATER THAN 24" DEEP

GRAB BARS — NOT TO SCALE — 1

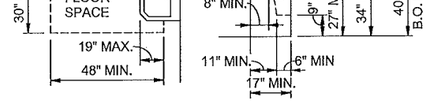
URINALS — NOT TO SCALE — 2



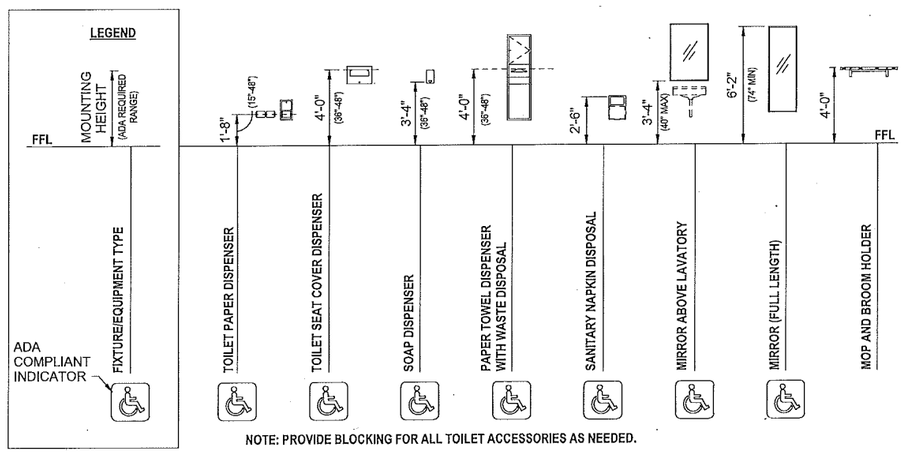
STANDARD STALL — STANDARD STALL

NOTE:
WHERE "*" IS INDICATED - TOE CLEARANCE AT THE FRONT OF THE PARTITION IS NOT REQUIRED IN A COMPARTMENT GREATER THAN 62" DEEP WITH A WALL-HUNG WATER CLOSET OR 65" DEEP WITH A FLOOR-MOUNTED WATER CLOSET. TOE CLEARANCE AT THE SIDE IS NOT REQUIRED IN A COMPARTMENT GREATER THAN 66" WIDE (ICC/ANSI A117.1/ABA/ADA). TOE CLEARANCE IS EXCLUSIVE OF PARTITION SUPPORT MEMBERS.

STANDARD STALLS — NOT TO SCALE — 3



LAVATORIES — NOT TO SCALE — 4



NOTE: PROVIDE BLOCKING FOR ALL TOILET ACCESSORIES AS NEEDED.

STANDARD ADA MOUNTING HEIGHTS — NOT TO SCALE — 6

LICENSED ARCHITECT RYAN F. LANG C-29726 Date: STATE OF WYOMING

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CITY OF CHEYENNE — LARAMIE COUNTY, WYOMING

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FRONT ENTRANCE AND SCALE HOUSE

CODE REVIEW & NOTES

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GENERAL NOTES:

1. REFER TO ARCHITECTURAL LEGEND. FOR SYMBOLS AND ABBREVIATIONS
2. REFER TO ELECTRICAL LIGHTING PLANS FOR LOCATION OF EXIT SIGNS AND EMERGENCY LIGHTING.
3. FINAL LOCATIONS OF FIRE EXTINGUISHERS SHALL BE APPROVED BY THE AHJ PRIOR TO INSTALLATION.

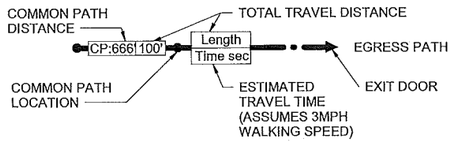
FIRE RATING KEY:

1-HR FIRE RATING

LIFE SAFETY KEY:

- FE-# 1. MULTI-PURPOSE DRY CHEMICAL TYPE EXTINGUISHER. UL OR FM RATED 1-A:10:B:C. 5LB NOMINAL CAPACITY IN ENAMEL-STEEL CONTAINER.
  2. CLEAN AGENT TYPE EXTINGUISHER UL RATING 5-B:C, 5LB NOMINAL CAPACITY

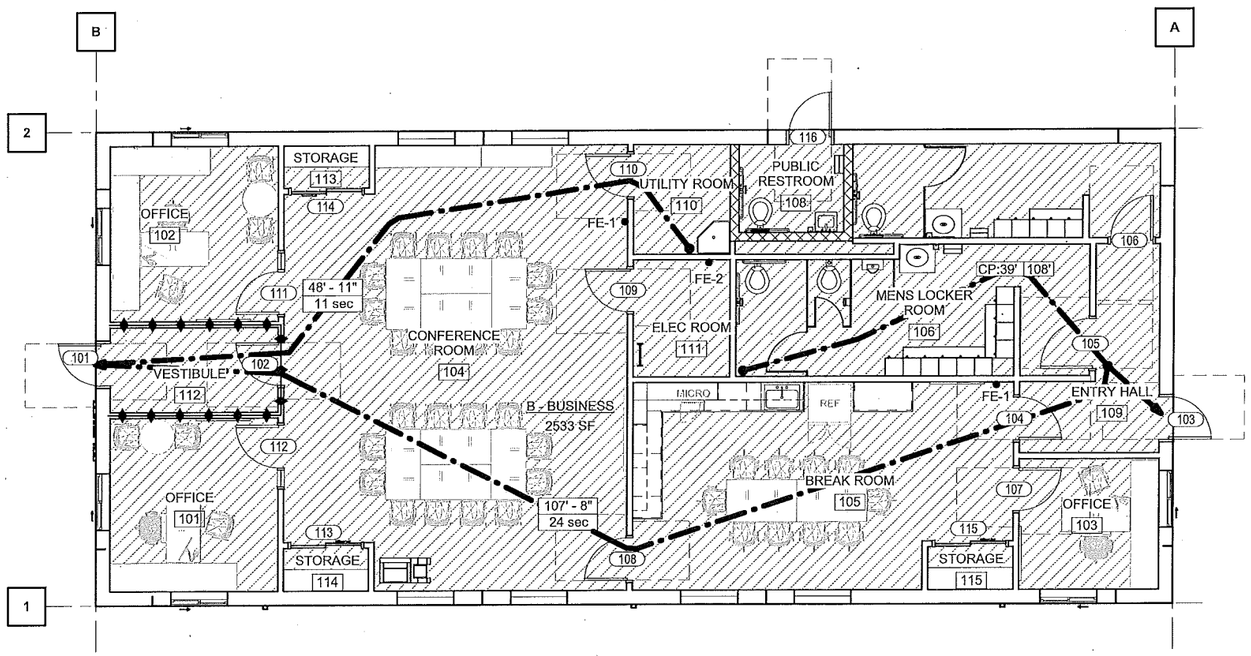
EGRESS PATH:



OCCUPANCY LEGEND:

B - BUSINESS

Calculating...



LIFE SAFETY PLAN

0 2' 4' 8'

SCALE IN FEET

NORTH

CODE REVIEW: ADMINISTRATION BUILDING

CODES

2018 INTERNATIONAL BUILDING CODE
2018 INTERNATIONAL ENERGY CONSERVATION CODE
2018 INTERNATIONAL MECHANICAL CODE
2018 INTERNATIONAL PLUMBING CODE
2018 INTERNATIONAL FUEL GAS CODE
2018 INTERNATIONAL FIRE CODE
2017 NATIONAL ELECTRICAL CODE

CHAPTER 3 - USE AND OCCUPANCY CLASSIFICATION

OCCUPANCY TYPE	OCCUPANCY GROUP	DESCRIPTION	AREAS APPLIED
B	-	BUSINESS	ALL

CHAPTER 5 - GENERAL BUILDING HEIGHTS AND AREAS

SECTION 504 - BUILDING HEIGHT AND NUMBER OF STORIES

OCCUPANCY	ALLOWABLE BUILDING HEIGHT (FT) TABLE 504.3	ALLOWABLE NUMBER OF STORIES TABLE 504.4	ACTUAL BUILDING HEIGHT (FT)
B	55	2	14

SECTION 506 - BUILDING AREA

OCCUPANCY	ALLOWABLE AREA PER TABLE 506.2 (SF)	ACTUAL FLOOR AREA	RATIO OF ACTUAL TO ALLOWABLE AREA
B	9,000	2533	0.28

CHAPTER 6 - TYPES OF CONSTRUCTION

SECTION 602 - CONSTRUCTION CLASSIFICATION

CLASSIFICATION	TYPE
II	B

TABLE 601 - FIRE-RESISTANCE RATING REQUIREMENTS

BUILDING ELEMENT	RATING (HOURS)
ALL	0

CHAPTER 9 - FIRE PROTECTION AND LIFE SAFETY SYSTEMS

SECTION 903 - AUTOMATIC SPRINKLER SYSTEMS

SPRINKLER SYSTEM IS NOT REQUIRED IN B OCCUPANCY PER SECTION 903.2

SECTION 905 - STANDPIPE SYSTEMS

STANDPIPE SYSTEM IS NOT REQUIRED PER SECTION 905.3

SECTION 906 - PORTABLE FIRE EXTINGUISHERS

PORTABLE FIRE EXTINGUISHERS WILL BE INSTALLED THROUGHOUT PER SECTION 906.1

SECTION 907 - FIRE ALARM AND DETECTION SYSTEMS

MANUAL FIRE ALARM SYSTEM IS NOT REQUIRED PER SECTION 907.2.2

CHAPTER 10 - MEANS OF EGRESS

SECTION 1004 -OCCUPANT LOAD

FUNCTION	OCCUPANT LOAD FACTOR	ACTUAL FLOOR AREA (SF)	MAX OCCUPANCY
REMAINING BUSINESS AREA	150	1,436	10
CONFERENCE ROOM	15	723	48
BREAK ROOM	15	374	25
TOTAL		2,533	83

SECTION 1005 - MEANS OF EGRESS SIZING ENTIRE BUILDING

81 OCCUPANTS*0.2IN/OCCUPANT = 16.2IN REQUIRED < 64IN PROVIDED

1 EXIT REQUIRED, 2 EXITS PROVIDED FOR A TOTAL OF 64 INCHES PROVIDED

SECTION 1006 - NUMBER OF EXITS AND EXITS ACCESS DOORWAYS PER SPACE

OCCUPANCY	MAXIMUM OCCUPANT LOAD PER SPACE	TRAVEL DISTANCE (FT)	MAXIMUM COMMON PATH OF EGRESS (FT) PER TABLE 1006.2.1	MINIMUM # OF EXITS PER TABLE 1006.2.1	MAXIMUM TRAVEL DISTANCE PER TABLE 1017.2 (FT)
B	49	75	75	1	200

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KEY PLAN

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Centennial, CO 80112
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designed	checked
K. THURMAN	R. LANG

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LARAMIE COUNTY, WYOMING

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ADMINISTRATION BUILDING LIFE SAFETY PLAN

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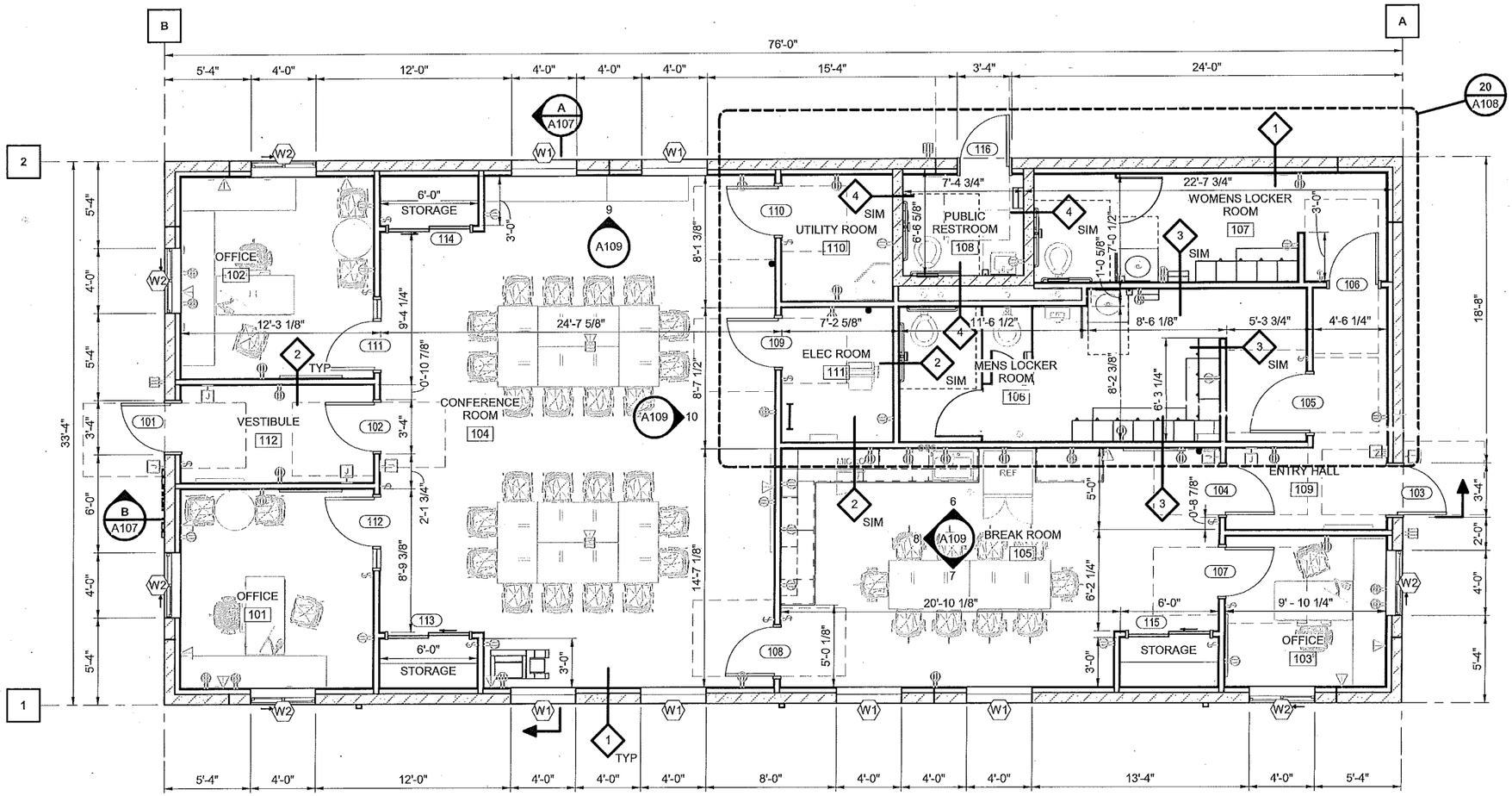
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NOTES:

1. DIMENSIONS SHOWN ARE TO FINISHED FACE OF WALL. CONTRACTOR TO VERIFY FINISH MATERIAL THICKNESS.
2. SEE A104 FOR REFLECTED CEILING PLAN.
3. SEE A111 FOR DOOR AND WINDOW SCHEDULES AND DETAILS.
4. SEE A113 FOR FINISH SCHEDULE.
5. DOOR LOCATIONS NOT DIMENSIONED ARE 6" FROM FINISHED FACE OF WALL TO JAMB FACE. VERIFY PULL SIDE CLEARANCE OF 18" FROM STRIKE TO INTERSECTING FINISH FACE OF WALL. NOTIFY OWNER FOR NON-COMPLIANCE PRIOR TO SETTING DOOR FRAME.

LEGEND:

- A / SIM — WALL TYPE, SEE A110
- (A) — DOOR TAG, SEE A111
- 1t — WINDOW TAG, SEE A111
- RECEPT/SWITCH/DATA, SEE ELEC DRAWINGS



FINISHED FLOOR PLAN

0 2' 4' 8'

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ADMINISTRATION BUILDING FLOOR PLAN

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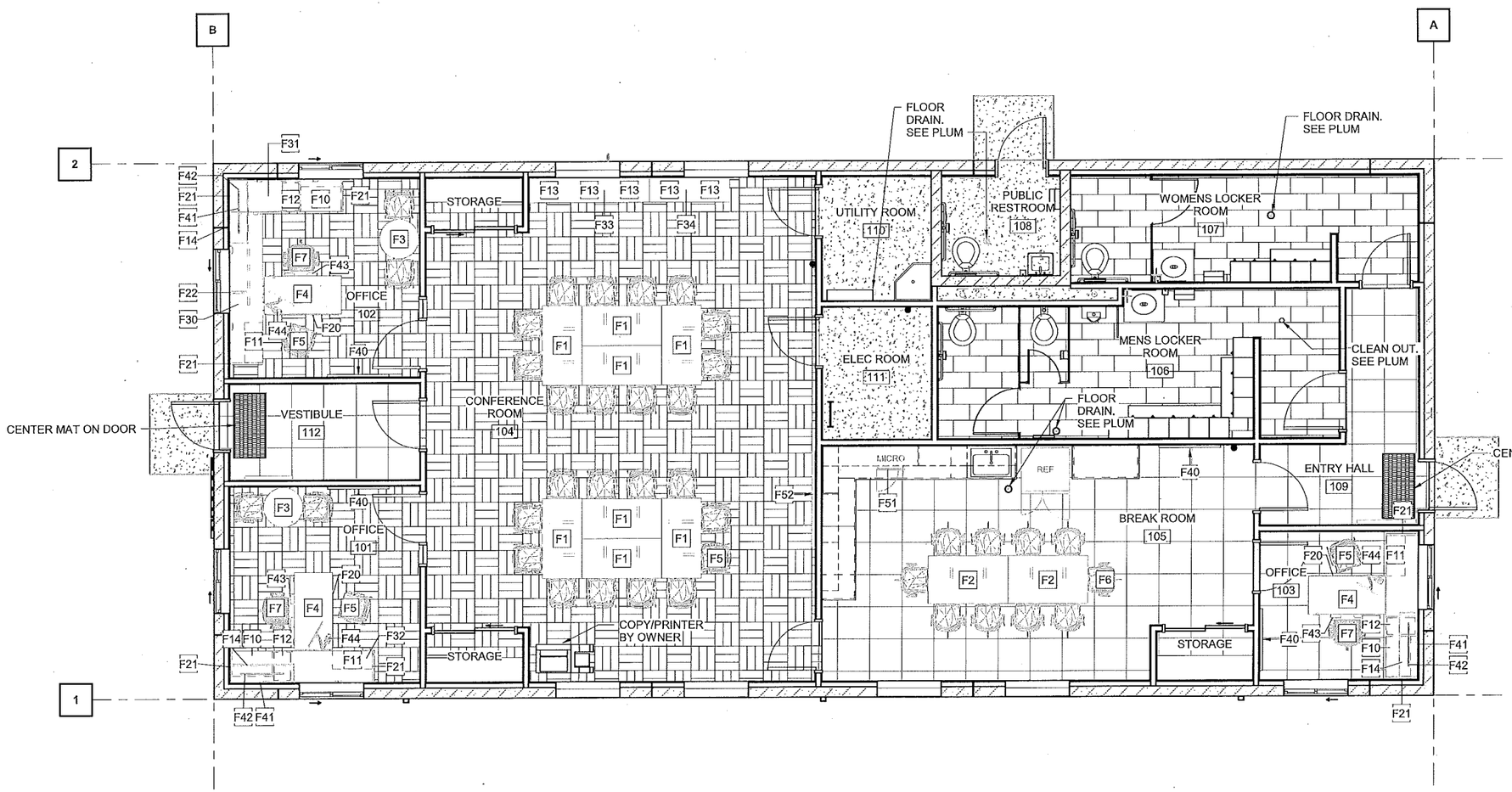
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FLOOR FINISH LEGEND:

- 12"X24" CERAMIC TILE, RUNNING BOND PATTERN DAL-TILE IRONCRAFT. CASPER GREY IC12.
- 24"X24" CARPET TILE, BASKET WEAVE PATTERN TARKETT POWERBOND HYBRID RESILIENT MAELSTROM 04849 - MERCURY RETROGRADE 33205
- FLEXCO EVOLVING STYLES 18"X18" RUBBER FLOOR TILE. COLOR CE-103 FRENCH GRAY WITH BLACK.
- SEALED CONCRETE
- HELIX® HZ1 24"X48" RECESSED ENTRANCE MAT



FLOOR FINISHES AND FURNITURE PLAN

0 2' 4' 8'
SCALE IN FEET

NORTH

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ADMINISTRATION BUILDING FLOOR FINISHES AND FURNITURE PLAN

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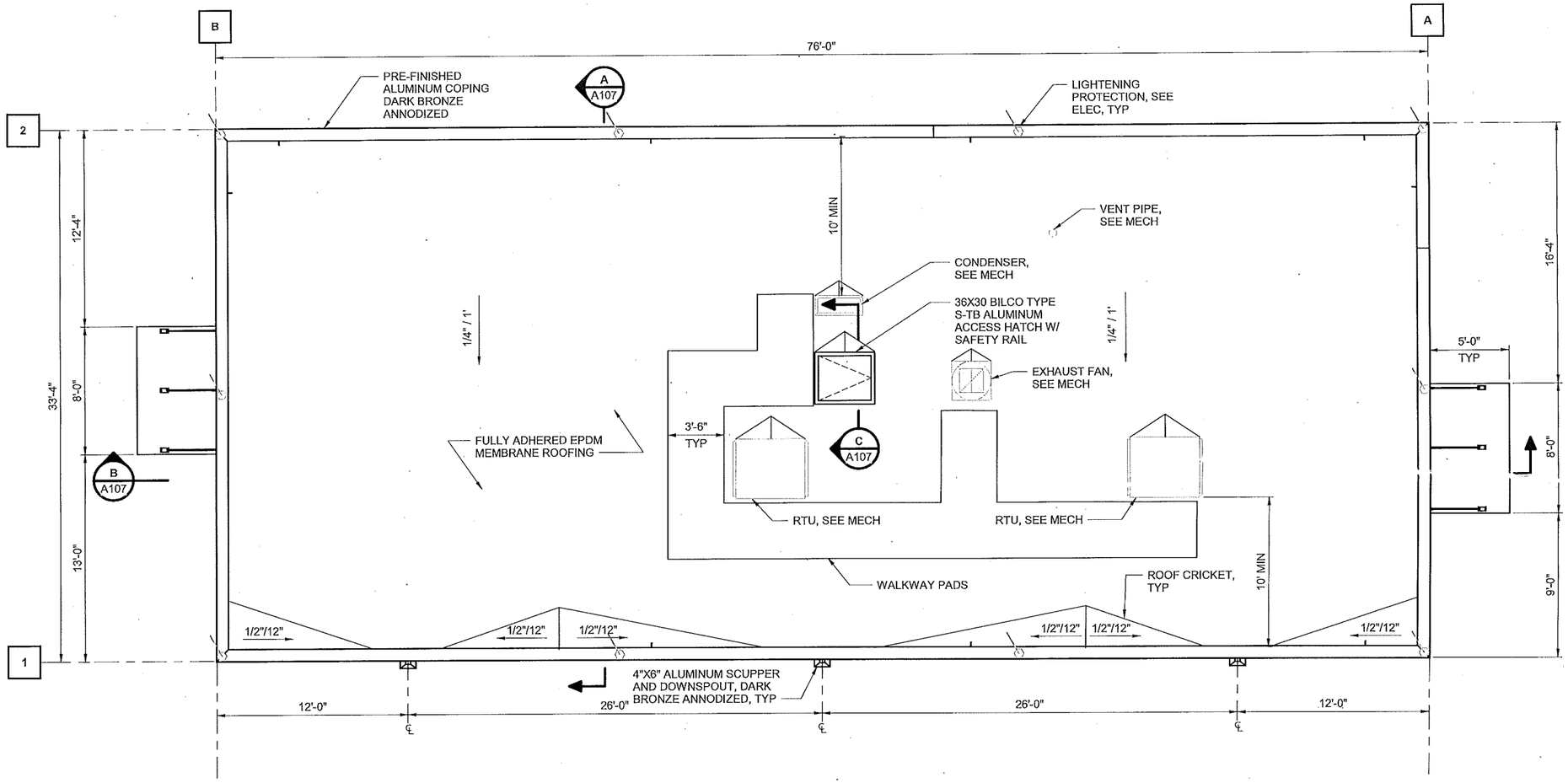
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NOTES:

1. SEE A114 FOR STANDARD ROOFING DETAILS.



ROOF

0 2' 4' 8'

SCALE IN FEET

NORTH

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ADMINISTRATION BUILDING ROOF PLAN

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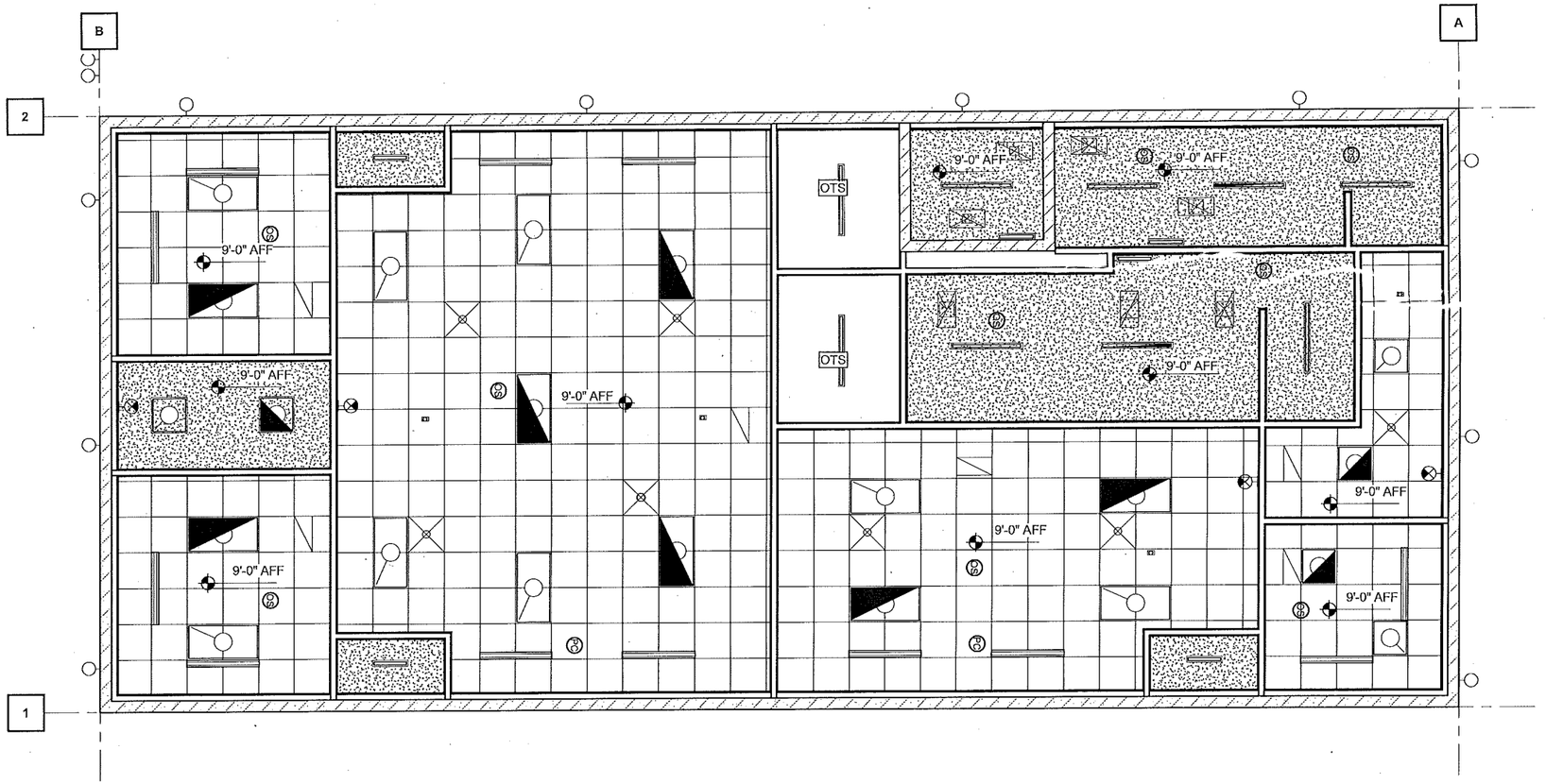
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CEILING LEGEND:

- 2'X2' ACOUSTICAL CEILING TILE, REF FINISH SCHEDULE FOR TYPE
- GYPSUM BOARD - PAINT
- OTS — OPEN TO STRUCTURE - PAINTED
- LED LIGHT FIXTURE - RECESSED
- EMERGENCY LED FIXTURE - RECESSED
- LED STRIP LIGHT - RECESSED
- 9' - 0" — CEILING HEIGHT ABOVE FINISH FLOOR
- HVAC AIR SUPPLY GRILLE
- HVAC EXHAUST OR RETURN GRILLE
- EXTERIOR FIXTURE
- EXIT SIGN
- OS — OCCUPANCY SENSOR



REFLECTED CEILING PLAN

0 2' 4' 8'

SCALE IN FEET

NORTH

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SCALE BLDG

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K. THURMAN	R. LANG

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

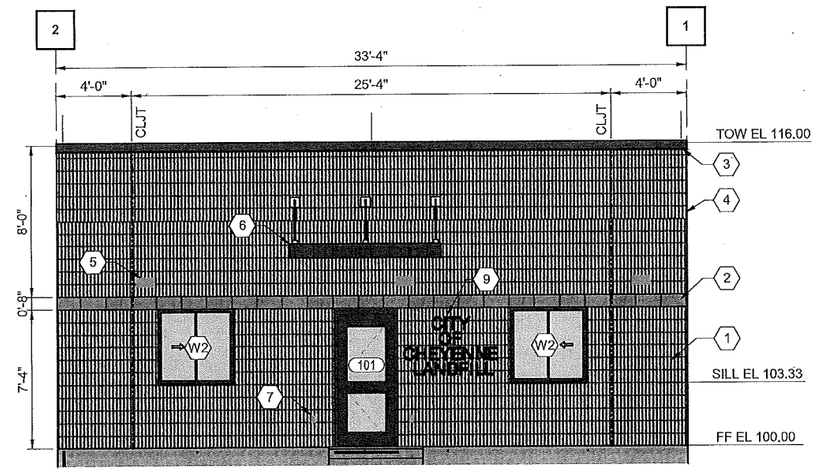
ADMINISTRATION BUILDING REFLECTED CEILING PLAN

project	contract
118706	
drawing	rev.
A104	0
sheet	of sheets
file	

LICENSED ARCHITECT
RYAN P. LANG
C-2926
Date:
STATE OF WYOMING

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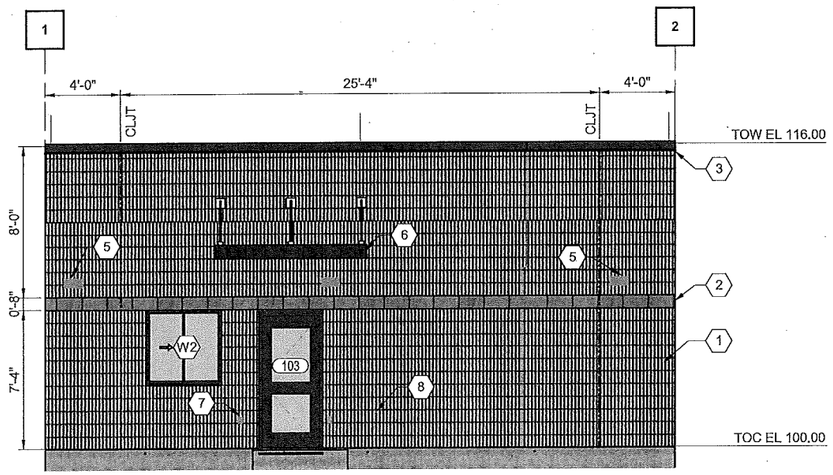
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NORTH ELEVATION

0 2' 4' 8'

SCALE IN FEET



SOUTH ELEVATION

0 2' 4' 8'

SCALE IN FEET

KEY NOTES: (#)

1. BASALITE 8X8X16 SPLIT FACE, 5 SCORE CMU. RUNNING BOND, COLOR #5656R
2. BASALITE 8X8X16 PRECISION CMU. RUNNING BOND, COLOR #5656R
3. PREFINISHED ALUMINUM COPING. DARK BRONZE ANODIZED.
4. PREFINISHED ALUMINUM SCUPPER AND DOWNSPOUT. DARK BRONZE ANODIZED, PRECAST SPLASH BLOCK.
5. EXTERIOR LIGHTING. SEE ELECTRICAL DWGS.
6. CANOPY, SEE A107.
7. OUTDOOR RECEPT. SEE ELECTRICAL DWGS.
8. OUTDOOR SPIGOT. SEE PLUMBING DWGS.
9. 8" CAST ALUMINUM LETTERING. EXACT WORDING TO BE SELECTED BY OWNER.

no.	date	by	ckd	description
0	7/10/20	KDT	RPL	ISSUED FOR BID

BURNS McDONNELL

9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	**checked**
K. THURMAN	R. LANG

CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING ELEVATIONS

project	contract
118706	

drawing **A105** — rev. **0**

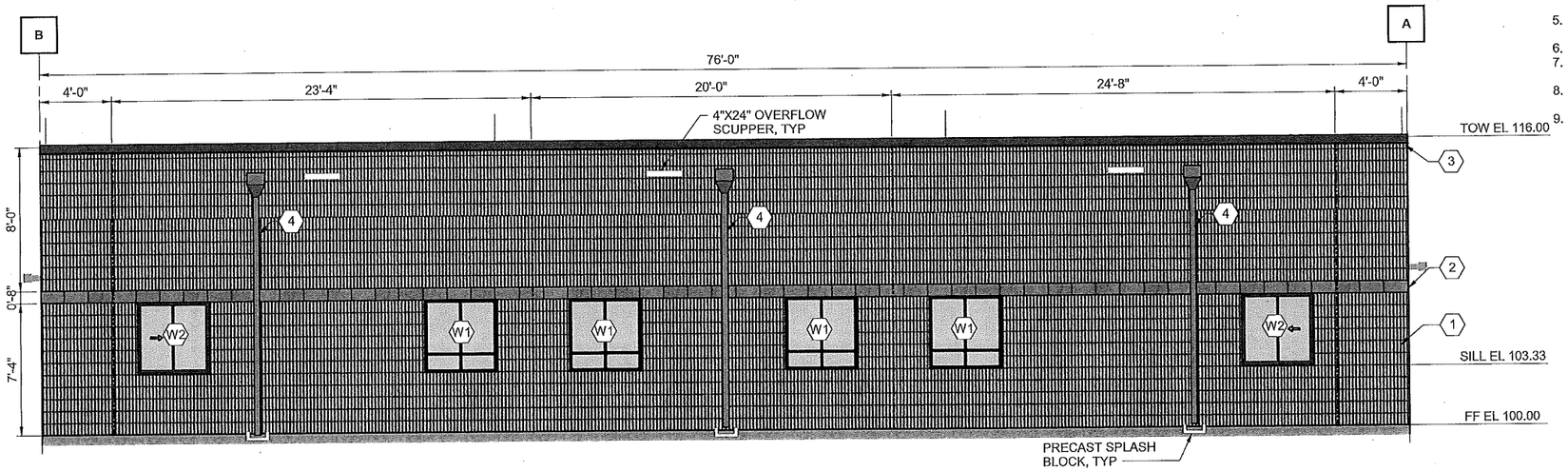
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RYAN F. LANG
C 2926
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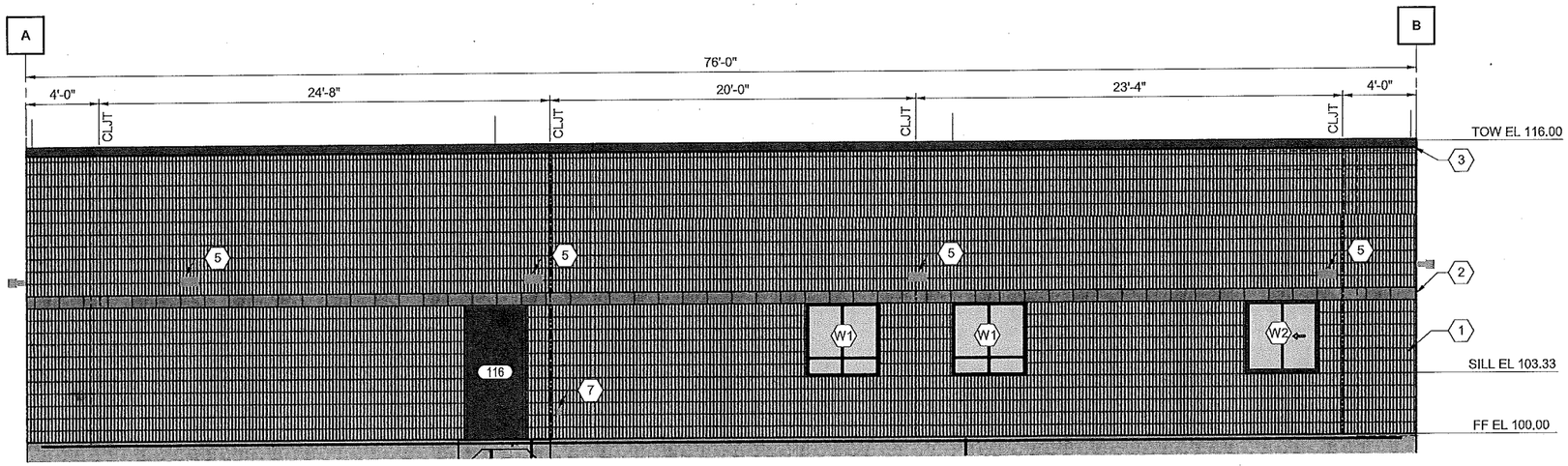
WEST ELEVATION

0 2' 4' 8'
SCALE IN FEET

KEY NOTES: (#)

1. BASALITE 8X8X16 SPLIT FACE, 5 SCORE CMU. RUNNING BOND, COLOR #5656R
2. BASALITE 8X8X16 PRECISION CMU. RUNNING BOND, COLOR #5656R
3. PREFINISHED ALUMINUM COPING. DARK BRONZE ANODIZED.
4. PREFINISHED ALUMINUM SCUPPER AND DOWNSPOUT. DARK BRONZE ANODIZED, PRECAST SPLASH BLOCK.
5. EXTERIOR LIGHTING. SEE ELECTRICAL DWGS.
6. CANOPY, SEE A107.
7. OUTDOOR RECEPT. SEE ELECTRICAL DWGS.
8. OUTDOOR SPIGOT. SEE PLUMBING DWGS.
9. 8" CAST ALUMINUM LETTERING. EXACT WORDING TO BE SELECTED BY OWNER.

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EAST ELEVATION

0 2' 4' 8'
SCALE IN FEET

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CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING ELEVATIONS

project	contract
118706	

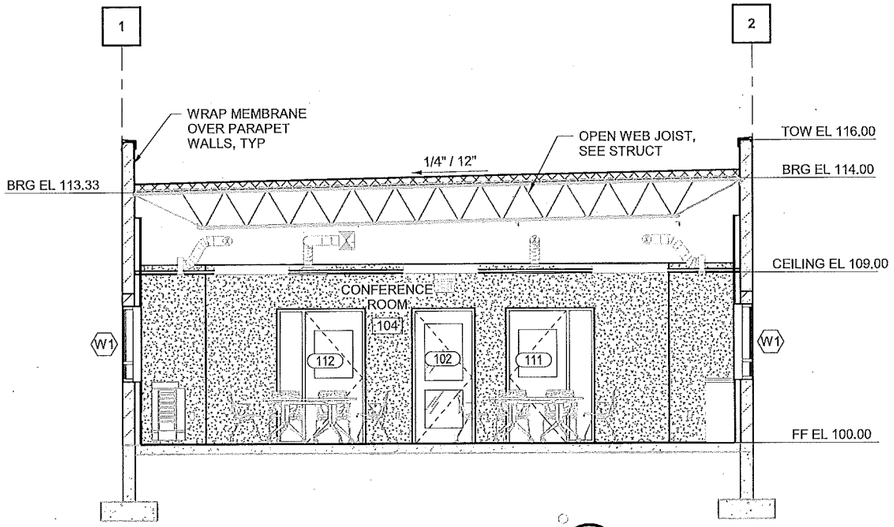
drawing	rev.
A106 —	0

sheet of sheets
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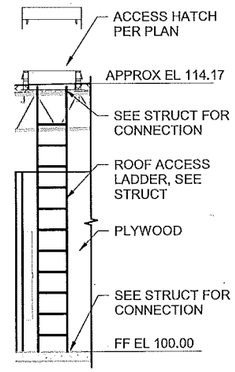
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SECTION A / A101

0 2' 4' 8'

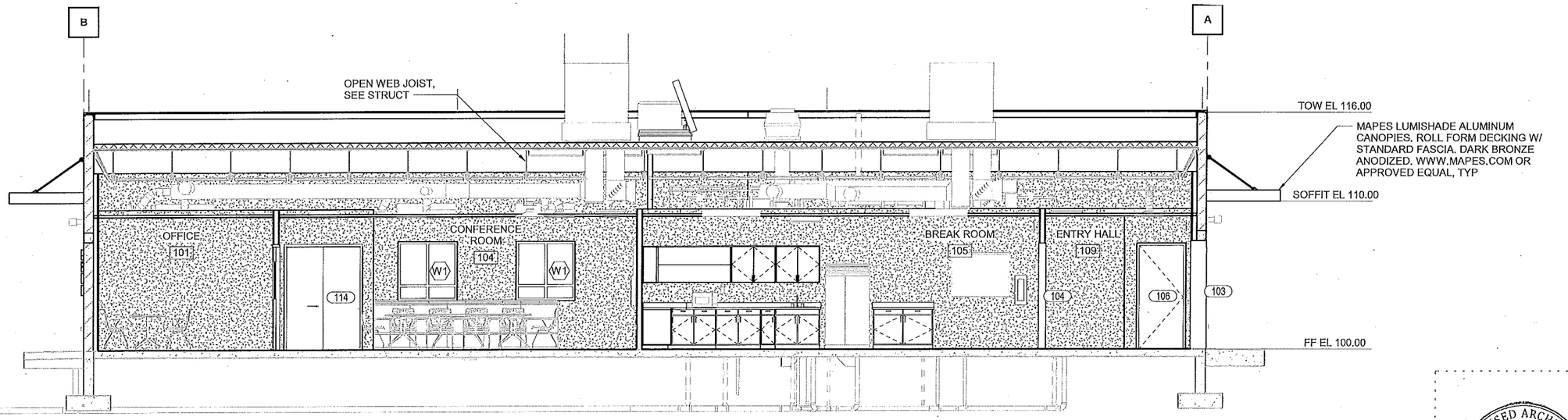
SCALE IN FEET



ROOF ACCESS LADDER C / A103

0 2' 4' 8'

SCALE IN FEET



SECTION B / A101

0 2' 4' 8'

SCALE IN FEET

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0	7/10/20	KDT	RPL	ISSUED FOR BID

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JULY 2020	N. ARYAN
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CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING SECTIONS

project	contract
118706	

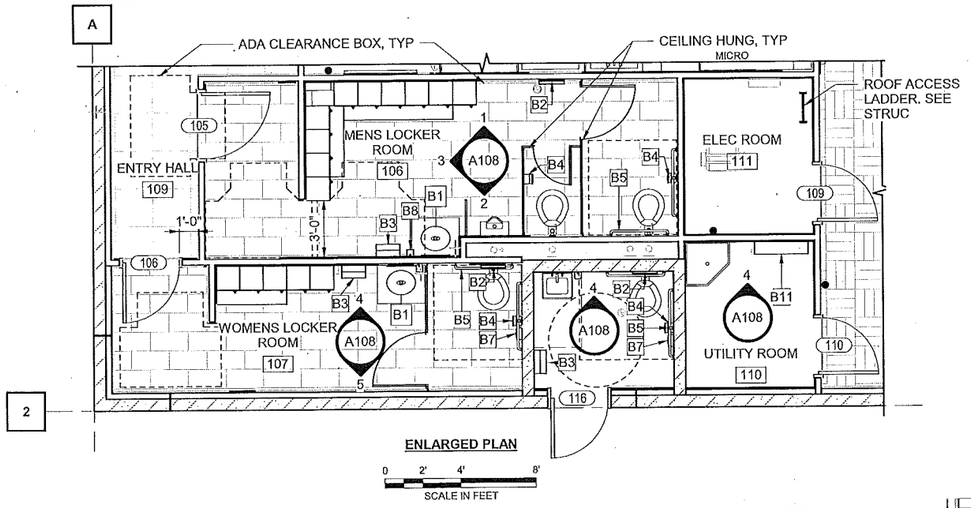
drawing	rev.
A107 —	0

sheet	of	sheets
file		

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C 2926
Date:
STATE OF WYOMING

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ENLARGED PLAN

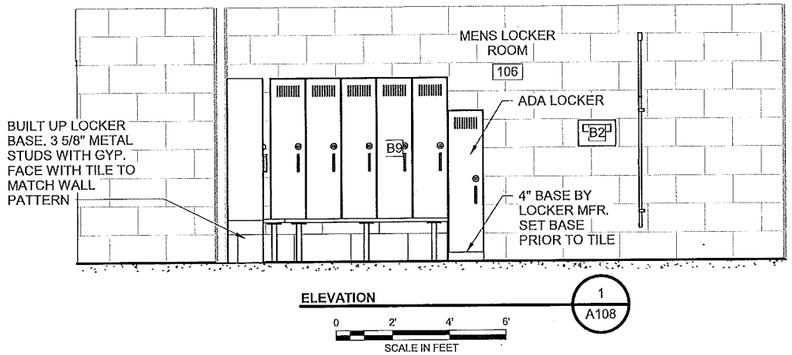
0 2' 4' 8'

SCALE IN FEET

LOCKER ROOM SCHEDULE					
MARK	QTY	DESCRIPTION	MODEL	MFR	REMARKS
B1	2	VANITY WITH UNDERMOUNT SINK			1
B2	3	TOILET SEAT COVER DISPENSER, SURFACE MOUNT	B-4221	BOBRICK	
B3	3	SURFACE MOUNTED CONVERTIBLE COMBINATION TOWEL AND WASTE UNIT	B-39619	BOBRICK	
B4	4	MULTI-ROLL TOILET PAPER HOLDER	B-4288	BOBRICK	
B5	3	1 1/4" DIAMETER STAINLESS STEEL ADA GRAB BAR WITH SNAP FLANGE	B-5806	BOBRICK	2
B6	3	TEMPERED GLASS WELDED FRAME MIRROR	B-2908	BOBRICK	
B7	2	SURFACE MOUNTED SANITARY NAPKIN DISPOSAL	B-270	BOBRICK	
B8	3	AUTOMATIC WALL MOUNTED LIQUID SOAP DISPENSER	B-2012	BOBRICK	
B9	15	15"X15"X48" METAL LOCKERS	REBEL ATHLETIC	DEBOURGH MFG. CO.	3
B10	3	SOLID WOOD BENCH			3
B11	1	UTILITY SHELF WITH RAG HOOKS AND BROOM HOLDERS	B-239	BOBRICK	
B12	1	MOP SINK			SEE PLUMB DWGS

REMARKS:

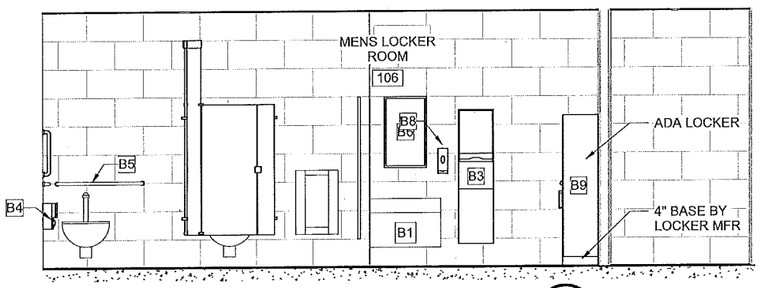
1. SEE PLUMBING DRAWINGS FOR LAVATORY SIZE AND FIXTURES. SEE VANITY DETAIL THIS SHEET FOR ADDITIONAL REQUIREMENTS.
2. HORIZONTAL AND VERTICAL GRAB BARS. SEE ADA MOUNTING DETAILS FOR REQUIREMENTS.
3. SEE SPEC SECTION 10 51 13 FOR ADDITIONAL REQUIREMENTS.
4. SEE SPEC SECTION 10 21 13.13 FOR METAL TOILET COMPARTMENT REQUIREMENTS.



ELEVATION 1 / A108

0 2' 4' 6'

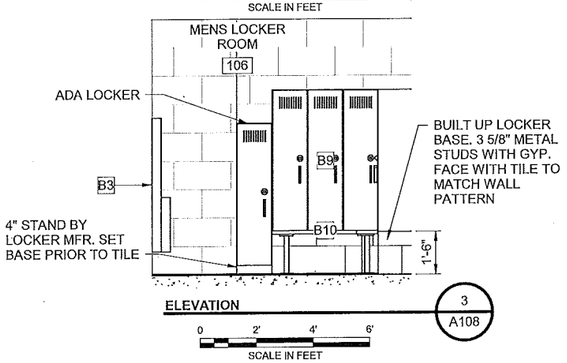
SCALE IN FEET



ELEVATION 2 / A108

0 2' 4' 6'

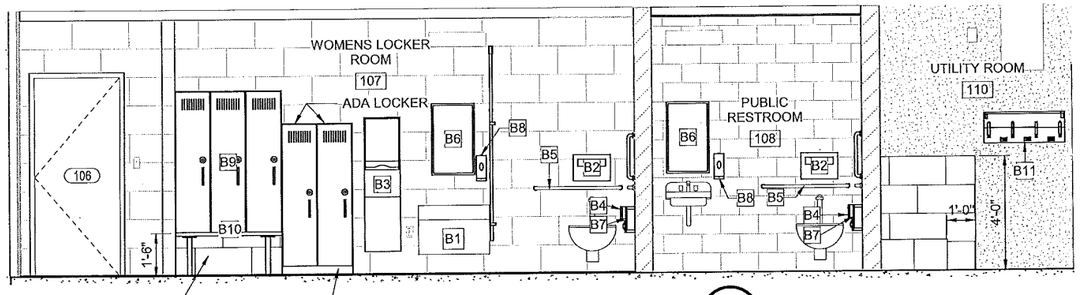
SCALE IN FEET



ELEVATION 3 / A108

0 2' 4' 6'

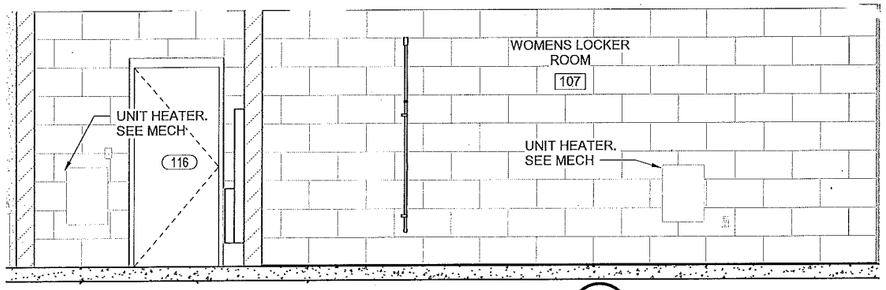
SCALE IN FEET



ELEVATION 4 / A108

0 2' 4' 6'

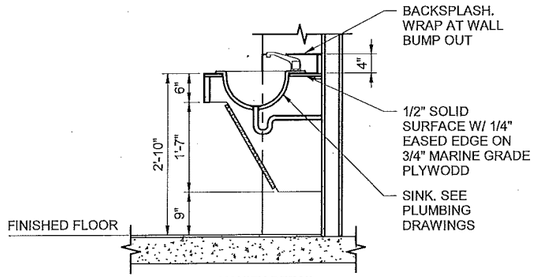
SCALE IN FEET



ELEVATION 5 / A108

0 2' 4' 6'

SCALE IN FEET

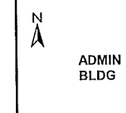


VANITY DETAIL

0 1' 2' 3'

SCALE IN FEET

no.	date	by	ckd	description
0	7/10/20	KDT	RPL	ISSUED FOR BID



KEY PLAN

BURNS McDONNELL
9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	checked
K. THURMAN	R. LANG

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING ENLARGED PLAN AND INTERIOR ELEVATIONS

project	contract
118706	

drawing **A108** — rev. **0**

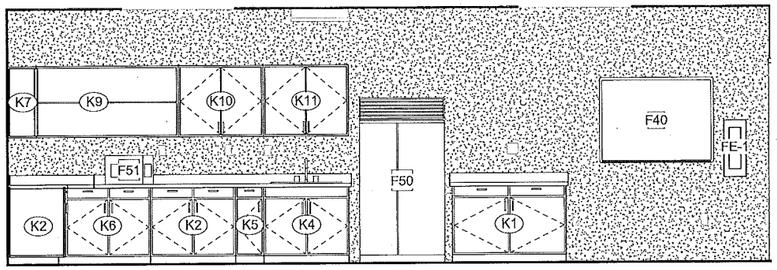
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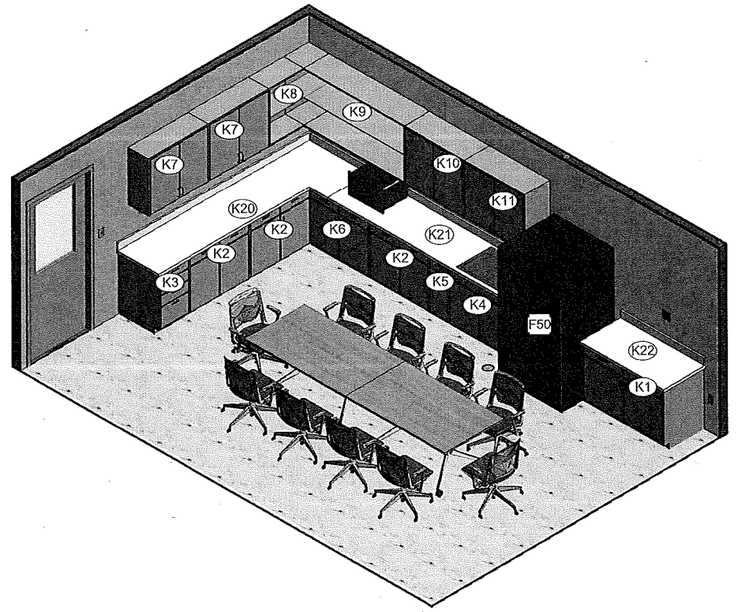
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ELEVATION 6 / A101

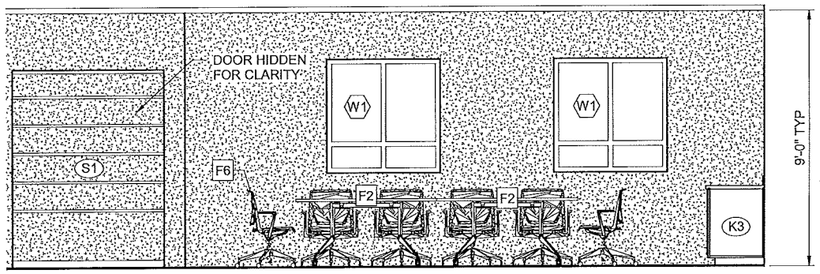
0 2' 4' 6'

SCALE IN FEET



BREAKROOM CASEWORK ISO

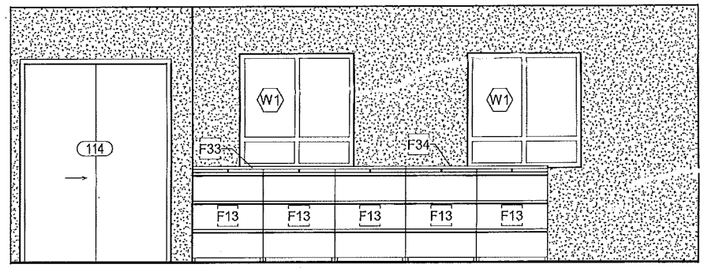
NOT TO SCALE



ELEVATION 7 / A101

0 2' 4' 6'

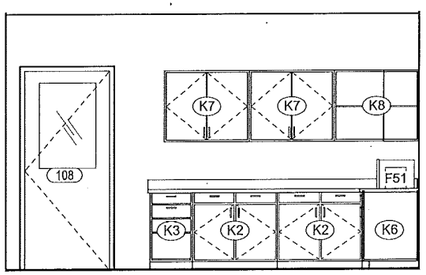
SCALE IN FEET



ELEVATION 9 / A101

0 2' 4' 6'

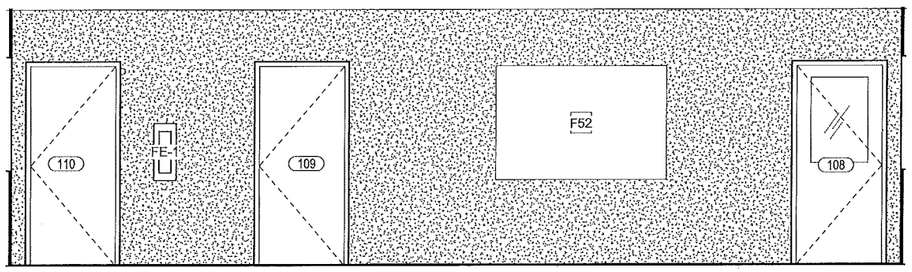
SCALE IN FEET



ELEVATION 8 / A101

0 2' 4' 6'

SCALE IN FEET



ELEVATION 10 / A101

0 2' 4' 6'

SCALE IN FEET

LEGEND:

F# FURNITURE TAG. PROVIDE BLOCKING AS REQUIRED

K# CASEWORK TAG. PROVIDE BLOCKING AS REQUIRED

LETTER MAY VARY

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING INTERIOR ELEVATIONS

project	contract
118706	

drawing **A109** — rev. **0**

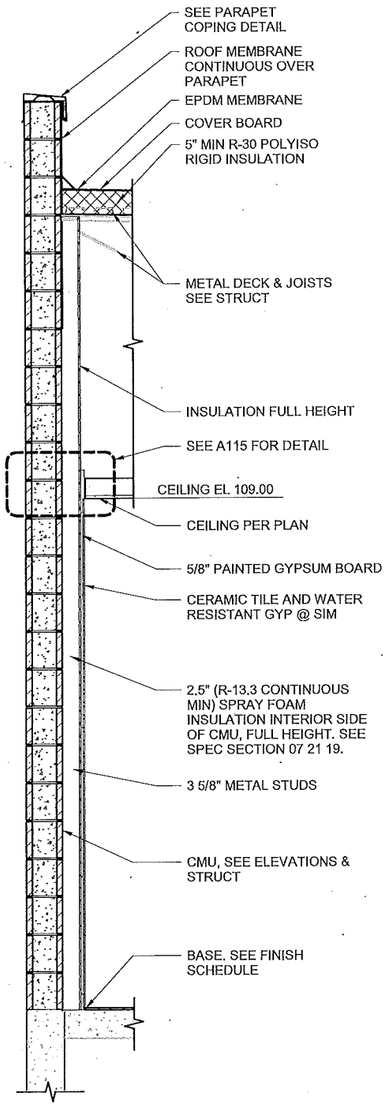
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RYAN F. LANG
C-2926
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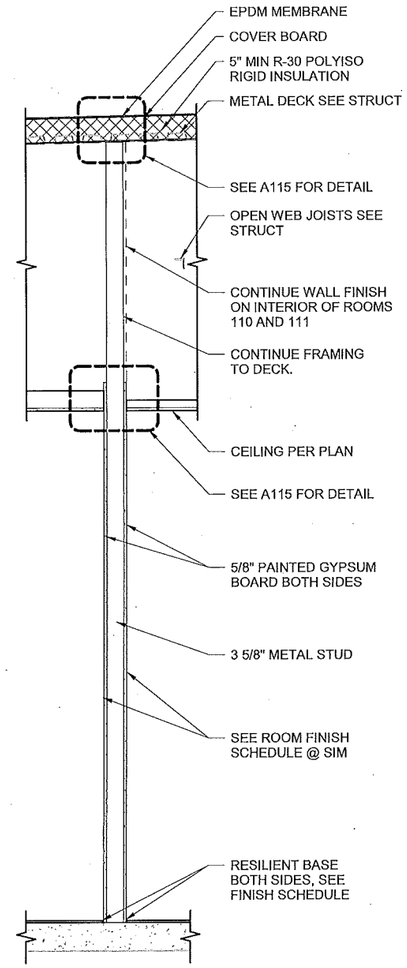
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WALL SECTION 1 A101

0 1' 2' 3'

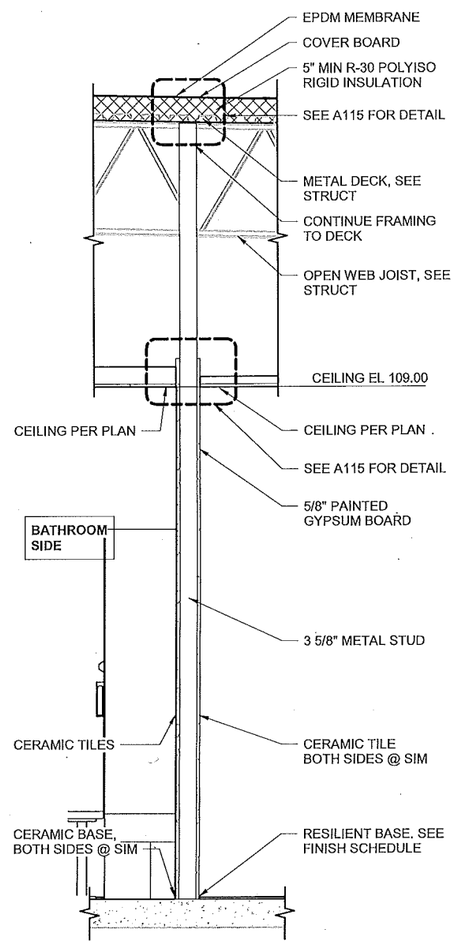
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WALL SECTION 2 A101

0 1' 2' 3'

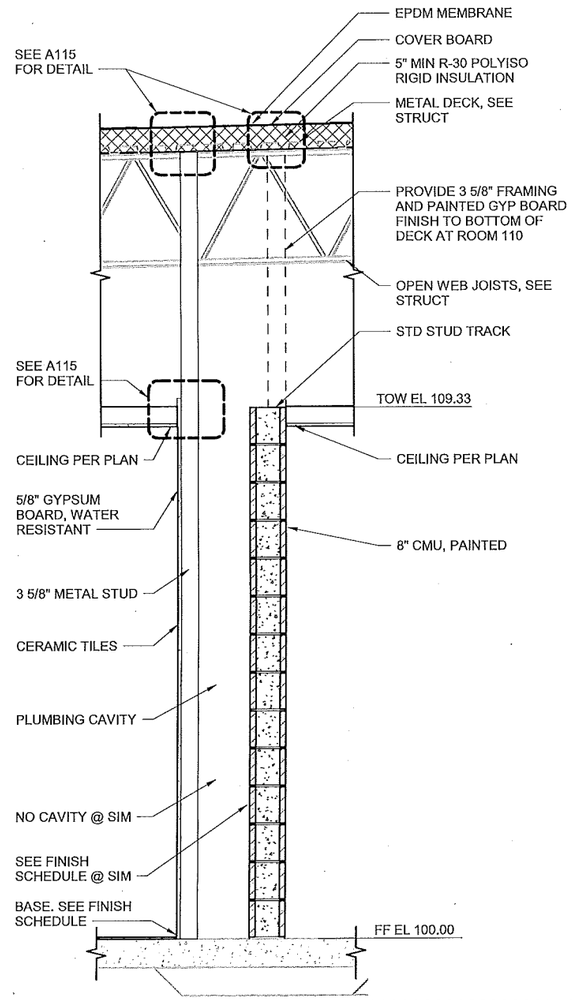
SCALE IN FEET



WALL SECTION 3 A101

0 1' 2' 3'

SCALE IN FEET



WALL SECTION 4 A101

0 1' 2' 3'

SCALE IN FEET

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ADMINISTRATION BUILDING WALL SECTIONS AND DETAILS

project	contract
118706	

drawing	rev.
A110 —	0

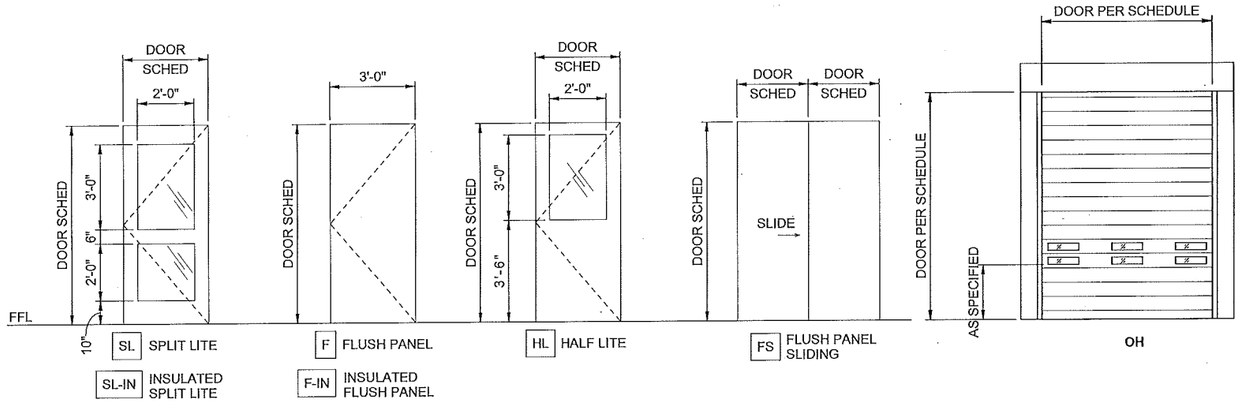
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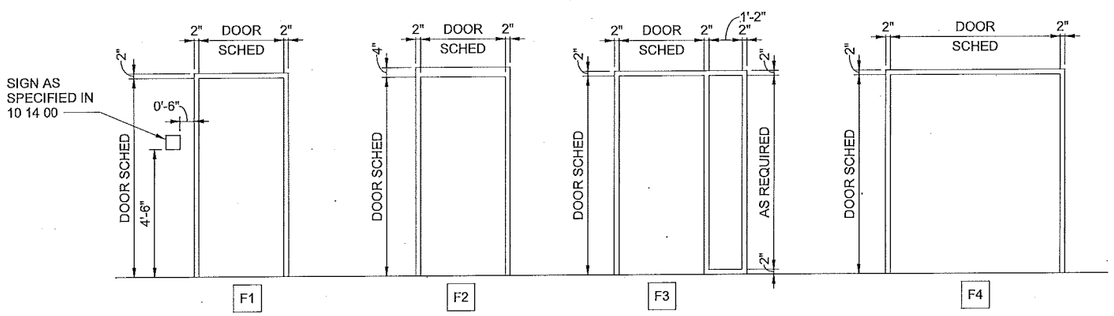
DOOR SCHEDULE

DOOR NUMBER	DOOR SIZE			DOOR TYPE	DOOR MATERIAL	DOOR FINISH	FRAME TYPE	FRAME MATERIAL	FRAME FINISH	ASSEMBLY FIRE RATING	DETAIL (A112) HEAD	DETAIL (A112) JAMB	DETAIL (A112) SILL	HARDWARE SET	REMARKS
101	-	3'-0"	7'-0"	SL-IN	HM	PAINT	F2	HM	PAINT	-	1	1	1	01	2,3
102	-	3'-0"	7'-0"	SL	HM	PAINT	F1	HM	PAINT	1 HR	2	2	-	08	3
103	-	3'-0"	7'-0"	SL-IN	HM	PAINT	F2	HM	PAINT	-	1	1	1	01	2,3
104	-	3'-0"	7'-0"	SL	HM	PAINT	F1	HM	PAINT	-	2	2	-	08	3
105	-	3'-6"	7'-0"	F	WOOD	FACTORY	F1	HM	PAINT	-	2	2	-	09	1
106	-	3'-0"	7'-0"	F	WOOD	FACTORY	F1	HM	PAINT	-	2	2	-	09	1
107	-	3'-0"	7'-0"	HL	WOOD	FACTORY	F1	HM	PAINT	-	2	2	-	06	
108	-	3'-0"	7'-0"	HL	WOOD	FACTORY	F1	HM	PAINT	-	2	2	-	05	
109	-	3'-0"	7'-0"	F	HM	PAINT	F1	HM	PAINT	-	2	2	2	04	
110	-	3'-0"	7'-0"	F	HM	PAINT	F1	HM	PAINT	-	2	2	2	05	1
111	-	3'-0"	7'-0"	HL	WOOD	FACTORY	F3	HM	PAINT	-	2	2	-	06	
112	-	3'-0"	7'-0"	HL	WOOD	FACTORY	F3	HM	PAINT	-	2	2	-	06	
113	PR.	2'-6"	7'-0"	FS	WOOD	FACTORY	-	-	-	-	3	3	3	10	
114	PR.	2'-6"	7'-0"	FS	WOOD	FACTORY	-	-	-	-	3	3	3	10	
115	PR.	2'-6"	7'-0"	FS	WOOD	FACTORY	-	-	-	-	3	3	3	10	
116	-	3'-0"	7'-0"	F-IN	HM	PAINT	F2	HM	PAINT	-	1	1	1	03	1,2
301	-	16'-8"	16'-8"	OH-C	GALV	FACTORY	-	-	-	-	5	5	6		4
302	-	16'-8"	16'-8"	OH-C	GALV	FACTORY	-	-	-	-	5	5	6		4

REMARKS:
1. PROVIDE ROOM SIGN AS INDICATED IN FRAME F1.
2. GROUT FRAME SOLID.
3. PROVIDE ADA PUSH BUTTON EACH SIDE OF DOOR. MOUNT PER DETAIL ON A004.
4. OVERHEAD DOORS ARE LOCATED AT THE EXISTING GARAGE TO THE SOUTH OF THE PRIMARY CONSTRUCTION SITE. CONTRACTOR TO FIELD VERIFY DIMENSIONS OF EXISTING DOORS PRIOR TO ORDERING. SEE SPEC SECTION 08 33 23 FOR ADDITIONAL OVERHEAD DOOR REQUIREMENTS.
5. SEE SPEC SECTION 08 700 00 FOR FINISH HARDWARE SETS.



DOOR LEGEND

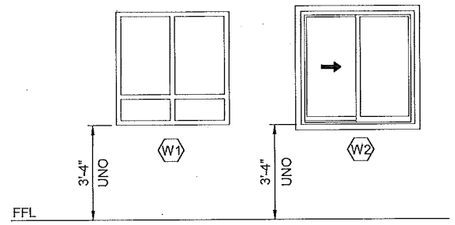


DOOR FRAME LEGEND

WINDOW SCHEDULE

QUANTITY	TYPE	SIZE WIDTH	SIZE HEIGHT	HEAD HEIGHT	SILL HEIGHT	DETAIL HEAD	DETAIL JAMB	DETAIL SILL	REMARKS
6	W1	4'-0"	4'-0"	7'-4"	3'-4"	W1	W1	W1	
6	W2	4'-0"	4'-0"	7'-4"	3'-4"	W1	W1	W1	1

REMARKS:
1. OPERABLE WINDOW



WINDOW LEGEND

no.	date	by	ckd	description
0	7/10/20	KDT	RPL	ISSUED FOR BID

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9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	checked
K. THURMAN	R. LANG

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
ADMIN BUILDING DOOR & WINDOW SCHEDULES AND DETAILS

project	contract
118706	

drawing **A111** — rev. **0**

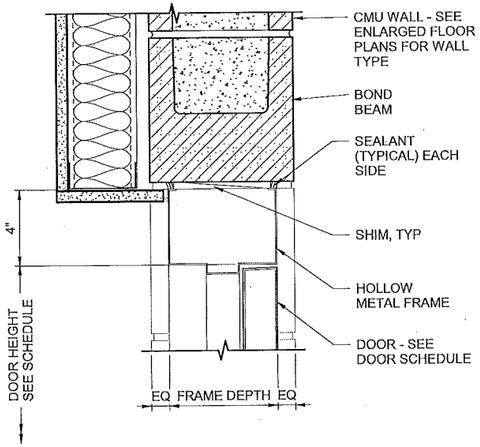
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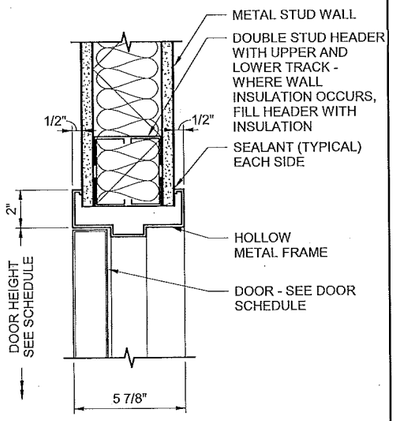
LICENSED ARCHITECT RYAN P. LANG C-2926 Date: STATE OF WYOMING

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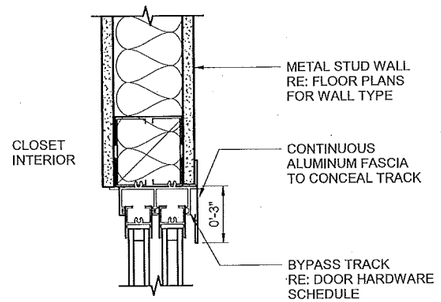
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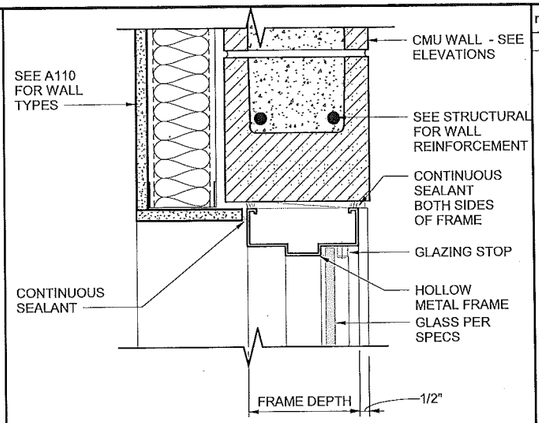
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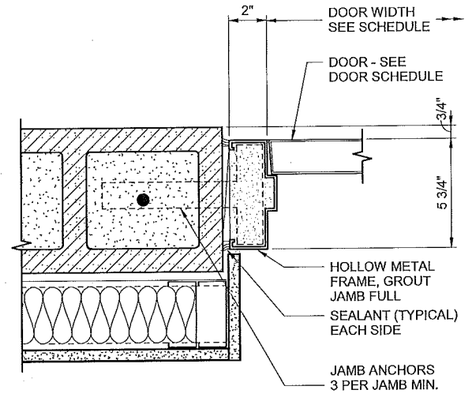
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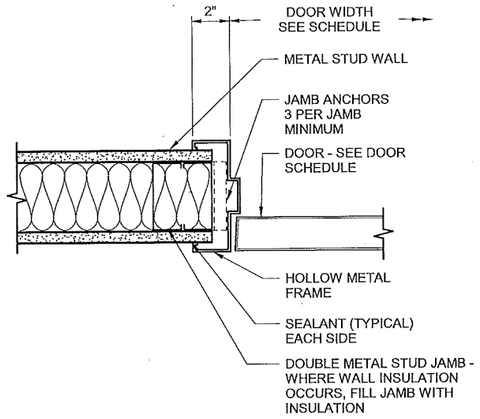
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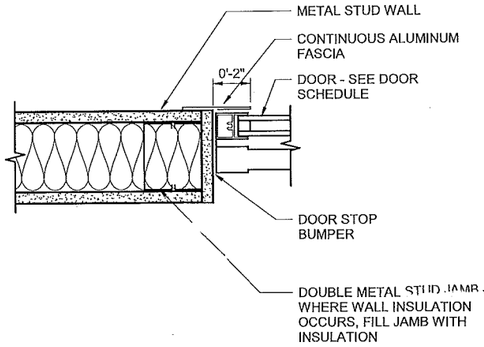
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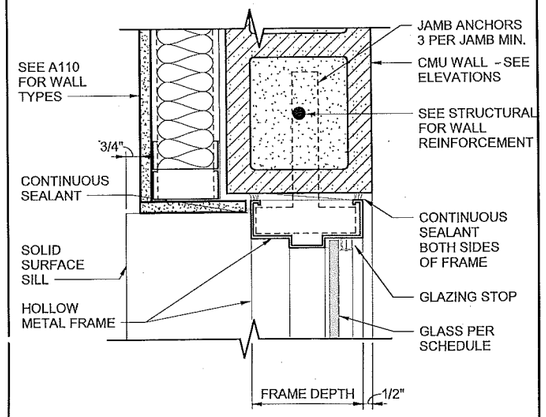
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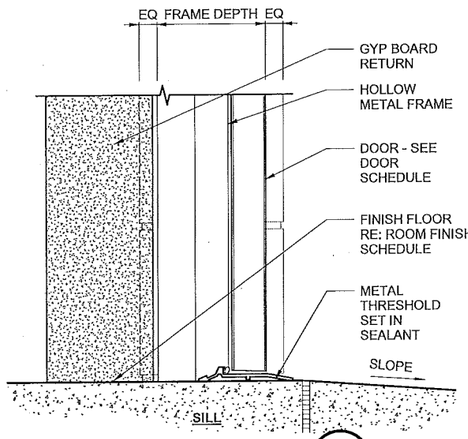
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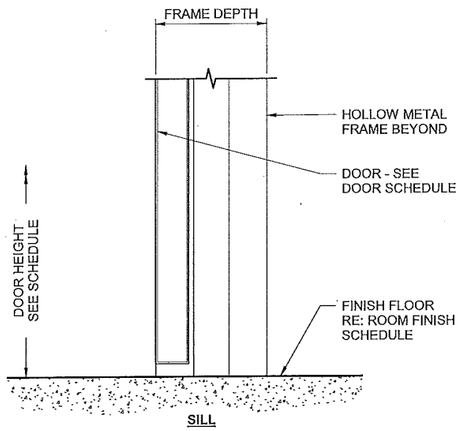
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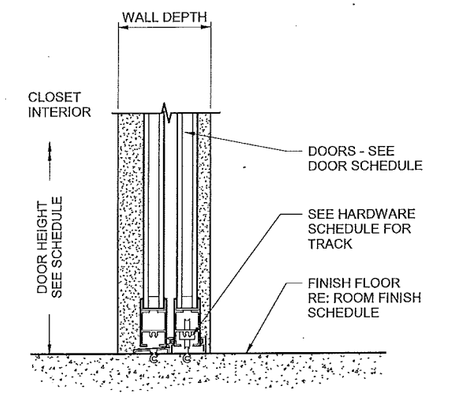
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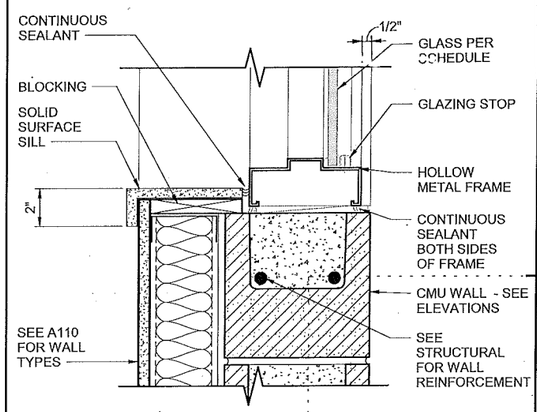
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NOT TO SCALE



DETAIL 2 (HEAD, JAMB & SILL) — 2
NOT TO SCALE



DETAIL 3 (HEAD, JAMB & SILL) — 3
NOT TO SCALE



DETAIL W1 (HEAD, JAMB & SILL) — 4
NOT TO SCALE

no.	date	by	ckd	description
0	7/10/20	KDT	RPL	ISSUED FOR BID

LICENSED ARCHITECT
RYAN P. LANG
C-2926
Date:
STATE OF WYOMING

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JULY 2020	N. ARYAN
designed	checked
K. THURMAN	R. LANG

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
ARCHITECTURAL DOOR & WINDOW DETAILS

project	contract
118706	

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ROOM FINISH SCHEDULE

ROOM NUMBER	ROOM NAME	FLOOR	BASE	WALLS				CEILING	REMARKS
				NORTH	SOUTH	EAST	WEST		
101	OFFICE	13	23	31	31	31	31	42	
102	OFFICE	13	23	31	31	31	31	42	
103	OFFICE	11	21	31	31	31	31	42	
104	CONFERENCE ROOM	13	23	31	31	31	31	42	
105	BREAK ROOM	11	21	31	31	31	31	42	
106	MENS LOCKER ROOM	12	22	33	33	33	33	41	
107	WOMENS LOCKER ROOM	12	22	33	33	33	33	41	
108	PUBLIC RESTROOM	12	22	32	32	31	32	41	
109	ENTRY HALL	11	21	31	31	31	31	42	
110	UTILITY ROOM	10	20	31	32	31	31	40	
111	ELEC ROOM	10	20	34	34	34	34	40	
112	VESTIBULE	11	21	31	31	31	31	43	
113	STORAGE	13	23	31	31	31	31	43	
114	STORAGE	13	23	31	31	31	31	43	
115	STORAGE	11	21	31	31	31	31	43	

REMARKS:
1. SEE SPEC DIVISION 9 FOR FLOOR, WALL, AND CEILING FINISHES. WALL AND FLOOR FINISHES TO BE APPROVED BY ARCHITECT PRIOR TO INSTALLATION.
2. ADMINISTRATION BUILDING SLAB-ON-GRADE TO HAVE STEEL TROWEL CONCRETE FINISH.
3. PAINT ALL UNFINISHED SURFACES THAT ARE EXPOSED TO VIEW.

ROOM FINISH LEGEND:

FLOOR
- 10 - HARD TROWEL CONCRETE FINISH - SEALED
- 11 - RUBBER TILE
- 12 - CERAMIC TILE
- 13 - CARPET TILE

BASE
- 20 - NO BASE
- 21 - RUBBER COVE BASE
- 22 - CERAMIC TILE COVE BASE
- 23 - RUBBER STRAIGHT BASE

WALL
- 30 - EXPOSED CONCRETE (NO FINISH)
- 31 - GYP. BOARD - PAINTED
- 32 - PAINT ON CMU
- 33 - CERAMIC TILE
- 34 - PLYWOOD PANELS - PAINTED WHITE

CEILING
- 40 - EXPOSED STRUCTURE
- 41 - MOISTURE RESISTANT GYPBOARD CEILING
- 42 - ACOUSTIC CEILING TILE
- 43 - GYP. BOARD CEILING

CASEWORK SCHEDULE

MARK	QTY	DESCRIPTION	WIDTH	DEPTH	HEIGHT	REMARKS
K1	1	2 DOOR/DRAWER BASE	4'-0"	2'-0"	2'-9"	1, 2
K2	3	2 DOOR/DRAWER BASE	3'-0"	2'-0"	2'-9"	1, 2
K3	1	4 DRAWER BASE	1'-6"	2'-0"	2'-9"	1, 2
K4	1	2 DOOR SINK BASE	3'-0"	2'-0"	2'-9"	1, 2
K5	1	PULL OUT TRASH BASE	1'-0"	2'-0"	2'-9"	1, 4
K6	1	2 DOOR/DRAWER CORNER BASE	3'-0"	2'-0"	2'-9"	1, 2
K7	2	2 DOOR WALL CABINET	3'-0"	1'-0"	2'-6"	2
K8	1	CORNER WALL SHELVING	3'-0"	1'-0"	2'-6"	2
K9	1	CORNER WALL SHELVING	6'-0"	1'-3"	2'-6"	2
K10	1	2 DOOR WALL CABINET	3'-0"	1'-3"	2'-6"	2
K11	1	2 DOOR WALL CABINET	3'-0"	1'-3"	2'-6"	3
K20	1	SOLID SURFACE COUNTERTOP		2'-1"	2'-10"	6
K21	1	SOLID SURFACE COUNTERTOP		2'-1"	2'-10"	6
K22	1	SOLID SURFACE COUNTERTOP		2'-1"	2'-10"	6
S1	3	HARDWOOD SHELVING	6'-0"	1'-6"	7'-0"	7

CASEWORK REMARKS:
1. ADA HEIGHT COUNTER TOP.
2. PROVIDE ADJUSTABLE SHELVING, MINIMUM OF (2) SHELVES.
3. PROVIDE CONCEALED DISH DRYING RACK. DRIP DRY® MODEL DDC28 OR APPROVED EQUAL, thedripdry.com
4. SIZE FOR (2)-27QT TRASH CANS.
5. EQUAL SPACED SHELVES AT 18" OC, WITH FIRST SHELF AT 30" AFF.
6. CONTINUOUS BACKSPASH. PROVIDE LENGTHS AS REQUIRED TO FIT CABINETRY.
7. PROVIDE SHELVING AT ALL STORAGE CLOSETS. CONFIGURATION TO BE COORDINATED WITH OWNER.

FURNITURE SCHEDULE

MARK	QTY	DESCRIPTION	MODEL	MANUFACTURER	REMARKS
F1	8	CONFERENCE TABLE	TARA-3060-LJSNYH4	Haworth	30"X60"
F2	2	BREAKROOM TABLE	TARA-3660-LJSNYH4	Haworth	36"X60"
F3	2	OFFICE TABLE	TARN-3030-LJSNXG4A	Haworth	
F4	3	SIT/STAND DESK	TS00-2H7S	Haworth	WITH MODESTY PANEL F20
F5	31	CONFERENCE AND SIDE CHAIRS	SCS-34-31E	Haworth	
F6	10	BREAKROOM CHAIRS	SCC-34-12E	Haworth	
F7	3	OFFICE CHAIR	SJT-30-711A1A	Haworth	
F10	3	FILE CABINET	JLPD-0230-SJA	Haworth	
F11	3	BOOKCASE	JBCS-0230	Haworth	
F12	3	DESK DRAWERS	JPAH-24-SJ	Haworth	
F13	5	FILE CABINET	JLPD-0330-SJ	Haworth	
F14	3	UPPER STORAGE	UUFS-1648-PWL	Haworth	
F20	3	MODESTY PANEL	TA0M-1354-LF	Haworth	
F21	7	SUPPORT PANEL		Haworth	COLOR TO MATCH WORKSURFACE
F22	1	SUPPORT PANEL		Haworth	COLOR TO MATCH WORKSURFACE
F30	1	WORK SURFACE	WURA-24B4-LJSA	Haworth	2'-0" X 9'-8", WUAR-7200-PHS SUPPORT BAR
F31	1	WORK SURFACE	WURA-2484-LJSA	Haworth	2'-0" X 7'-0"
F32	2	WORK SURFACE	WURA-24A8-LJSA	Haworth	2'-0" X 9'-0"
F33	1	LAMINATE TOP	JTPL-1890-JYJYS	Haworth	1'-6" X 7'-6"
F34	1	LAMINATE TOP	JTPL-1860-JYJYS	Haworth	1'-6" X 5'-0"
F40	4	DRY ERASE BOARD	52676/28326	Staples	3'-0" x 5'-0"
F41	3	WALL MOUNT TACKBOARD	KUAF-1648	Haworth	
F42	3	UNDERMOUNT TASK LIGHT	LUTN-0031-19ULDN	Haworth	
F43	3	KEYBOARD TRAY	6FB259-S12	Humanscale	
F44	3	DESK MOUNT MONITOR ARM	M21CMSBTB	Humanscale	
F50	1	25 CU. FT. SIDE BY SIDE REFIGERATOR	WRS315SNHM	Whirlpool	
F51	1	MICROWAVE	NN-SN686S	Panasonic	
F52	1	SMART BOARD 6000 PRO SERIES	6375P	SMARTBoard®	

SCHEDULE REMARKS:
1. PRODUCTS PROVIDED ARE A BASIS OF DESIGN TO SET A MINIMUM STANDARD. SUBSTITUTIONS ARE PERMITTED ONLY WITH PRIOR APPROVAL OF THE ARCHITECT OR OWNER.
2. FURNITURE CONTACT:
   ENCOMPAS
   SUSAN KIDD
   916.285.6467
   susan@encompas.com

no.	date	by	ckd	description
0	7/10/20	KDT	RPL	ISSUED FOR BID

BURNS McDONNELL
9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

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JULY 2020	N. ARYAN
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K. THURMAN	R. LANG

LICENSED ARCHITECT
RYAN P. LANG
C/2926
STATE OF WYOMING
Date:

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LARAMIE COUNTY, WYOMING

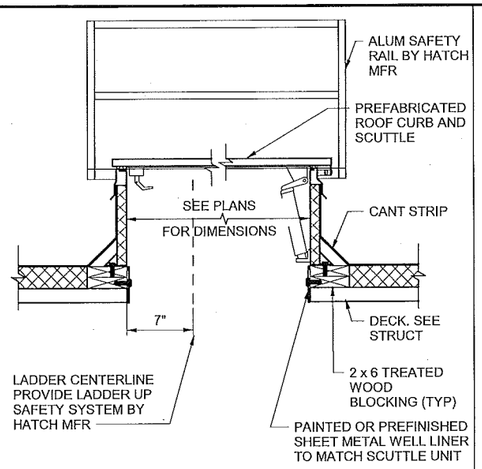
HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
ADMINISTRATION BUILDING ROOM FINISH SCHEDULE AND DETAILS

project	contract
118706	

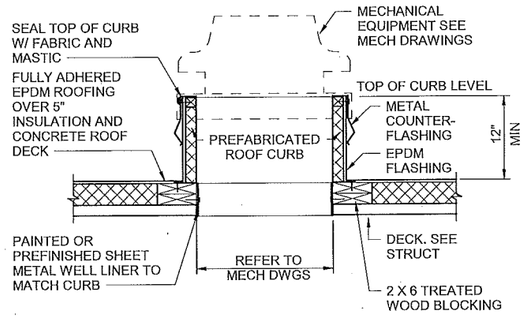
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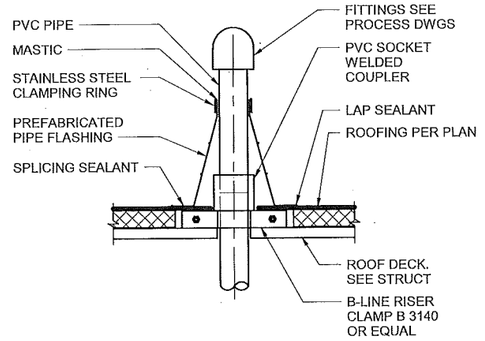
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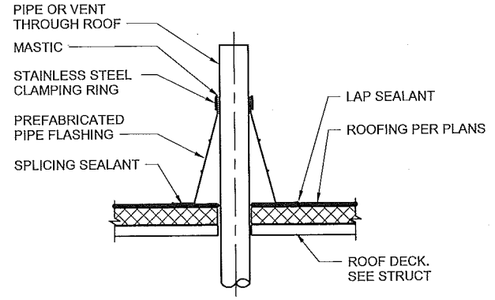
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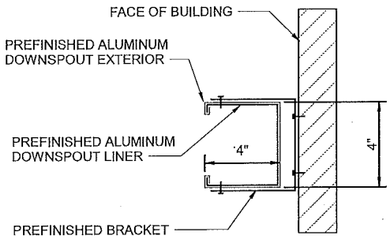
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TYP PVC VENT PIPE FLASHING DETAIL
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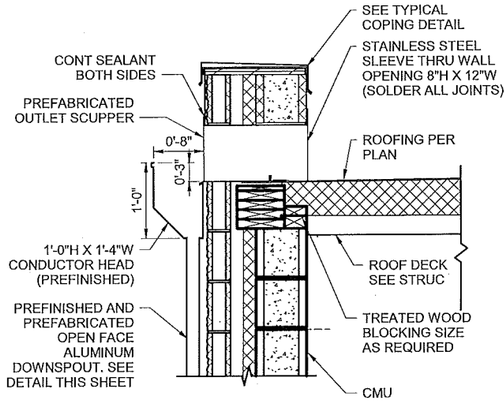
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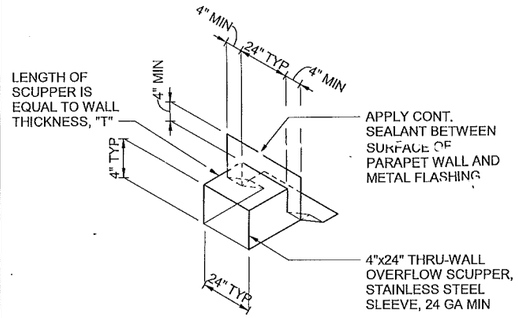
NOTE:

USE CLOSED FACE WHERE DOWNSPOUT IS NOT VERTICAL AND A MIN OF 12" BEYOND TRANSITION.

TYPICAL DOWNSPOUT SECTION
NOT TO SCALE



TYPICAL WALL SECTION @ SCUPPER
NOT TO SCALE



SECONDARY OVERFLOW SCUPPER
NOT TO SCALE

no.	date	by	ckd	description
0	7/10/20	KDT	RPL	ISSUED FOR BID

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FRONT ENTRANCE AND SCALE HOUSE

ARCHITECTURAL DETAILS I

project	contract
118706	

drawing **A114** — rev. **0**

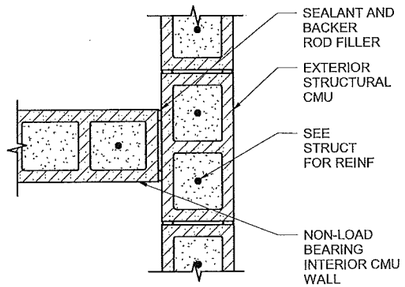
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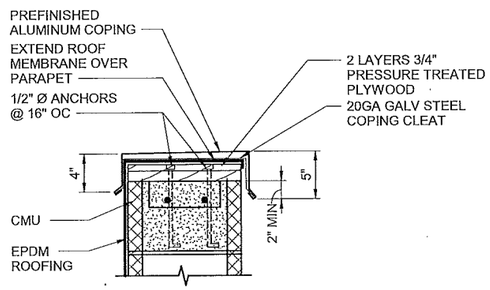
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C-2926
Date:
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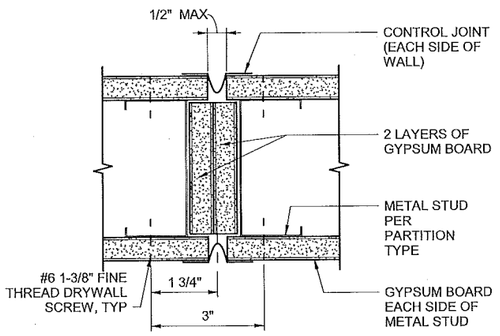
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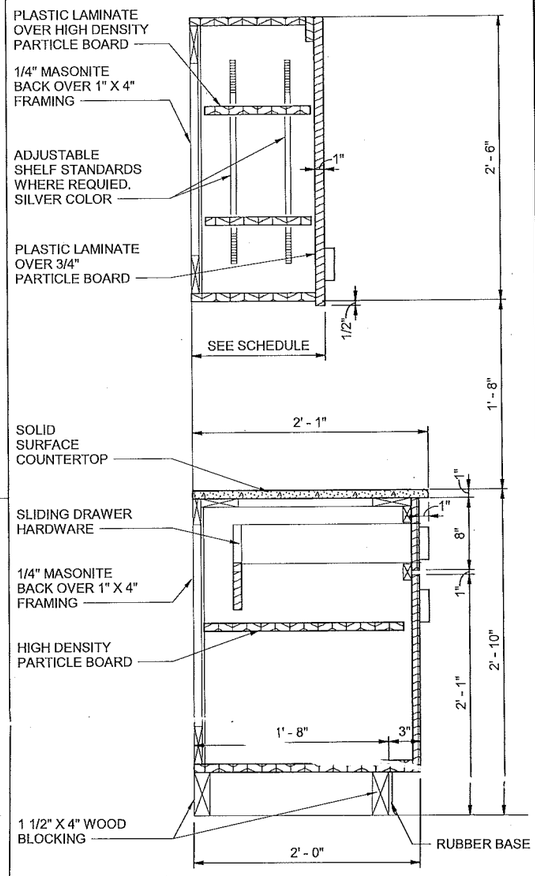
JOINT @ EXTERIOR WALL
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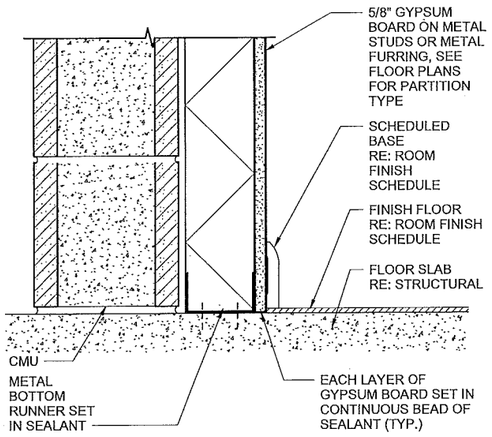
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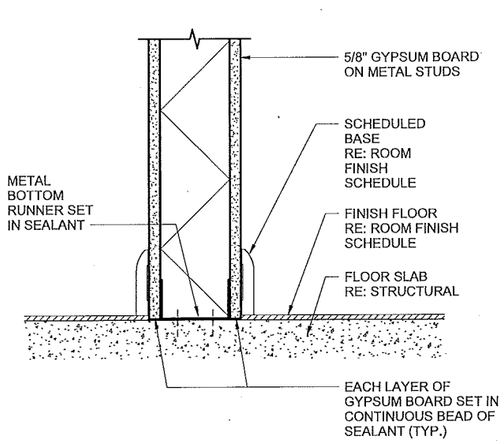
GYPSUM BOARD CONTROL JOINT
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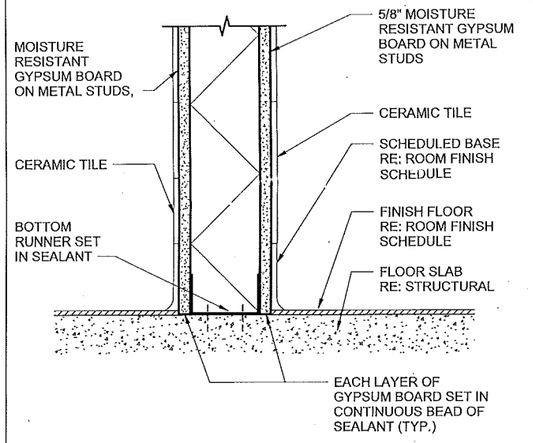
CASEWORK SECTION — 1
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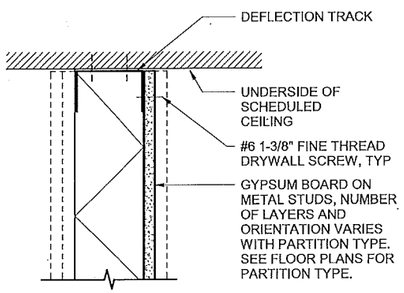
INTERIOR PARTITION BASE @ MASONRY WALL
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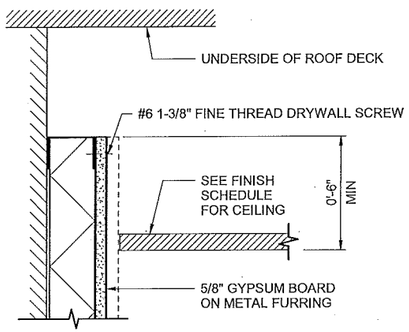
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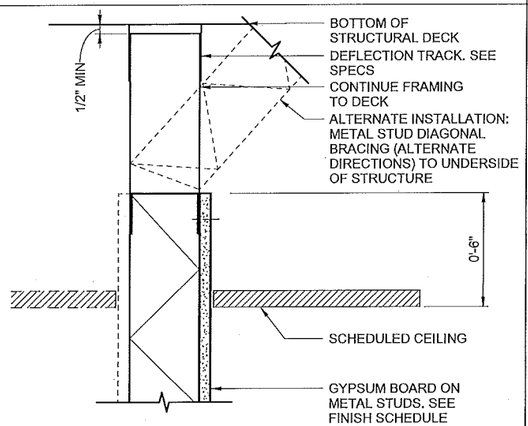
PARTITION BASE AT BATHROOM
NOT TO SCALE



INTERIOR PARTITION CEILING CONNECTION DETAIL
NOT TO SCALE



INTERIOR PARTITION CEILING DETAIL @ MASONRY WALL
NOT TO SCALE



INTERIOR PARTITION BRACING DETAIL
NOT TO SCALE

no.	date	by	ckd	description
0	7/10/20	KDT	RPL	ISSUED FOR BID

BURNS McDONNELL
9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	N. ARYAN
designed	checked
K. THURMAN	R. LANG

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ARCHITECTURAL DETAILS II

project	contract
118706	

drawing A115 — rev. 0

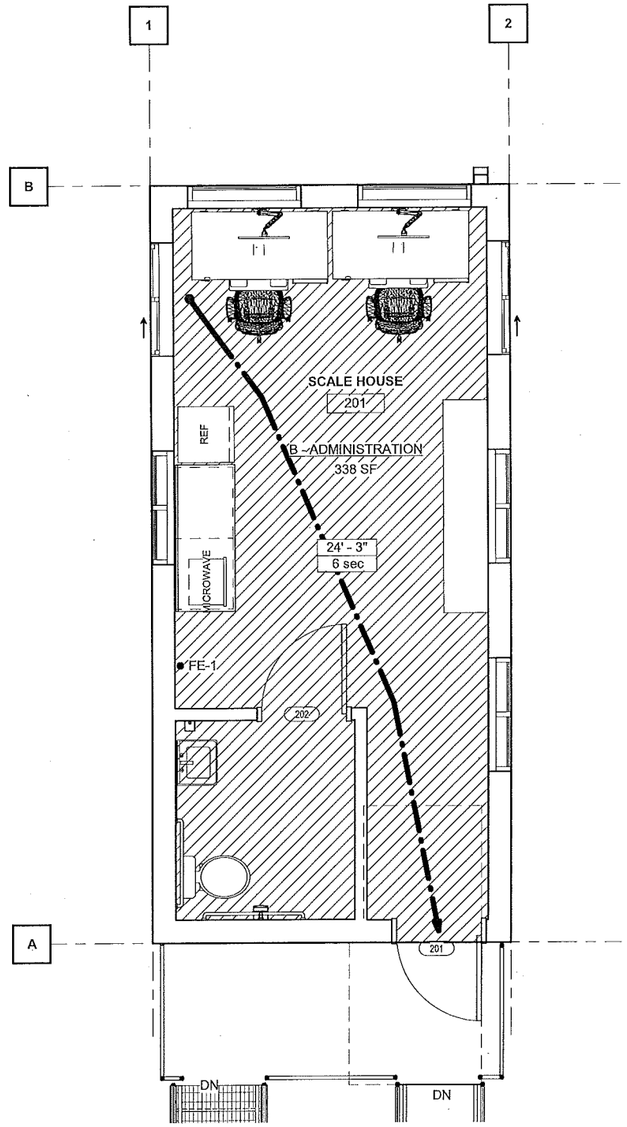
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LICENSED ARCHITECT
BRYAN P. LANG
C-2926
Date:
STATE OF WYOMING

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LIFE SAFETY PLAN

0 2' 4' 8'

SCALE IN FEET

NORTH

CODE REVIEW: SCALE HOUSE

CODES

2018 INTERNATIONAL BUILDING CODE
2018 INTERNATIONAL ENERGY CONSERVATION CODE
2018 INTERNATIONAL MECHANICAL CODE
2018 INTERNATIONAL PLUMBING CODE
2018 INTERNATIONAL FUEL GAS CODE
2018 INTERNATIONAL FIRE CODE
2017 NATIONAL ELECTRICAL CODE

CHAPTER 3 - USE AND OCCUPANCY CLASSIFICATION

OCCUPANCY TYPE	OCCUPANCY GROUP	DESCRIPTION	AREAS APPLIED
B	-	BUSINESS	ALL

CHAPTER 5 - GENERAL BUILDING HEIGHTS AND AREAS
SECTION 504 - BUILDING HEIGHT AND NUMBER OF STORIES

OCCUPANCY	ALLOWABLE BUILDING HEIGHT (FT) TABLE 504,3	ALLOWABLE NUMBER OF STORIES TABLE 504,4	ACTUAL BUILDING HEIGHT (FT)
B	55	2	12

SECTION 506 - BUILDING AREA

OCCUPANCY	ALLOWABLE AREA PER TABLE 506,2 (SF)	ACTUAL FLOOR AREA	RATIO OF ACTUAL TO ALLOWABLE AREA
B	9,000	338	0,04

CHAPTER 6 - TYPES OF CONSTRUCTION
SECTION 602 - CONSTRUCTION CLASSIFICATION

CLASSIFICATION	TYPE
II	B

TABLE 601 - FIRE-RESISTANCE RATING REQUIREMENTS

BUILDING ELEMENT	RATING (HOURS)
ALL	0

CHAPTER 9 - FIRE PROTECTION AND LIFE SAFETY SYSTEMS
SECTION 903 - AUTOMATIC SPRINKLER SYSTEMS
SPRINKLER SYSTEM IS NOT REQUIRED IN B OCCUPANCY PER SECTION 903.2
SECTION 905 - STANDPIPE SYSTEMS
STANDPIPE SYSTEM IS NOT REQUIRED PER SECTION 905.3
SECTION 906 - PORTABLE FIRE EXTINGUISHERS
PORTABLE FIRE EXTINGUISHERS WILL BE INSTALLED THROUGHOUT PER SECTION 906.1
SECTION 907 - FIRE ALARM AND DETECTION SYSTEMS
MANUAL FIRE ALARM SYSTEM IS NOT REQUIRED PER SECTION 907.2.2

CHAPTER 10 - MEANS OF EGRESS
SECTION 1004 - OCCUPANT LOAD

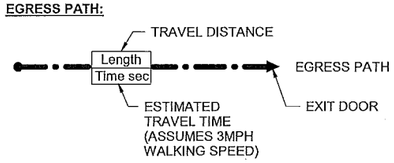
FUNCTION	OCCUPANT LOAD FACTOR	ACTUAL FLOOR AREA (SF)	MAX OCCUPANCY
BUSINESS	150	338	2

SECTION 1005 - MEANS OF EGRESS SIZING
2OCCUPANTS*0.2IN/OCCUPANT = 0.4IN REQUIRED < 32" PROVIDED
1 EXIT REQUIRED, 1 EXIT PROVIDED FOR A TOTAL OF 32 INCHES PROVIDED

LIFE SAFETY KEY:

- FE-# 1. MULTI-PURPOSE DRY CHEMICAL TYPE EXTINGUISHER. UL OR FM RATED 1-A:10:B:C. 5LB NOMINAL CAPACITY IN ENAMEL-STEEL CONTAINER.

EGRESS PATH:



OCCUPANCY LEGEND

B - ADMINISTRATION

LICENSED ARCHITECT
RYAN P. LANG
C-2926
Date:
STATE OF WYOMING

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N

ADMIN BLDG

SCALE BLDG

KEY PLAN

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

SCALE HOUSE LIFE SAFETY PLAN

project	contract
118706	

drawing A200 — rev. 0

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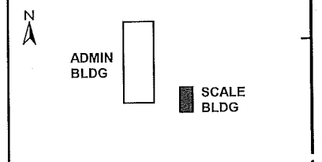
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SCALE HOUSE BUILDING PERFORMANCE CRITERIA

General Information	
Site Location	Cheyenne, WY
Building Codes	International Building Code, 2018 w/ City of Cheyenne Amendments
	International Energy Conservation Code, 2018
	NFPA 70, National Electric Code, 2017
	NFPA 10, Standard for Portable Fire Extinguishers, 2010
	International Mechanical Code, 2018 w/ City of Cheyenne Amendments
	International Fuel Gas Code, 2018 w/ City of Cheyenne Amendments
	NFPA 72, National Fire Alarm and Signaling Code
General Building Configuration	
Length (ft-in)	See Plan
Width (ft-in)	See Plan
Height (ft-in)	12' - 0"
Ceiling Height (ft-in)	9' - 0"
Minimum Design Load Requirements	
Dead Load	Weight of Materials of Construction as Determined by Building Manufacturer
All Other Load Criteria	Reference "Structural General Notes" on Drawing S-001 and
	"Assumed Loading Information - Scale House Building" on Drawing S200
Exterior Doors	
Door Quantity and Construction	(1) South Entry (Door 201) 18ga Hollow Metal door with Steel Frame
Door Size	36" x 84"
Door Special Requirements	Half Lite Panel (W=24" x H=30" - bottom of panel 48" a.f.f. max.)
Door Finish	Painted to match doors at Main Building
Door Hardware	(3) BB5 heavy weight ball bearing hinge - US32D, or equivalent
	Panic bar (electronic latch retraction and integral request to exit) - Entry - US32D, or equivalent
	"Best Lock System" lock cylinder
	416 closer with heavy duty arm or equivalent
	SW-R 36" mill finish door sweep or equivalent
	TH5 36" mill finish saddle threshold or equivalent
	Reese 775A weather-strip, or equivalent
Interior Doors	
Door Quantity and Construction	(1) Restroom (Door 202) Wood Door with Steel Frame, Painted
Door Size	36" x 84"
Door Finish	Stained
Door Hardware	(3) BB5 heavy weight ball bearing hinge - US32D, or equivalent
	Design Hardware Z-series cylindrical lever set - Privacy - US32D, or equivalent
	Design Hardware 416 closer with heavy duty arm, or equivalent
	Design Hardware SS-S door gasket, or equivalent
	Design Hardware WS-CC wall stop - US32D, or equivalent
	Design Hardware KP050 kick plate 10" x 34" - US32D - Each Side, or equivalent
Windows	
Window Quantity and Material	(3) Type 1 Aluminum Frame
Window Size	48"x48"
Window Basis of Design	EFCO Series 3500 or approved equal
Glazing	Sealed Insulating Glass
Window Accessories	Operable, Insect Screen
Window Quantity and Material	(2) Type 2 Aluminum Frame
Window Size	48"x48"
Window Basis of Design	EFCO Series 3500 or approved equal
Glazing	Sealed Insulating Glass
Window Accessories	None
Window Quantity and Material	(2) Type 3 Aluminum Frame
Window Size	48"x44"
Window Basis of Design	Ready Access 275 Single panel manual open/self closing slider
Glazing	Sealed Insulating Glass
Window Accessories	Interior mounted Stainless steel shelf
Minimum Thermal Requirements	
Floors	Minimum R-10
Walls	Minimum R-13 + R-13 continuous insulation
Roof	Minimum R-30 continuous
Exterior Doors	U-0.37
Operable Windows	U-0.43, SHGC-0.40
Fixed Windows	U-0.36, SHGC 0.40
Building Interior Finishes	
Flooring by Building MFR(UNO)	18"x18" Flexco Rubber Tiles: CE-103 French Gray w/ Black, Smooth Profile, or Architect approved equal
Flooring at Restroom by Building MFR	12"x24" Daltile Porcelain Tile: Ironcraft Casper Gray, Matte Finish, or Architect approved equal.
Walls by Contractor (UNO)	5/8" Painted Gypsum Board. Provide 1-5/8" metal stud furring
Walls at Restrooms by Contractor	Full height 12"x24" Daltile Porcelain Tile: Ironcraft Casper Gray, Matte Finish, or Architect approved equal.
Base by Contractor(UNO)	4" Flexco Wallflowers Cove Base, Medium Gray 014. or Architect approved equal.
Base at Restroom by Contractor	6" x 12" Ironcraft porcelain cove tile, Casper Gray or Architect approved equal
Ceiling by Building MFR (UNO)	24"x24" acoustic ceiling tiles
Ceiling at Restroom by Contractor	Painted Gypsum Board
Casework by Contractor	Base Cabinets BOD: Plastic laminate with matching PVC edge and white melamine interiors. Countertop, Back & Sidesplash BOD: Solid surface per Seciton 06 40 23. Match Administration Building. Cabinet doors and drawers to be flush style, type A-Frameless construction. Height of base cabinet with countertop shall be 2'-10" AFF. Base cabinet depth to be 24" UNO.
Building Exterior Finishes	
Metal Panel Walls	Color and Gloss: MBCI Singature® 300 Almond or Approved Equal.
Metal Panel Roof	Dark Bronze to match Awnings and Coping at Administraiton Building
Plumbing	
Domestic Water	All domestic water piping shall be copper. Install shut-off valves in accessible locations. Insulate all hot and cold water piping above the ground with 1" elastomeric pipe insulation and PVC jacketing. No domestic water piping shall be exposed to freezing conditions.
Water Meter and Backflow Prevention	Provide code approved backflow preventer on domestic water entrance piping, and compound series water meter.
Domestic Water Accessories	Provide bladder tank if necessary to ensure potable water system will function per code and manufacturer requirements under "normal peak" conditions with 59 psig pressure available at the building and "extreme peak" conditions with 53 psig pressure is available at the building. Perform domestic water pressure drop calculation to confirm the system design meets the required pressure.
Sanitary	All waste and vent piping shall be no-hub cast iron piping.
Floor Drains	Provide cast iron floor drains with polished nickel bronze strainer in restroom.
Water Heater	One Electric instantaneous water heater capable of providing 1.0 gpm hot water at a 65 degree rise, serving the restroom lavatory.
Water Closet	Floor Mount, Vitreous China low-flow Water Closet with exposed flushometer (1.28 gpf maximum) and open front elongated seat, less cover.
Lavatory	Wall mount, deep single bowl, white vitreous china lavatory with chrome single handle manual faucet, with 0.5 GPM aerator.

HVAC	
HVAC Unit Type	Exterior Wall Mount Unit Constant Volume Air Conditioner with individual thermostat.
Outside Air Intake	Provide adequate makeup air and ventilation per ASHRAE 62.1. Provide motorized damper in outside air intake to close off outside air when gas detection is in alarm.
Cooling Capacity	As required to maintain 75 degree indoor temperature with 95 degree ambient outdoor temperature. Provide with epoxy coated condenser coil
Heating Capacity	Electric strip heat as required to maintain 70 degree indoor temperature with 0 degree ambient outdoor temperature
Fan Capacity	Fan adequately sized to overcome dirty filter, ductwork, balancing damper and air device pressure drop.
Thermostat/Control Panel	Honeywell T775B or similar - 7 day programmable with emergency shutdown, unit failure and high temp alarm
Power	See Electrical for power service
Pressurization	Positive pressurization is required to prevent heat and humidity infiltration. Provide increased positive pressure in locations with operable windows to prevent infiltration of vehicle exhaust. Purge and pressurization per NFPA 496 is not required.
Supply Air Device	Lay-in Ceiling Diffuser, Titus TMS or similar. Wall mounted Registers, Titus 301FL or similar in wall sized to throw 50 fpm to opposite wall
Return Air Grille	Titus 350 RL or similar for wall applications, Titus 50F or similar for ceiling applications
Transfer Air	Provide transfer air openings and acoustically lined ductwork as necessary to transfer return air back to air conditioner return grille.
Supply Air Ductwork	Supply galvanized steel ductwork with 2" external fiberglass wrap insulation and balancing dampers installed above suspending ceiling and routed to supply diffusers.
Exhaust Fan	Inline Centrifugal to exhaust 1 cfm per sf from restrooms. Ceiling mounted exhaust fan, Greenheck SP-B or similar
Exhaust Duct Termination	Hooded Wall Cap with Birdscreen and backdraft damper
Exhaust Fan Accessories	Provide with disconnect switch.
Coil Coating	All condenser coils shall include a phenolic coating. The condenser shall be rated with phenolic coating applied and rated at a higher temperature than ambient.
Fire Dampers	Provide UL 555 compliant, 1-1/2 hr, dynamic rated fire damper per 2018 IBC.
Electrical	
Exterior Area Classification	Unclassified
Interior Area Classification	General Purpose
Exterior Service Power Connection	120/240V, 1-Phase, 3-Wire, 60 Hz
Interior Lighting	Main - (5) 2'x2' LED Troffer. Refer to ceiling plan for locations.
	Restroom - (1) 4' Surface-mount LED bracket. All rooms must have manual ON/OFF switches
Interior Lighting Control	Main - Minimum (1) ceiling mounted occupancy sensor(s). Refer to ceiling plan for locations.
	Restroom(s) - Wall switch combination type vacancy sensor.
Exterior Lighting	WST Wall mounted LED with Dusk-to-Dawn photocell and power supply - mounted on north and south walls of Scale house
Exterior Lighting Control	Photocell - built into specified fixture - if other fixture is selected, photocell to be located on or above roofline and facing horth .
Average Illumination Levels	Main: 20 foot-candles
	Restroom(s): 10 (20 at vanities) foot-candles
	Building Exterior: 1 foot-candle
	Egress Lighting: Provide in accordance with NFPA 101 for a minimum duration of 1-1/2 hours. Provide not less than an average of 1 ft-candle and, at any point, not less than 0.1 ft-candle measured along the path of egress at floor level. Provide emergency battery ballast for egress lighting.
Misc. Equipment & Electrical Loads	Main: Minimum of (6) convenience receptacles. Refer to floor plan for locations.
	Restroom(s): Minimum (1) GFCI convenience receptacle, located near sink.
	Exterior: Minimum (1) GFCI 'weatherproof while in use' convenience receptacles. All exterior HVAC and Electrical equipment shall have one receptacle located within 25'.
	Microwave(s): (1) dedicated 20A circuit, with 20A-120V receptacle each
	Refrigerator(s): (1) 20A-120V receptacle each
	Water Cooler: (1) 20A-120V receptacle each
	HOP Table(s): (1) quad receptacle each
	Scale Display: Provided and installed by electrical contractor
	IT Equipment: Coordinate all IT/Telecommunications equipment requirements with owner. Provide 20A-120V receptacles as required to serve these loads.
	Mechanical/HVAC Equipment: Coordinate and provide all power requirements with Mechanical section
	Plumbing Equipment: Coordinate and provide all power requirements with Plumbing section
Building Service Size	Reference Electrical, Mechanical, and Plumbing sections to size the building service ampacity. Size shall allow for all building loads with minimum 30% additional spare capacity.
Building Service Equipment	Interior, recessed mounted 240/120V DELTA 50A MCB panelboard with minimum 20% spare breakers.
Building Service Disconnect	Non-fused disconnect switch. Mounted to building exterior. Size and rating shall match that of service equipment and s hall be service entrance rated
HVAC Disconnect(s)	Size and rating shall match that of equipment to be served. Provided separately or by HVAC manufacturer.
Lightning Protection	Contractor shall furnish and install a complete lightning protection system. The system shall be designed and installation supervised by a firm that is approved and listed by UL, Inc. The system shall comply with the latest edition of UL96A, NFPA 70, and NFPA 780. Reference Section 26 41 13 for specification on Lighting Protection for Strcuctures
	At the completion of the lightning protection system installation, a UL master label shall be acquired in the corporations name verifying the installation meets the requirements for a UL master label per UL96A.
	Air terminals to be placed at each corner of the building. Distance between air terminals not to exceed 25'.
	Confirm exact mounting location of all mechanical equipment with mechanical contractor prior to rough-in.
	Bond lightning protection system down conductor to grounding. Down conductors shall be fully concealed in PVC schedule 40 conduit within the building walls.
	Bare Ground Conductor: #4/0 aluminum.
	Down Conductor: #4/0
Telecommunications	
Horizontal Cabling	CAT6A. Verify with client prior to installation.
Outlet Connections	RJ45
Drops	(1) Each workstation
Wireless Equipment	Drops for wireless access point (WAP) every 2,500 sq.ft. with additional 10% coverage.
Building Service Connection	Provide exterior fiber pullbox for connection to incoming telecommunication service. Provide conduit from box to MEP Utility Room
Other Requirements	
Engineer of Record	Drawings shall be signed and sealed by professional engineer registered in the state of the project site.
3rd Party Review	Vendor shall provide fabrication shop drawings to be reviewed and approved by owner contracted consultants prior to commencing fabrication
Radio Signal Repeater Couplings	Provide 4 couplings in building exterior wall capped for future roof mounted antennas.
Deposit Safe	ULINE Model H-7767. Mount safe inside cabinet C1.
Stair and Access Ramp	Provide prefabricated aluminum stair and ADA access ramp. Design per IBC requirements.

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KEY PLAN

BURNS McDONNELL
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303-721-9292

date: JULY 2020	detailed: N. ARYAN
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LARAMIE COUNTY, WYOMING

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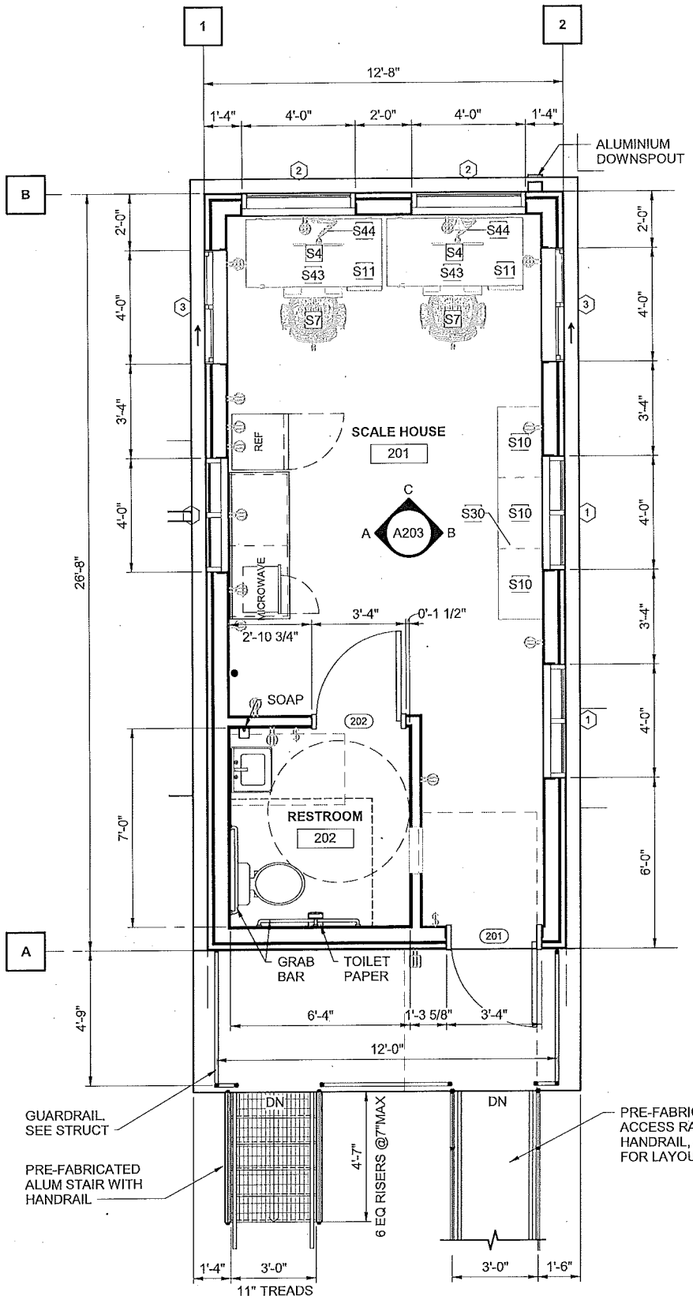
SCALE HOUSE PERFORMANCE CRITERIA

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drawing: A201	rev.: 0
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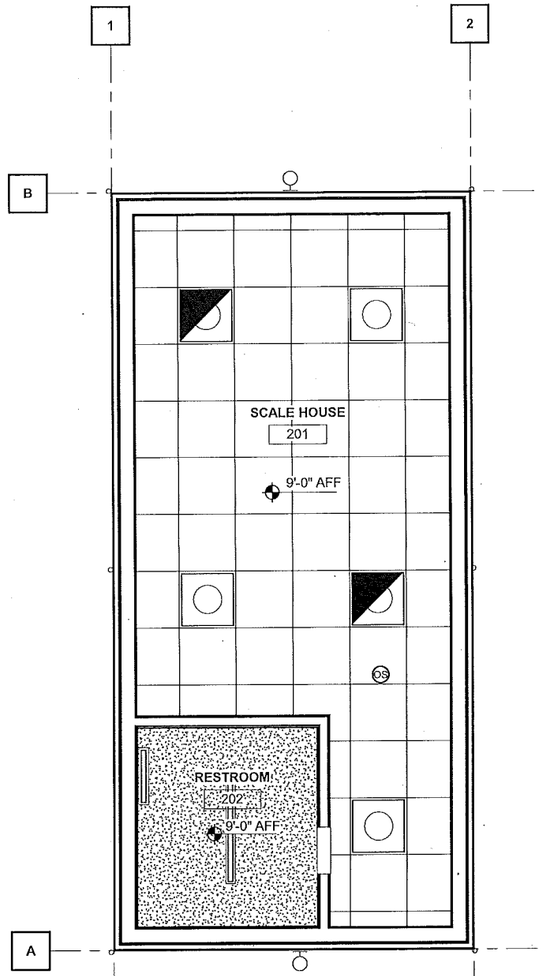


FINISHED FLOOR PLAN

0 2' 4' 6'

SCALE IN FEET

NORTH



REFLECTED CEILING PLAN

0 2' 4' 6'

SCALE IN FEET

NORTH

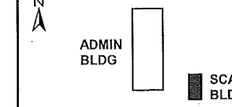
GENERAL FLOOR PLAN NOTES:

1. BUILDING MANUFACTURER TO PROVIDE ALL ITEMS SHOWN ON THIS FLOOR PLAN INCLUDING CONNECTION TO ELECTRICAL EQUIPMENT AND DEVICES, MECHANICAL EQUIPMENT, AND PLUMBING EQUIPMENT UNLESS NOTED N.I.C.
2. DOOR LOCATIONS NOT DIMENSIONED ARE 6" FROM FINISHED FACE OF WALL TO JAMB FACE. VERIFY PULL SIDE CLEARANCE OF 18" FROM STRIKE TO INTERSECTING FINISH FACE OF WALL. NOTIFY OWNER FOR NON-COMPLIANCE PRIOR TO SETTING DOOR FRAME.
3. ALL WORK SHALL COMPLY WITH ALL APPLICABLE CODES AND STANDARDS AS LISTED OR REFERENCED IN THE PERFORMANCE CRITERIA OR AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
4. ALL PARTITIONS ARE 3-5/8" METAL STUD FRAMING @ 16" OC W/ ONE LAYER OF 5/8" GYPSUM WALL BOARD ON BOTH SIDES OF FRAMING. TERMINATE AT STRUCTURE ABOVE.
5. ALL COLUMN ENCLOSURES ARE 1-5/8" METAL STUD FRAMING @ 16" OC W/ ONE LAYER OF 5/8" GYPSUM WALL BOARD ON ONE SIDE OF FRAMING. TERMINATE AT STRUCTURE ABOVE.
6. WALL TO BE LOCATED ALIGNMENT WITH STRUCTURAL COLUMNS SUCH THAT FINISH FACE IS CONTINUOUS WHERE APPLICABLE .
7. PROVIDE MOISTURE RESISTANT GYPSUM BOARD IN RESTROOMS AND AT ALL SINK LOCATIONS.
8. PROVIDE 9" X 9" ADA COMPLIANT PLAQUE SIGNS AT ALL CODE REQUIRED SPACES.
9. FURNITURE, TVS, WHITEBOARDS, CASEWORK, AND APPLIANCES SHOWN SHALL BE PROVIDED BY CONTRACTOR. LOCATIONS PROVIDED TO ALLOW FOR COORDINATION. BUILDING MANUFACTURER TO PROVIDE ALL REQUIRED UTILITIES AND BLOCKING AT THESE LOCATIONS.
10. FURNITURE SHOWN IS THE BASIS OF DESIGN. ACTUAL FURNITURE WILL BE SELECTED BY CLIENT IN COMPLIANCE WITH THE FURNITURE ALLOWANCE PROVIDED IN THE CONTRACT.

PLAN LEGEND:

- EXPOSED CEILING
- GYPSUM BOARD - PAINT
- 2'X2' ACOUSTICAL CEILING TILE,
- LIGHT FIXTURE - RECESSED
- STRIP LIGHT - RECESSED OR WALL MOUNTED
- 10' - 0" CEILING HEIGHT ABOVE FINISH FLOOR
- EXTERIOR FIXTURE
- OS OCCUPANCY SENSOR
- RECEPTACLE
- DATA CONNECTION
- $ SWITCH

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SCALE HOUSE FLOOR AND REFLECTED CEILING PLAN

project	contract
118706	

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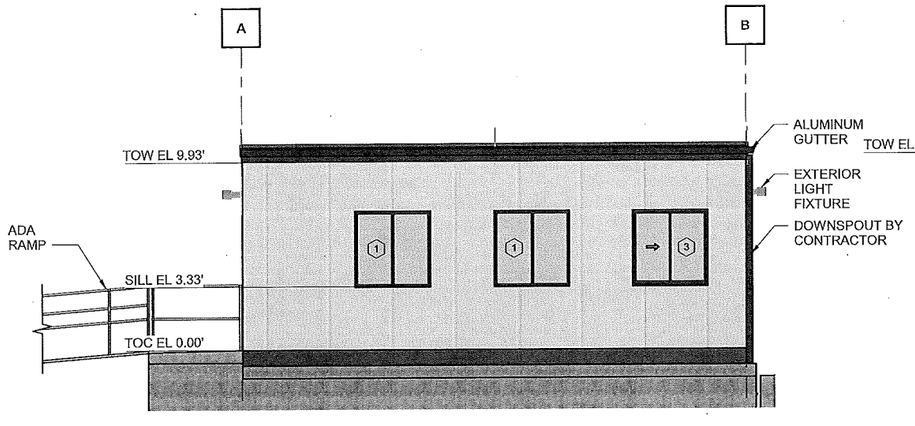
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FURNITURE & EQUIPMENT SCHEDULE

MARK	QTY	DESCRIPTION	MODEL	MANUFACTURER	COMMENTS
B1	1	AUTOMATIC WALL MOUNTED LIQUID SOAP DISPENSER	B-2012	Bobrick Washroom Equipment, Inc.	
B2	1	TEMPERED GLASS WELDED FRAME MIRROR	B-2908	Bobrick Washroom Equipment, Inc.	
B3	1	ADA GRAB BARS	B-5806	Bobrick Washroom Equipment, Inc.	
B4	1	MULTI-ROLL TOILET PAPER HOLDER	B-4288	Bobrick Washroom Equipment, Inc.	
C1	2	DOUBLE DOOR/DRAWER			2'-6"W X 2'-9"H X 2'-0"D
C2	1	SOLID SURFACE COUNTERTOP			1" THICKNESS
S4	2	SIT/STAND DESK	TS00-2H7S	Haworth	
S7	2	OFFICE CHAIR	SJT-30-711A2A	Haworth	
S10	3	FILE CABINET	JPMA-18-SJC	Haworth	
S11	2	FILE CABINET	JLPD-0330-SJ	Haworth	
S30	1	WORK SURFACE	JTPL-1890-JYJYS	Haworth	
S43	2	KEYBOARD TRAY	6FB259-S12	Humanscale	
S44	2	DESK MOUNT MONITOR ARM	M21CMSBTB	Humanscale	
S50	1	UNDERCOUNTER REFRIGERATOR	GCE06GSHSB	General Electric	STAINLESS STEEL
S51	1	MICROWAVE	NN-SN686S	Panasonic	

NOTES:

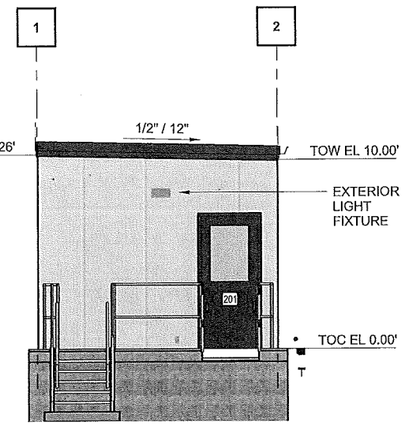
1. SEE PERFORMANCE CRITERIA FOR FINISHES.
2. PRODUCTS PROVIDED ARE A BASIS OF DESIGN TO SET A MINIMUM STANDARD. SUBSTITUTIONS ARE PERMITTED ONLY WITH PRIOR APPROVAL OF THE ARCHITECT OR OWNER.
3. FURNITURE CONTACT:
   ENCOMPAS
   SUSAN KIDD
   816.285.6467
   susan@encompas.com



EAST ELEVATION

0 2' 4' 8'

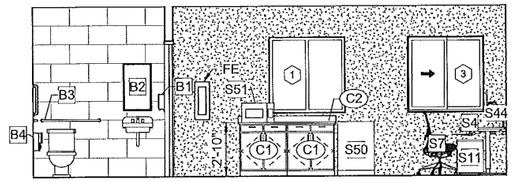
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SOUTH ELEVATION

0 2' 4' 8'

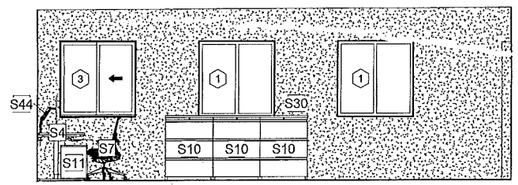
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INTERIOR ELEVATION A / A202

0 2' 4' 8'

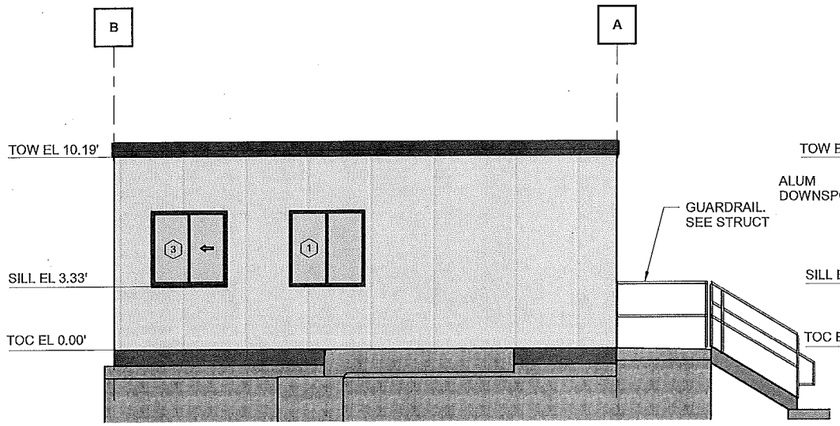
SCALE IN FEET



INTERIOR ELEVATION B / A202

0 2' 4' 8'

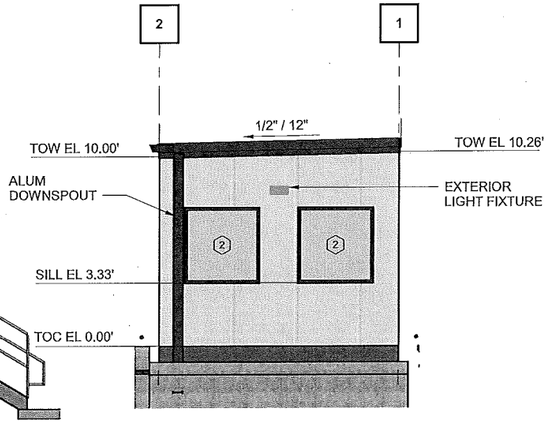
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WEST ELEVATION

0 2' 4' 8'

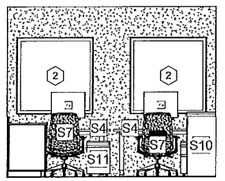
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NORTH ELEVATION

0 2' 4' 8'

SCALE IN FEET



INTERIOR ELEVATION C / A202

0 2' 4' 8'

SCALE IN FEET



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BURNS McDONNELL

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date	detailed
JULY 2020	N. ARYAN
designed	checked
K. THURMAN	R. LANG

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

SCALE HOUSE ELEVATIONS

project	contract
118706	

drawing **A203** — rev. **0**

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HVAC LEGEND

- CONTROL DAMPER, MOTOR OPERATED
- MANUAL BALANCE DAMPER
- BACKDRAFT DAMPER
- ACCESS DOOR (AD) ACCESS PANEL (AP)
- DAMPERS: FIRE (F) - SMOKE (S) - FIRE SMOKE (F/S) -
- SECURITY BARS
- FLEXIBLE DUCT CONNECTION
- RECTANGLUAR ELBOW WITH TURNING VANES
- RECTANGULAR TEE WITH TURNING VANES
- RECTANGULAR RADIUS ELBOW
- ROUND & RECTANGULAR DUCT TAKEOFF
- RISE IN RESPECT TO AIR-FLOW
- DROP IN RESPECT TO AIR-FLOW
- SQUARE OR RECTANGULAR TO ROUND TRANSITION
- SUPPLY AIR OR OUTSIDE AIR RECTANGULAR DUCT SECTION
- RETURN AIR RECTANGULAR DUCT SECTION
- EXHAUST AIR RECTANGULAR DUCT SECTION
- SUPPLY AIR OR OUTSIDE AIR ROUND DUCT SECTION
- RETURN AIR ROUND DUCT SECTION
- EXHAUST AIR ROUND DUCT SECTION
- ROUND FLEXIBLE DUCT (5'-0" MAX LENGTH)
- SQUARE OR RECTANGULAR SUPPLY DIFFUSER
- RETURN AIR DIFFUSER
- EXHAUST AIR DIFFUSER
- THERMOSTAT
- HUMIDISTAT
- CO2 CARBON DIOXIDE SENSOR
- CO CARBON MONOXIDE SENSOR
- M MOTOR
- OCC OCCUPANCY SENSOR
- ESS EMERGENCY SHUT-OFF SWITCH
- FCP FAN CONTROL PANEL
- S STATIC PRESSURE SENSOR
- DP DIFFERENTIAL PRESSURE SENSOR
- BA BREATHING AIR DROP
- CA COMPRESSED AIR DROP
- LINEAR SLOT DIFFUSER
- VAV- VARIABLE AIR VOLUME TERMINAL BOX
- (3'-0") FINNED TUBE RADIATION. LENGTH OF ELEMENT SHOWN IN PARENTHESIS
- AIRFLOW ARROW

PIPE LINE ACCESSORIES

- GATE VALVE
- OS&Y OUTSIDE SCREW & YOKE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- 2-WAY VALVE
- 3-WAY VALVE
- BALL VALVE
- BALANCING VALVE / CIRCUIT SETTER
- RELIEF, SAFETY OR THERMAL RELIEF VALVE
- MOTORIZED CONTROL VALVE
- HOSE GATE DRAIN VALVE
- GLOBE VALVE
- PLUG VALVE
- SRC SPRING RETURN CLOSED BALL VALVE
- ANGLE VALVE
- SELF CONTAINED PRESSURE REDUCING (REGULATING) VALVE
- AV AUTOMATIC AIR VENT ASSEMBLY
- MV MANUAL AIR VENT ASSEMBLY - SEE SPECIFICATIONS FOR APPROPRIATE VALVE TYPE
- FLEX CONNECTION
- PUMP
- THERMOMETER
- BFP BACKFLOW PREVENTION ASSEMBLY
- SUCTION DIFFUSER
- PRESSURE GUAGE
- Y-TYPE STRAINER
- REMOVABLE CAP
- REMOVABLE PLUG
- REDUCER (CONCENTRIC)
- UNION
- BLIND FLANGE
- TEST CONNECTION
- M METER
- FM FLOW METER
- S STRAINER
- IF INSULATING FLANGE
- PIPE WITH HEAT TRACE
- FLOW ARROW

MECHANICAL ABBREVIATIONS

12"Ø	ROUND DUCT DIMENSION
24x12	RECTANGULAR DUCT DIMENSION (INCHES)
ACU	AIR CONDITIONING UNIT
AFF	ABOVE FINISHED FLOOR
AFMS	AIR FLOW MEASURING STATION
AHU	AIR HANDLING UNIT
ARF	ABOVE RAISED FLOOR
AS	AIR SEPARATOR
BBO	BOILER BLOW-OFF
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BP	BOOSTER PUMP
BS	BRANCH SELECTOR (VRF SYSTEM)
CF	CEILING FAN
CFM	CUBIC FEET PER MINUTE
CHR	CHILLED WATER RETURN
CHS	CHILLED WATER SUPPLY
CL	CENTER LINE OF PIPE ELEVATION
CONC	CONCENTRIC
COND	COOLING COIL CONDENSATE DRAIN
CRAC	COMPUTER ROOM AIR CONDITIONER
CU	CONDENSING UNIT
CUH	CABINET UNIT HEATER
DB	DRY BULB
DH	DEHUMIDIFIER
DN	DOWN
DRG	DIFFUSER, REGISTER, GRILLE
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EF	EXHAUST FAN
EG	EXHAUST GRILLE
EL	ELEVATION
ELL	ELBOW
EMCS	ENERGY MANAGEMENT CONTROL SYSTEM
ER	AUST REGISTER
ESP	EXTERNAL STATIC PRESSURE
ET	EXPANSION TANK
EWT	ENTERING WATER TEMPERATURE
EXIST	EXISTING
FCU	FAN COIL UNIT
FD	FEEDWATER
FF	FLAT FACED
FO	FLAT OVAL
FOB	FLAT ON BOTTOM
FOT	FLAT ON TOP
HWB	HEATING HOT WATER BOILER
HWP	HEATING HOT WATER PUMP
HWR	HEATING HOT WATER RETURN
HWS	HEATING HOT WATER SUPPLY
I.E.	INVERT ELEVATION
IA	INSTRUMENT AIR
IH	INFRARED HEATER
IN. W.C	INCHES WATER COLUMN
L	LOUVER
LAT	LEAVING AIR TEMPERATURE
LR	LONG RADIUS
LWT	LEAVING WATER TEMPERATURE
MA	MIXED AIR
MAT	MIXED AIR TEMPERATURE
MAU	MAKEUP AIR UNIT
MFR	MANUFACTURER
MJ	MECHANICAL JOINT
MW	MAKE-UP WATER (AFTER BACKFLOW PREVENTER)
NC	NORMALLY CLOSED (FAIL POSITION)
NG	NATURAL GAS
NO	NORMALLY OPEN (FAIL POSITION)
OA	OUTSIDE AIR
OB	OPPOSED BLADE
OD	OVERFLOW DRAIN
PB	PARALLEL BLADE
PCW	PROCESS COLD WATER
PFX	PLATE AND FRAME HEAT EXCHANGER
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
RA	RETURN AIR
RED	REDUCER-REDUCING
RG	REFRIGERANT HOT GAS DISCHARGE
RL	REFRIGERANT LIQUID
RMJ	RESTRAINED MECHANICAL JOINT
RS	REFRIGERANT SUCTION
SA	SUPPLY AIR
SCH	SCHEDULE
SCR	SPRING RETURN CLOSED
SHR	SHORT RADIUS
SP	STATIC PRESSURE SENSOR
SR	SUPPLY REGISTER
ST	STEAM TRAP
STM	STEAM
SW	SOCKET WELD
TA	TRANSFER AIR
TOA	TREATED OUTSIDE AIR
TOC	TOP OF CONCRETE
TOD	TOP OF DUCT
TOS	TOP OF STEEL
UH	UNIT HEATER
V	VENT
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
VRF	VARIABLE REFRIGERANT FLOW
WB	WET BULB
WE	WELD END
WN	WELD NECK

CONSTRUCTION INTERFACE

- DEMOLITION
- EXISTING
- NEW
- EXISTING
- EXISTING
- NEW
- DEMOLITION

AIR DISTRIBUTION DEVICE IDENTIFICATION

AIR FLOW — NECK SIZE
QUANTITY — (2)175-8Ø
SA-A
SYSTEM TYPE — SPEC. TYPE

PIPELINE ABBREVIATIONS

BLWDN	BLOWDOWN
CD	CONDENSATE DRAIN
CHR	CHILLED WATER RETURN
CHS	CHILLED WATER SUPPLY
CR	CONDENSATE RETURN
CT	CHEMICAL TREATMENT
CTB	COOLING TOWER BLOWDOWN
CWR	CONDENSER WATER RETURN
CWS	CONDENSER WATER SUPPLY
D	DRAIN
DI	DEIONIZED WATER
FOR	FUEL OIL RETURN
FOS	FUEL OIL SUPPLY
HPS	HIGH PRESSURE STEAM
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
LPS	LOW PRESSURE STEAM
MPS	MEDIUM PRESSURE STEAM
MW	MAKEUP WATER (AFTER BACKFLOW PREVENTER)
N	NITROGEN
NG	NATURAL GAS
O	OXYGEN
PCR	PUMPED CONDENSATE RETURN
V	VACUUM

GENERAL NOTES:

1. LEGEND IS GENERAL IN NATURE AND MAY INDICATE MORE INFORMATION THAN IS APPLICABLE TO PROJECT. SEE PLANS FOR SPECIFIC SYMBOLS AND ABBREVIATIONS.
2. PROVIDE ALL MATERIALS, VALVES, HANGERS, ETC. AND EQUIPMENT AND PERFORM ALL LABOR REQUIRED TO INSTALL COMPLETE AND OPERABLE MECHANICAL SYSTEMS AS INDICATED ON THE DRAWINGS, AS SPECIFIED, AND AS REQUIRED BY CODE.
3. INSTALL ALL MECHANICAL EQUIPMENT AND APPURTENANCES IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS, CONTRACT DOCUMENTS, AND APPLICABLE CODES AND REGULATIONS.
4. COORDINATE CONSTRUCTION OF ALL MECHANICAL WORK WITH STRUCTURAL, CIVIL, ELECTRICAL WORK, ETC., SHOWN ON OTHER CONTRACT DOCUMENT DRAWINGS.
5. UNLESS OTHERWISE INDICATED MAINTAIN A MINIMUM OF 6'-8" CLEARANCE TO UNDERSIDE OF PIPES, CONDUITS, ETC., THROUGHOUT ACCESS ROUTES AND IN MECHANICAL ROOMS.
6. LOCATE ALL MECHANICAL EQUIPMENT FOR UNOBSTRUCTED ACCESS TO UNIT ACCESS PANELS, CONTROLS, AND VALVING.
7. VERIFY DIMENSIONS AND CONNECTION SIZE WITH FURNISHED EQUIPMENT.
8. ALL ELEVATIONS ARE ABOVE FINISHED FLOOR TO BOTTOM OF DUCT, PIPE, OR PIPE INSULATION UNLESS NOTED OTHERWISE.
9. DUCT DIMENSIONS INDICATED REFER TO SHEET METAL DIMENSIONS. SHEET METAL SIZE SHALL BE AIR OPENING DIMENSION PLUS THE THICKNESS OF ACOUSTICAL LINER WHERE LINER IS INSTALLED. WHERE LINER IS NOT INSTALLED, AIR OPENING SIZE AND SHEET METAL SIZE SHALL BE THE SAME.
10. DUCT STATIC PRESSURE CLASSIFICATION: UNLESS OTHERWISE INDICATED, CONSTRUCT DUCTS ON THE DISCHARGE SIDE OF FANS AND VAV BOXES TO HAVE 1.0 IN. W.C. POSITIVE PRESSURE AND DUCTS ON THE INLET SIDE OF EQUIPMENT TO HAVE 1.0 IN. W.C. NEGATIVE PRESSURE CLASSIFICATIONS. DUCTS ON OUTLET SIDE OF AHU'S SHALL HAVE 3.0 INCH POSITIVE PRESSURE CLASS DUCT.
11. LOCATE TRANSFER AIR DUCTS AND OPENINGS 24" ABOVE HIGHEST CEILING ELEVATION UNLESS OTHERWISE NOTED.
12. COORDINATE ALL WALL AND ROOF PENETRATIONS WITH STRUCTURAL AND ARCHITECTURAL PLANS.
13. INSTALL TEMPERATURE CONTROLS AT 48" ABOVE FINISHED FLOOR AND COORDINATE WITH OTHER DEVICES LOCATED ON WALLS. COORDINATE WITH ARCHITECTURAL WALL FINISHES.
14. CONTRACTOR SHALL AIR BALANCE ALL GRILLES TO CFM'S SHOWN ON PLANS.
15. MOUNT ALL OVERHEAD MECHANICAL EQUIPMENT AND FIXTURES WEIGHING 31 POUNDS OR MORE TO SUPPORTS THAT SHALL RESIST FORCES OF 0.5 TIMES THE EQUIPMENT WEIGHT IN ANY HORIZONTAL DIRECTION AND 1.5 TIMES THE EQUIPMENT WEIGHT IN THE DOWNWARD DIRECTION.

DETAIL / ENLARGED CALLOUT SYMBOL

- INDICATES LIMITS OF DETAIL/SECTION
- DETAIL/SECTION DESIGNATOR
- SHEET WHERE DETAIL/SECTION IS SHOWN

(A / M-001)

DETAIL/SECTION TITLE

A1 TITLE

LOCATION WHERE DETAIL / SECTION IS SHOWN ON SHEET

SECTION CUT SYMBOL

- INDICATES PERSPECTIVE AND LIMITS OF SECTION
- SECTION DESIGNATOR
- DRAWING WHERE SECTION IS SHOWN

(A / M-001)

PIPE SYMBOLS

- PIPE ELBOW
- PIPE DOWN
- PIPE UP
- PIPE CONTINUATION

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9785 Maroon Circle, Suite 400
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date: JULY 2020	detailed: C. HALL
designed: R. PEARSON	checked: G. JOHNSON

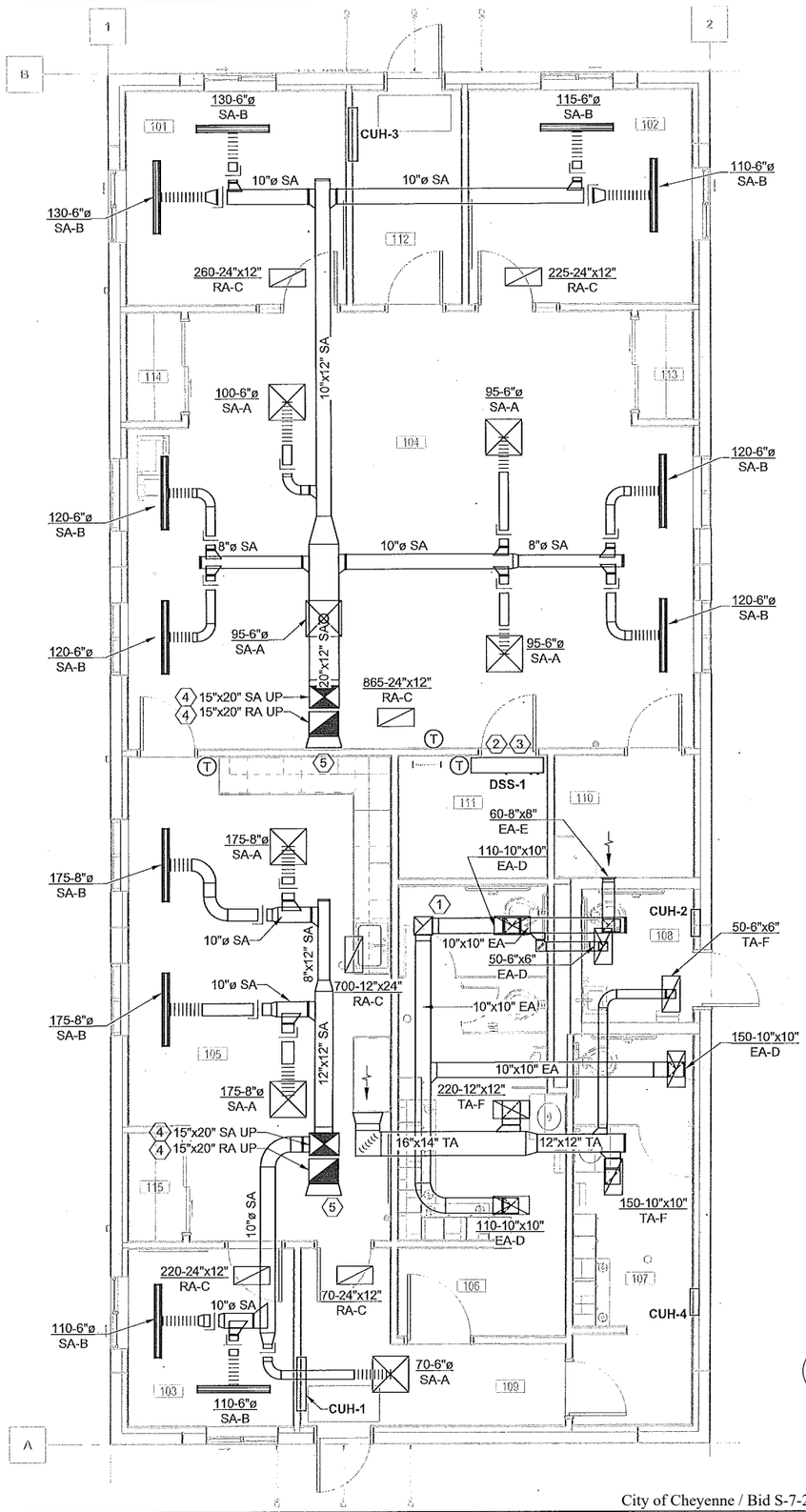
CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
MECHANICAL NOTES, LEGEND, SYMBOLS & ABBREVIATIONS

project: 118706	contract:
drawing: M001	rev.: 0
sheet:	of: sheets
file:	

Professional Engineer (Mechanical) ROBERT T. DARNELL 11676 Date 7/10/20 WYOMING

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1 MECHANICAL FLOOR PLAN
SCALE: 1/4" = 1'-0"

N

GENERAL NOTES:

1. FOR MECHANICAL SYMBOLS & ABBREVIATIONS, SEE M-001.
2. BRANCH RUNOUT SIZES TO SUPPLY DIFFUSERS ARE THE SAME SIZE AS THE DIFFUSER NECK SIZE INDICATED ON THE DIFFUSER TAG, UNLESS OTHERWISE NOTED.
3. INSTALL THERMOSTATS AT 48" A.F.F. UNLESS NOTED OTHERWISE.

KEYED NOTES:

〈1〉 12" X 10" EA DUCT UP TO EF-1 MOUNTED ON ROOF ABOVE, SEE M-110.

〈2〉 REFRIGERANT PIPING SIZES AND ROUTING SHALL BE PROVIDED BY CRU/ACCU EQUIPMENT MANUFACTURER.

〈3〉 ROUTE PUMPED CONDENSATE FROM DSS-1 TO UTILITY ROOM 110 AND SPILL INTO MOP BASIN 6" ABOVE BASIN RIM. DO NOT ROUTE WATER PIPING OVER ELECTRICAL ROOM.

〈4〉 EXTEND FULL SIZE SUPPLY AND RETURN AIR DUCTS DOWN INTO PLENUM SPACE. COORDINATE FINAL ROOF OPENING SIZES AND LOCATIONS WITH STRUCTURAL DRAWINGS.

〈5〉 TERMINATE RETURN AIR DUCT BELOW DECK WITH BELLMOUTH RETURN AIR OPENING COVERED WITH 1/2" x 1/2" STEEL MESH.

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ADMIN BLDG

SCALE BLDG

KEY PLAN

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303-721-9292

date	detailed
JULY 2020	C. HALL
designed	checked
R. PEARSON	G. JOHNSON

CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

MECHANICAL FLOOR PLAN

project	contract
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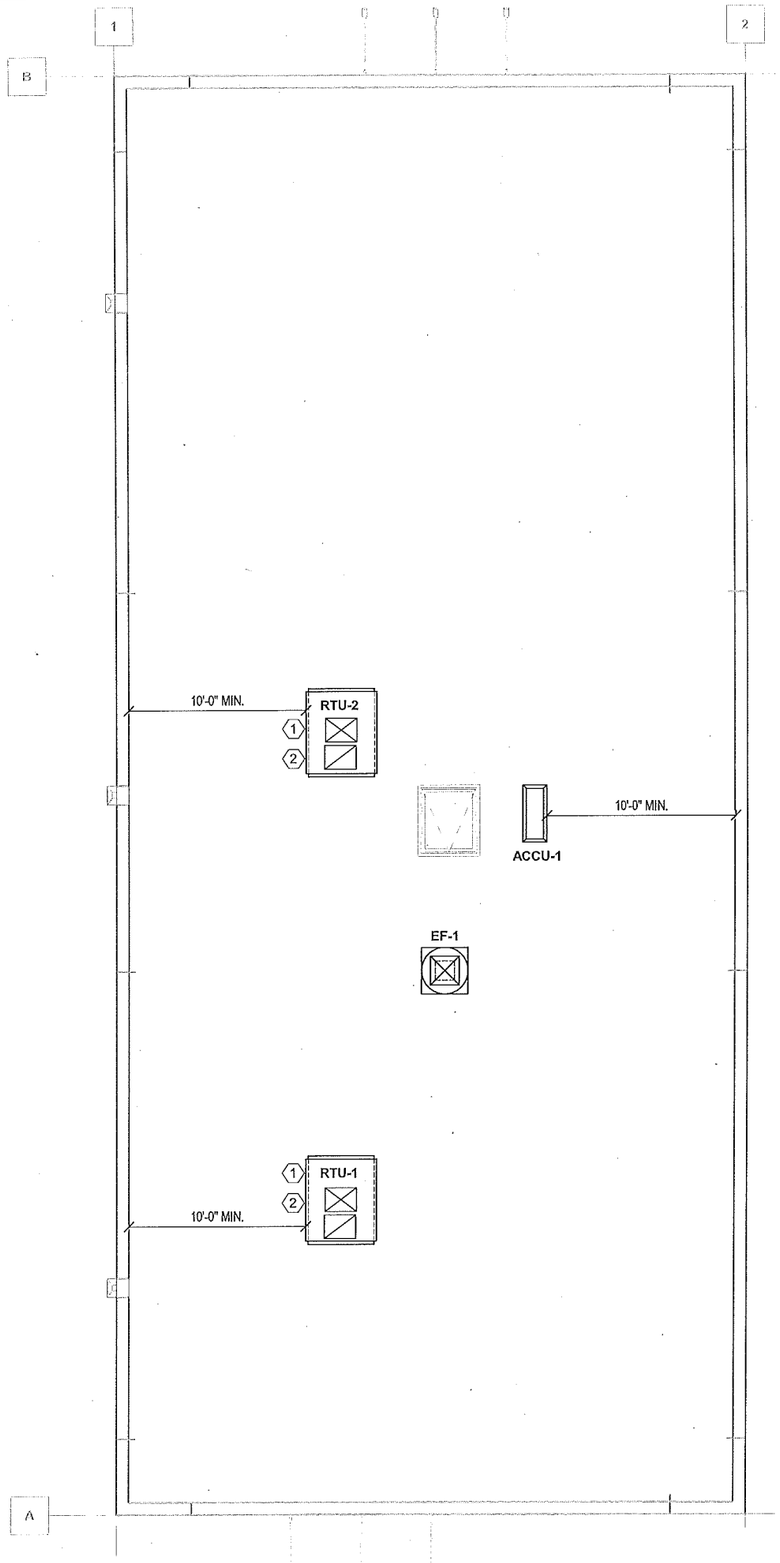
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Professional Engineer (Mechanical) ROBERT F. DARNELL 11676 WYOMING Date 7/10/20

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1 MECHANICAL ROOF PLAN
SCALE: 1/4" = 1'-0"

N

GENERAL NOTES:

1. FOR MECHANICAL SYMBOLS & ABBREVIATIONS, SEE M-001.
2. COORDINATE EQUIPMENT ROOF OPENINGS WITH EXISTING STRUCTURAL STEEL. LOCATE OPENINGS BETWEEN JOISTS.
3. SEE ARCHITECTURAL AND STRUCTURAL DETAILS FOR ROOF OPENINGS.
4. MAINTAIN MINIMUM CODE REQUIRED DISTANCES BETWEEN AIR INTAKES AND EXHAUST AIR OPENINGS.

KEYED NOTES:

1. MOUNT RTU ON MANUFACTURER'S ROOF CURB.
2. SPILL COOLING COIL CONDENSATE TO SPLASH BLOCK ON ROOF.

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KEY PLAN

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date	detailed
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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

MECHANICAL ROOF PLAN

project	contract
118706	

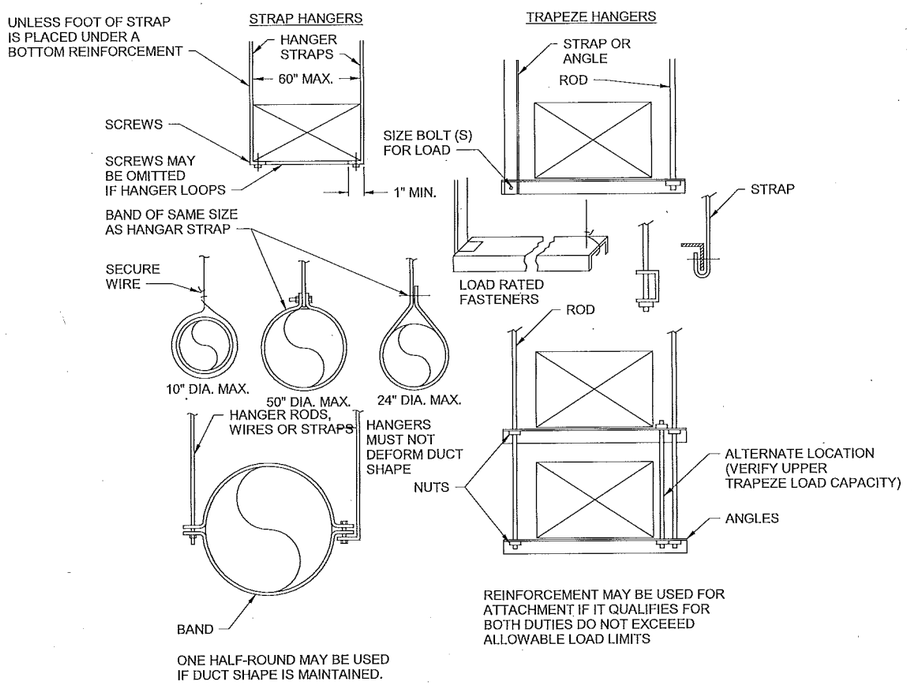
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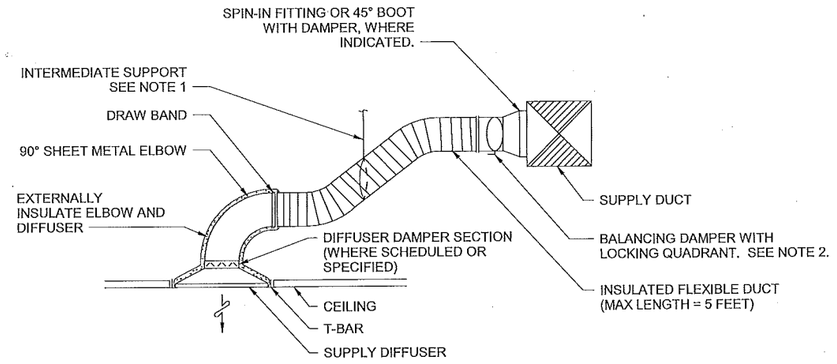
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Professional Engineer (Mechanical) ROBERT T. DARNELL 11676 Date WYOMING

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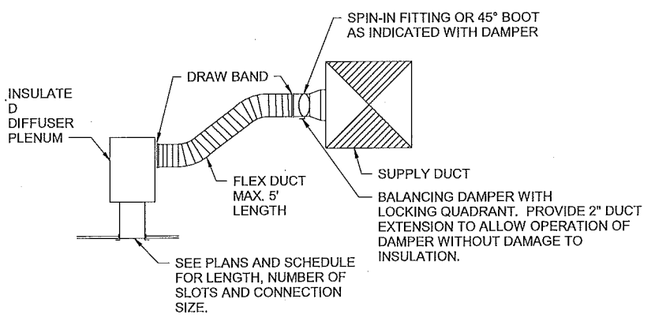
1 DUCT & PIPE HANGERS
SCALE:NTS



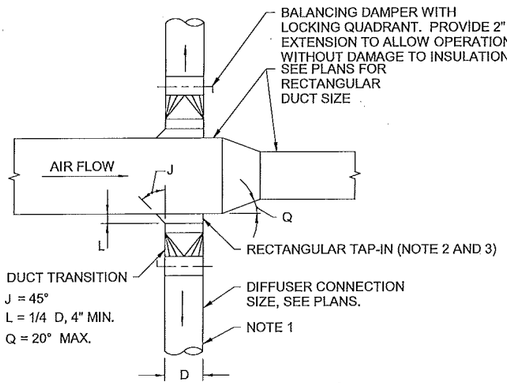
NOTES:

1. PROVIDE INTERMEDIATE SUPPORT, WHERE REQUIRED, TO PREVENT SAGGING AND KINKS AND TO KEEP FLEXIBLE DUCTWORK OFF SURROUNDING OBJECTS.
2. PROVIDE 2" DUCT EXTENSION TO ALLOW OPERATION OF DAMPER WITHOUT DAMAGE TO INSULATION.

2 DUCT CONNECTION TO DIFFUSER
SCALE:NTS



3 LINEAR SLOT DIFFUSER
SCALE:NTS



NOTES:

1. TAKEOFF ON BOTH SIDES OR SINGLE SIDE AS REQUIRED BY PLANS.
2. CLINCH LOCK CONNECTION TO DUCT SHALL HAVE CORNER SEALS (SEE SMACNA MANUAL).
3. EXTRACTORS, SCOOPS, DEFLECTORS OR DAMPERS THAT PROTRUDE INTO THE MAIN DUCT SHALL NOT BE USED. BALANCING DAMPERS SHALL BE LOCATED TO PREVENT PROTRUSION INTO THE MAIN DUCT AND TO PROVIDE STABLE AIR FLOW AND MINIMAL NOISE WHEN ADJUSTED.

4 RECTANGULAR DUCT WITH 2 DIFFUSER TAKE-OFFS
SCALE:NTS

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CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

MECHANICAL DETAILS

project	contract
118706	

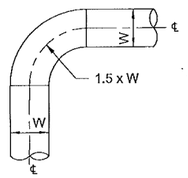
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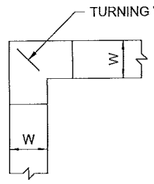
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Professional Engineer (Mechanical) ROBERT T. DARNELL 11676 Date WYOMING

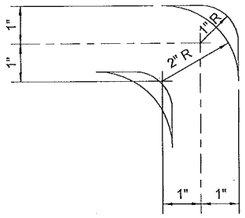
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ROUND 90 ELBOW



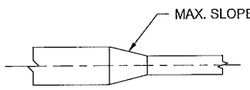
SQUARE 90 ELBOW



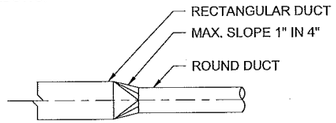
TURNING VANES DETAIL

NOTE:

1. USE THIS DESIGN WHERE SQUARE 90°ELBOWS ARE SHOWN ON DRAWINGS OR IF SPACE DOES NOT PERMIT ROUND 90° ELBOWS.



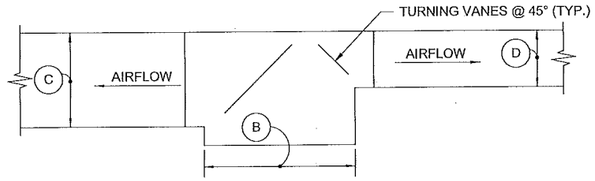
RECTANGULAR TRANSITION

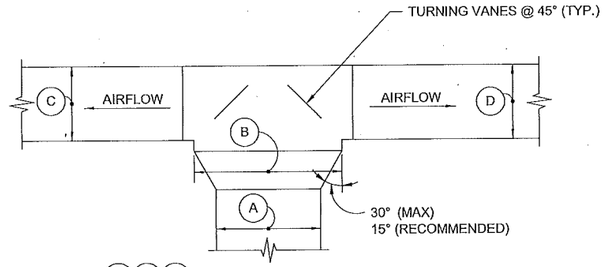


RECTANGULAR TO ROUND TRANSITION

1 LOW VELOCITY DUCT LAYOUT

SCALE:NTS



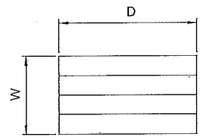


A C D DIMENSIONS, SEE PLANS FOR SIZES

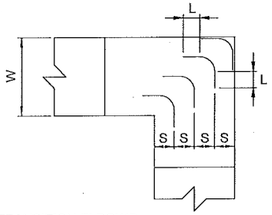
B DIMENSION IS EQUAL TO C + D

2 LOW PRESSURE DUCT TEE FITTING

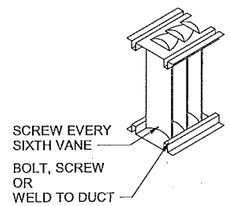
SCALE:NTS



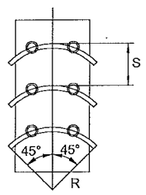
S= D/6 (MIN.2")
W/S= NO. OF SPACES
R= 1 1/4 S
L= 3/4 S



BLADES IN TRANSITION ELBOWS SHALL
BE DETERMINED ACCORDING TO SMALLEST WIDTH OF ELBOW.

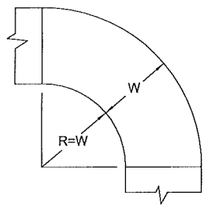


SINGLE VANE SCH.			
	R	S	GA
SMALL	51	38	24
LARGE	114	83	22

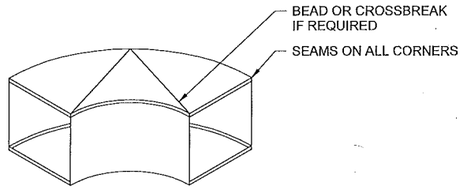


3 RECTANGULAR DUCT ELBOW TURNING VANES

SCALE:NTS



STANDARD RADIUS ELBOW
R=W. CENTERLINE R= 1 1/2 W
ALSO CALLED FULL RADIUS ELBOW.



4 RECTANGULAR DUCT STANDARD CURVE

SCALE:NTS

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JULY 2020	C. HALL
designed	checked
R. PEARSON	G. JOHNSON

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

MECHANICAL DETAILS

project	contract
118706	

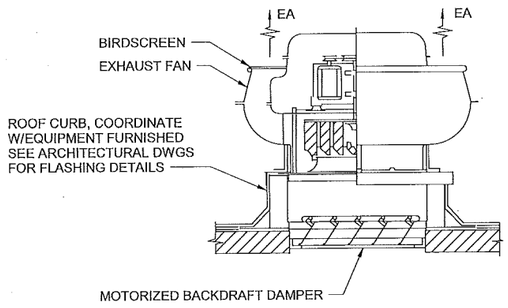
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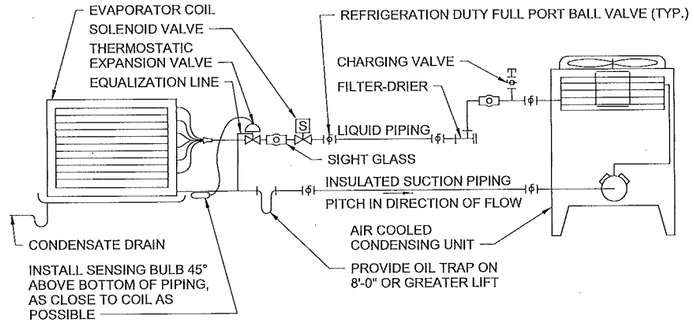
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Professional Engineer (Mechanical) ROBERT T. DARNELL 11676 Date WYOMING

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1 UPBLAST CENTRIFUGAL EXHAUST FAN
SCALE: 12" = 1'-0"



NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR COORDINATING REFRIGERANT LIQUID AND SUCTION PIPING, SIZES, ROUTING, AND ALL ACCESSORIES WITH EQUIPMENT MANUFACTURER. MAINTAIN UNIFORM SLOPE TO PREVENT OIL FROM POOLING IN LOW POINTS IN THE REFRIGERANT PIPING SYSTEM.

2 DX SPLIT SYSTEM PIPING
SCALE: 12" = 1'-0"

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ROOFTOP UNIT SCHEDULE (RTU)

TAG	LOCATION	SERVES	DESIGN OUTDOOR AIRFLOW (CFM)	SUPPLY FAN			COOLING COIL						HEATING COIL				ELECTRICAL		BASIS OF DESIGN		WEIGHT (LBS)	NOTES
				AIRFLOW (CFM)	ESP (IN)	MOTOR (HP)	TYPE	CAPACITY TOT (MBH)	CAPACITY SENS (MBH)	AIR EAT DB (°F)	AIR EAT WB (°F)	AIR LAT DB (°F)	AIR LAT WB (°F)	TYPE	CAPACITY (kW)	AIR EAT DB (°F)	AIR LAT DB (°F)	V/PH/HZ	DISCONN. BY	MFR	MODEL		
RTU-1	ROOF	ADMIN BLDG	220	1350	0.8	0.5	D/X	22.4	22.4	76.8	61.6	55	55	ELEC	10	55.9	81.2	240/1/60	DIV. 23	TRANE	4TCY036	422	1-6
RTU-2	ROOF	ADMIN BLDG	260	990	0.8	0.5	D/X	17.8	17.4	77.8	61.1	55	55	ELEC	10	47.7	82.2	240/1/60	DIV. 23	TRANE	4TCY030	418	1-6

NOTES:
1. ROOF MOUNTED WITH MANUFACTURER'S INSULATED 12" CURB AND DOWNTURNED WEATHERHOOD.
2. PROVIDE WITH LOW LEAKAGE DAMPERS.
3. PROVIDE SINGLE POINT ELECTRICAL CONNECTION.
4. PROVIDE WITH KYNAR FINISH. FINAL EQUIPMENT COLOR TO BE COORDINATED WITH ARCHITECT.
5. FULL ECONOMIZER WITH POWER EXHAUST.
6. PROVIDE WITH MERV 8 FILTERS.

AIR COOLED CONDENSING UNIT SCHEDULE (ACCU)

TAG	LOCATION	ASSOCIATED UNIT	TYPE	AMBIENT TEMP (°F)	TOTAL CAPACITY (MBH)	SENSIBLE CAPACITY (MBH)	EFFICIENCY (SEER)	ELECTRICAL V/PH/HZ	ELECTRICAL MCA	ELECTRICAL DISCONNECT BY	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	NOTES
ACCU-1	ROOF	DSS-1	HEAT PUMP	95	18	14.48	18	230/1/60	18.3	DIV. 23	DAIKIN	RX18NMVJU	1, 2, 3, 4

NOTES:
1. SIZE AND ROUTE REFRIGERANT PIPING TO INDOOR EVAPORATOR UNIT AS REQUIRED.
2. INSTALLATION SHALL MAINTAIN ALL MANUFACTURER'S CLEARANCE RECOMMENDATIONS.
3. INCLUDE MANUFACTURER'S LOW AMBIENT KIT.
4. MOUNT ON CURB.

DUCTLESS SPLIT SYSTEM SCHEDULE (DSS)

TAG	LOCATION	ASSOCIATED UNIT	TYPE	REFRIGERANT TYPE	AIRFLOW (CFM)	EAT DB (°F)	EAT WB (°F)	COOLING CAPACITY TOTAL (MBH)	COOLING CAPACITY SENSIBLE (MBH)	ELECTRICAL V/PH/HZ	ELECTRICAL MCA	ELECTRICAL DISCONNECT BY	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	NOTES
DSS-1	111 - ELEC ROOM	ACCU-1	HEAT PUMP	R-410A	713	80	67	18	14.48	230/1/60	18.3	DIV. 23	DAIKIN	FTX18NMVJU	1, 2

NOTES:
1. PROVIDE WITH WALL MOUNTED THERMOSTAT, MANUFACTURER'S CONDENSATE PUMP, AND WALL MOUNTING BRACKET.
2. INDOOR UNIT IS POWERED FROM OUTDOOR UNIT THROUGH FIELD WIRING.

UNIT HEATER SCHEDULE (UH)

TAG	LOCATION	MOUNTING	CAPACITY (KW)	AIRFLOW EAT (°F)	AIRFLOW LAT (°F)	ELECTRICAL V/PH/HZ	ELECTRICAL DISCONNECT BY	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	WEIGHT (LBS)	NOTES
CUH-1	109 - ENTRY HALL	VERTICAL RECESSED	2	68	95	240/1/60	DIV. 23	REZNOR	EHC	24	1, 2
CUH-2	108 - PUBLIC RESTROOM	VERTICAL RECESSED	3	68	95	240/1/60	DIV. 23	REZNOR	EHC	24	1, 2
CUH-3	112 - VESTIBULE	VERTICAL RECESSED	2	55	95	240/1/60	DIV. 23	REZNOR	EHC	24	1, 2
CUH-4	107 - WOMENS LOCKER ROOM	VERTICAL RECESSED	3	68	95	240/1/60	DIV. 23	REZNOR	EHC	24	1, 2

NOTES:
1. RECESSED IN WALL, BOTTOM OF UNIT 1'-4" A.F.F.
2. PROVIDE WITH INTEGRAL THERMOSTAT.

FAN SCHEDULE (F)

TAG	LOCATION	SERVING	TYPE	AIRFLOW (CFM)	ESP (IN)	FAN SPEED (RPM)	TIP SPEED (RPM)	SOUND (SONES)	MOTOR HP	MOTOR RPM	MOTOR ENCLOSURE	ELECTRICAL V/PH/HZ	ELECTRICAL DISCONNECT BY	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	WEIGHT (LBS)	NOTES
EF-1	ROOF	RESTROOMS	UPBLAST CENTRIFUGAL	480	0.5	1550	4413	7.9	0.09	1550	ODP	120/1/60	DIV. 23	GREENHECK	CUE-095-D	38	1, 2, 3

NOTES:
1. PROVIDE WITH MANUFACTURER'S INSULATED CURB AND MOTORIZED DAMPER.
2. PROVIDE WITH NEMA-1 TOGGLE SWITCH WITH THERMAL OVERLOAD. MOTOR SHALL BE ECM TYPE.
3. PROVIDE WITH GALVANIZED BIRDSCREEN.

DIFFUSER, REGISTER AND GRILLE SCHEDULE (D, R, G)

SYSTEM	TAG	DESCRIPTION	INTEGRAL DAMPER	MOUNTING	THROW PATTERN	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	NOTES
SA	A	24X24 SQUARE PLAQUE FACE SUPPLY AIR DIFFUSER	NO	LAY-IN	4-WAY	TITUS	OMNI	1, 3
SA	B	(2) 1"-SLOT LINEAR BAR SUPPLY AIR DIFFUSER WITH PLENUM	NO	LAY-IN	BI-DIRECTIONAL	TITUS	TBDI-80	1, 2, 3
RA	C	ALUMINUM RECTANGULAR EGGCRATE RETURN AIR GRILLE	NO	LAY-IN	-	TITUS	50F	
EA	D	ALUMINUM RECTANGULAR EGGCRATE EXHAUST AIR GRILLE	YES	SURFACE	-	TITUS	50F	
EA	E	LOUVERED ALUMINUM RECTANGULAR EXHAUST AIR GRILLE	YES	SURFACE	-	TITUS	350-FL	1, 3
TA	F	ALUMINUM RECTANGULAR EGGCRATE TRANSFER AIR GRILLE	NO	SURFACE	-	TITUS	50F	

NOTES:
1. MODEL NUMBERS ARE FOR GENERAL IDENTIFICATION. SPECIFIC MODEL NUMBERS DEPENDS ON APPLICABLE NOTES & ARCHITECTURAL PLANS. VERIFY FINISH, MOUNTING TYPE, AND DIMENSIONS WITH ARCHITECTURAL WORK.
2. STEEL CONSTRUCTION, ADJUSTABLE BLADES, 4' LENGTH, 1" SLOTS, STANDARD OFF-WHITE BAKED ENAMEL FINISH.
3. ALUMINUM CONSTRUCTION WITH BAKED ENAMEL FINISH. FINISH TO MATCH T-BAR CEILING.

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date	detailed
JULY 2020	C. HALL
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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

MECHANICAL SCHEDULES

project	contract
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PIPE LINE DESIGNATIONS

V	VENT
S	STORM (ABOVE GRADE)
S	STORM (BELOW GRADE)
OD	STORM OVERFLOW
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
DHWR	DOMESTIC HOT WATER RECIRCULATION
S	SANITARY SEWER (ABOVE GRADE)
S	SANITARY SEWER (BELOW GRADE)
COND	CONDENSATE DRAIN
CA	COMPRESSED AIR
NG	NATURAL GAS
CO	CLEANOUT IN RISER
WCO	CLEANOUT IN WALL
FCO	CLEANOUT IN FLOOR

PLUMBING SYMBOLS LEGEND

WC-1	WATER CLOSET
WC-2	WATER CLOSET - ACCESSIBLE
U-1	URINAL
U-2	URINAL, ACCESSIBLE
LAV-	LAVATORY, COUNTER MOUNTED
LAV-	LAVATORY, WALL MOUNTED
JS-1	JANITOR SINK
MB-1	MOP BASIN
SH-1	SHOWER
SK-1	KITCHEN
SK-2	SINK
SK-3	UNDER MOUNT SINK
EWC-1	DUAL ELECTRIC WATER COOLER
EEWS-	EMERGENCY EYEWASH / SHOWER
4" FD-A	SIZE - FLOOR DRAIN
	PRESSURE/TEMPERATURE RELIEF VALVE
HB	HOSE BIBB
WH	WALL HYDRANT

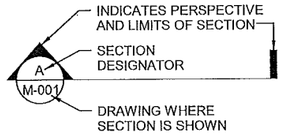
PLUMBING ABBREVIATIONS

AC	AIR COCK
AFF	ABOVE FINISHED FLOOR
AG	AIR GAP
ARV	AIR RELEASE VALVE
BF	BLIND FLANGE
BOP	BOTTOM OF PIPE
BW	BUTT WELD
CH OP	CHAIN WHEEL OPERATOR
CONC	CONCENTRIC
CORP STOP	CORPORATION STOP
CPVC	CHLORINATED POLYVINYL CHLORIDE
D	DRAIN
DI	DUCTILE IRON
DN	DOWN
DWH	DOMESTIC WATER HEATER
ELL	ELBOW
EXIST	EXISTING
FCA	FLANGED COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FE	FLANGED END
FF	FLAT FACED
FI	FLOW INDICATOR
FLGD	FLANGED
FM	FLOW METER
FOB	FLAT ON BOTTOM
FOT	FLAT ON TOP
FOV	FLOAT OPERATED VALVE
FRP	FIBERGLASS REINFORCED PIPE
FW	FIELD WELD
HD	HUB DRAIN
I.E.	INVERT ELEVATION
IF	INSULATED FLANGE
LC	LOCK CLOSED
LO	LOCK OPEN
LR	LONG RADIUS
NPSH	NET POSITIVE SUCTION HEAD
NRS	NON-RISING STEM
NWL	NORMAL WATER LEVEL
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
PVC	POLYVINYL CHLORIDE
RED	REDUCER-REDUCING
RS	RISING STEM
SCH	SCHEDULE
SCRD	SCREWED
SR	SHORT RADIUS
TD	TRENCH DRAIN
TOC	TOP OF CONCRETE
TOG	TOP OF GRATING
TOP	TOP OF PIPE
TOS	TOP OF STEEL
TP	TRAP PRIMER
VTR	VENT THROUGH ROOF
WCO	WASTE CLEANOUT

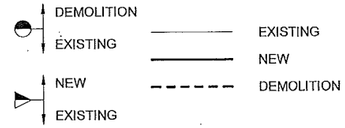
GENERAL NOTES:

1. UNLESS NOTED OTHERWISE, THE CIVIL AND MECHANICAL INTERFACE POINT IS 5 FEET OUTSIDE OF THE BUILDING WALL.
2. COORDINATE ALL PIPE SLEEVE REQUIREMENTS WITH FOUNDATION SUBCONTRACTOR.
3. COORDINATE MECHANICAL ROOM FLOOR DRAINS WITH ACTUAL EQUIPMENT LOCATIONS AND DRAINAGE REQUIREMENTS.
4. LEGEND IS GENERAL IN NATURE AND NOT ALL ITEMS SHOWN MAY BE USED ON THIS PROJECT.
5. INSTALL SANITARY PIPING WITH 2% SLOPE DOWNWARD IN DIRECTION OF FLOW. INSTALL VENT PIPING WITH 1% SLOPE DOWNWARD TOWARD FIXTURE OR STACK.
6. ALL FIXTURES SHALL HAVE A P-TRAP INSTALLED.
7. PROVIDE ALL MATERIALS, VALVES, HANGERS, ETC. AND EQUIPMENT AND PERFORM ALL LABOR REQUIRED TO INSTALL COMPLETE AND OPERABLE PLUMBING SYSTEMS AS INDICATED ON THE DRAWINGS, AS SPECIFIED AND AS REQUIRED BY CODE.
8. INSTALL ALL PLUMBING FIXTURES, EQUIPMENT AND APPURTENANCES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS, CONTRACT DOCUMENTS, AND APPLICABLE CODES AND REGULATIONS.
9. COORDINATE CONSTRUCTION OF ALL PLUMBING WORK WITH STRUCTURAL, CIVIL, ELECTRICAL WORK ETC., SHOWN ON OTHER CONTRACT DOCUMENT DRAWINGS.
10. MAINTAIN A MINIMUM OF 6' - 8 CLEARANCE TO UNDERSIDE OF PIPES, CONDUITS, ETC., THROUGHOUT ACCESS ROUTES AND IN MECHANICAL ROOMS.
11. LOCATE ALL PLUMBING EQUIPMENT FOR UNOBSTRUCTED ACCESS TO UNIT ACCESS PANELS, CONTROLS, AND VALVING.
12. VERIFY DIMENSIONS AND CONNECTION SIZE WITH FURNISHED EQUIPMENT.
13. ALL ELEVATIONS ARE ABOVE FINISHED FLOOR TO BOTTOM OF PIPE UNLESS NOTED OTHERWISE.

SECTION CUT SYMBOL



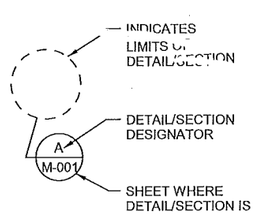
CONSTRUCTION INTERFACE



DETAIL/SECTION TITLE



DETAIL / ENLARGED CALLOUT SYMBOL



PIPE SYMBOLS

	PIPE ELBOW
	PIPE DOWN
	PIPE UP
	PIPE CONTINUATION

PIPE LINE ACCESSORIES

	GATE VALVE
OS&Y	OUTSIDE SCREW & YOKE VALVE
	BUTTERFLY VALVE
	CHECK VALVE
	2-WAY VALVE
	3-WAY VALVE
	BALL VALVE
	BALANCING VALVE / CIRCUIT SETTER
	RELIEF, SAFETY OR THERMAL RELIEF VALVE
M	MOTORIZED CONTROL VALVE
	HOSE GATE DRAIN VALVE
	GLOBE VALVE
	PLUG VALVE
SRC	SPRING RETURN CLOSED BALL VALVE
	ANGLE VALVE
	SELF CONTAINED PRESSURE REDUCING (REGULATING) VALVE
AV	AUTOMATIC AIR VENT ASSEMBLY
MV	MANUAL AIR VENT ASSEMBLY - SEE SPECIFICATIONS FOR APPROPRIATE VALVE TYPE
	FLEX CONNECTION
	PUMP
	THERMOMETER
BFP	BACKFLOW PREVENTION ASSEMBLY
	SUCTION DIFFUSER
	PRESSURE GUAGE
	Y-TYPE STRAINER
	REMOVABLE CAP
	REMOVABLE PLUG
	REDUCER (CONCENTRIC)
	UNION
	BLIND FLANGE
	TEST CONNECTION
M	METER
FM	FLOW METER
S	STRAINER
IF	INSULATING FLANGE
	PIPE WITH HEAT TRACE
	FLOW ARROW

RISER DIAGRAM LEGEND

CO	CLEANOUT (CO) IN RISER
FCO	CLEANOUT (FCO) IN FLOOR
	VENT THRU ROOF (VTR)
	FLOOR OR WALL PENETRATION
	PLUMBING FIXTURE TRAP
	FLOOR DRAIN / EQUIPMENT DRAIN
WHA-A	WATER HAMMER ARRESTOR
WCO	WALL CLEANOUT (WCO)
UP / DN	ISOMETRIC DIRECTION ARROW

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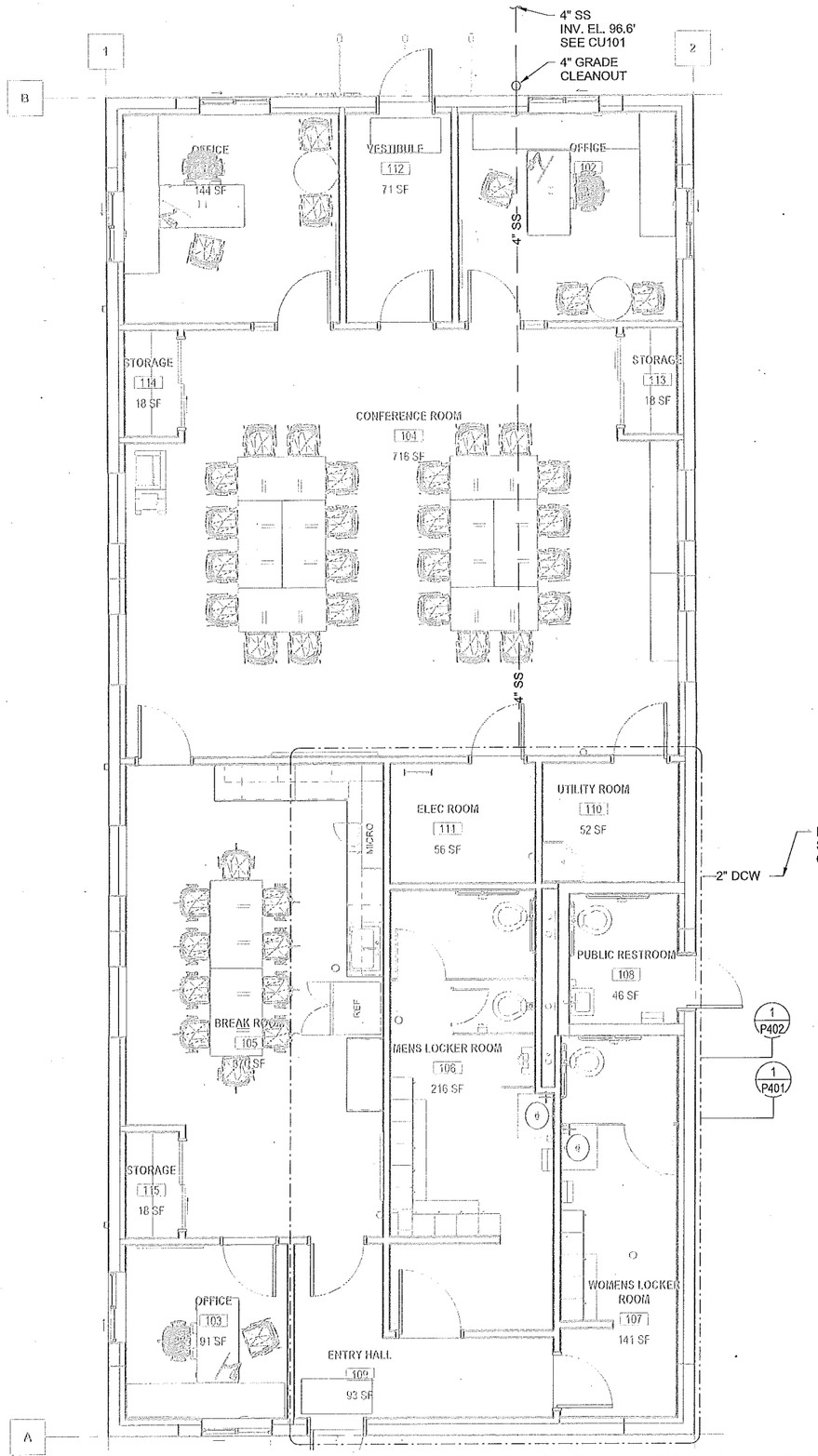
HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

PLUMBING NOTES, LEGEND, SYMBOLS & ABBREVIATIONS

project: 118706	contract:
drawing: P001	rev.: 0
sheet:	of: sheets:
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1 OVERALL PLUMBING PLAN
SCALE: 1/4" = 1'-0"

N

GENERAL NOTES:

1. FOR PLUMBING NOTES, LEGEND, SYMBOLS & ABBREVIATIONS, SEE P-001.

no.	date	by	ckd	description
0	7/10/20	CJH	GEJ	ISSUED FOR BID

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ADMIN BLDG

SCALE BLDG

KEY PLAN

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LARAMIE COUNTY, WYOMING

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FRONT ENTRANCE AND SCALE HOUSE

PLUMBING OVERALL PLAN

project	contract
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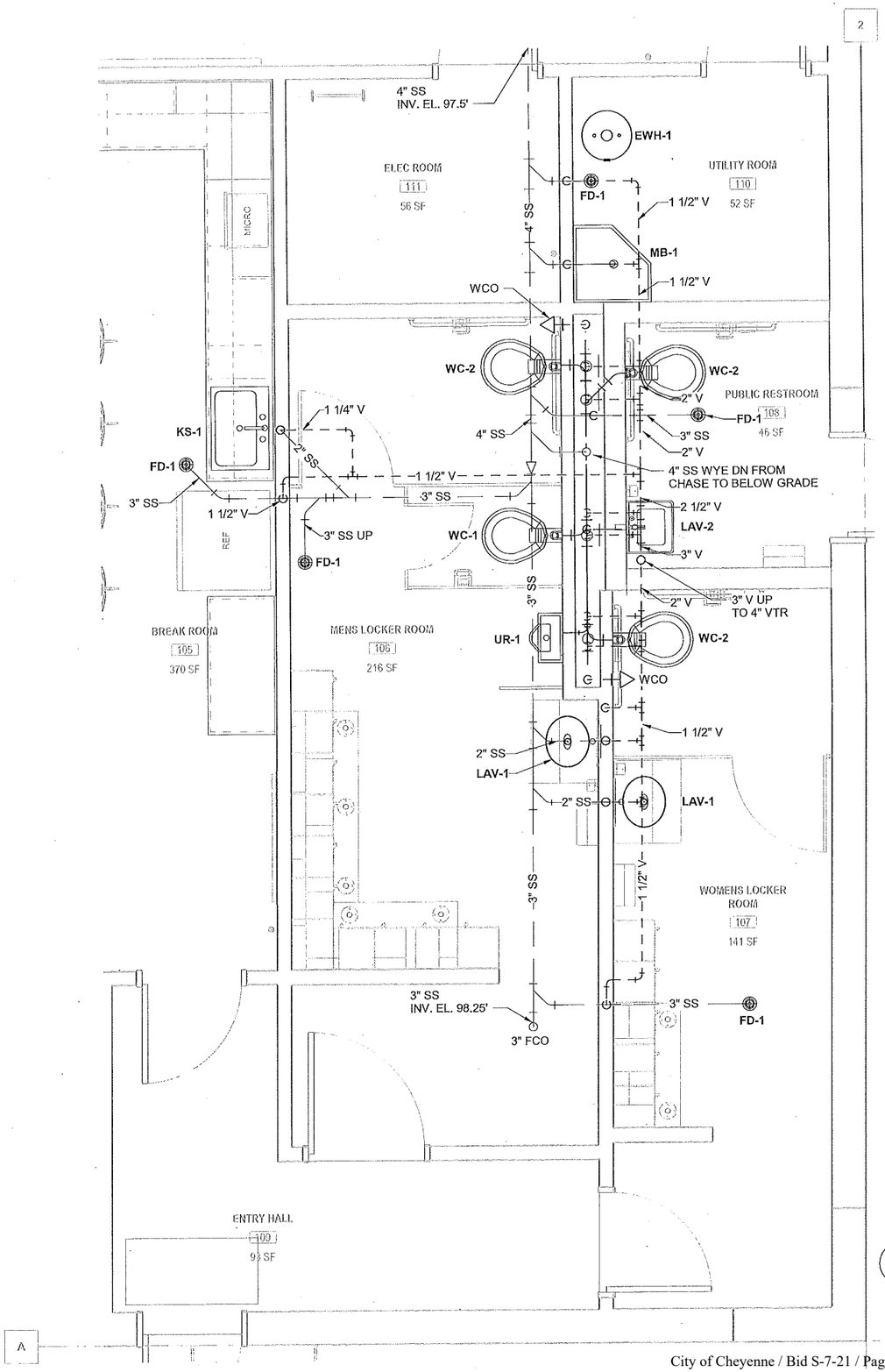
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1 PLUMBING WASTE AND VENT PLAN
SCALE: 1/2" = 1'-0"

GENERAL NOTES:

1. FOR PLUMBING NOTES, LEGEND, SYMBOLS & ABBREVIATIONS, SEE P-001.
2. SEE PLUMBING RISER DIAGRAMS ON P-701 FOR ADDITIONAL PIPING CONNECTIONS, VALVES, AND SIZING.

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ADMIN BLDG

SCALE BLDG

KEY PLAN

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HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
PLUMBING ENLARGED WASTE AND VENT PLAN

project	contract
118706	

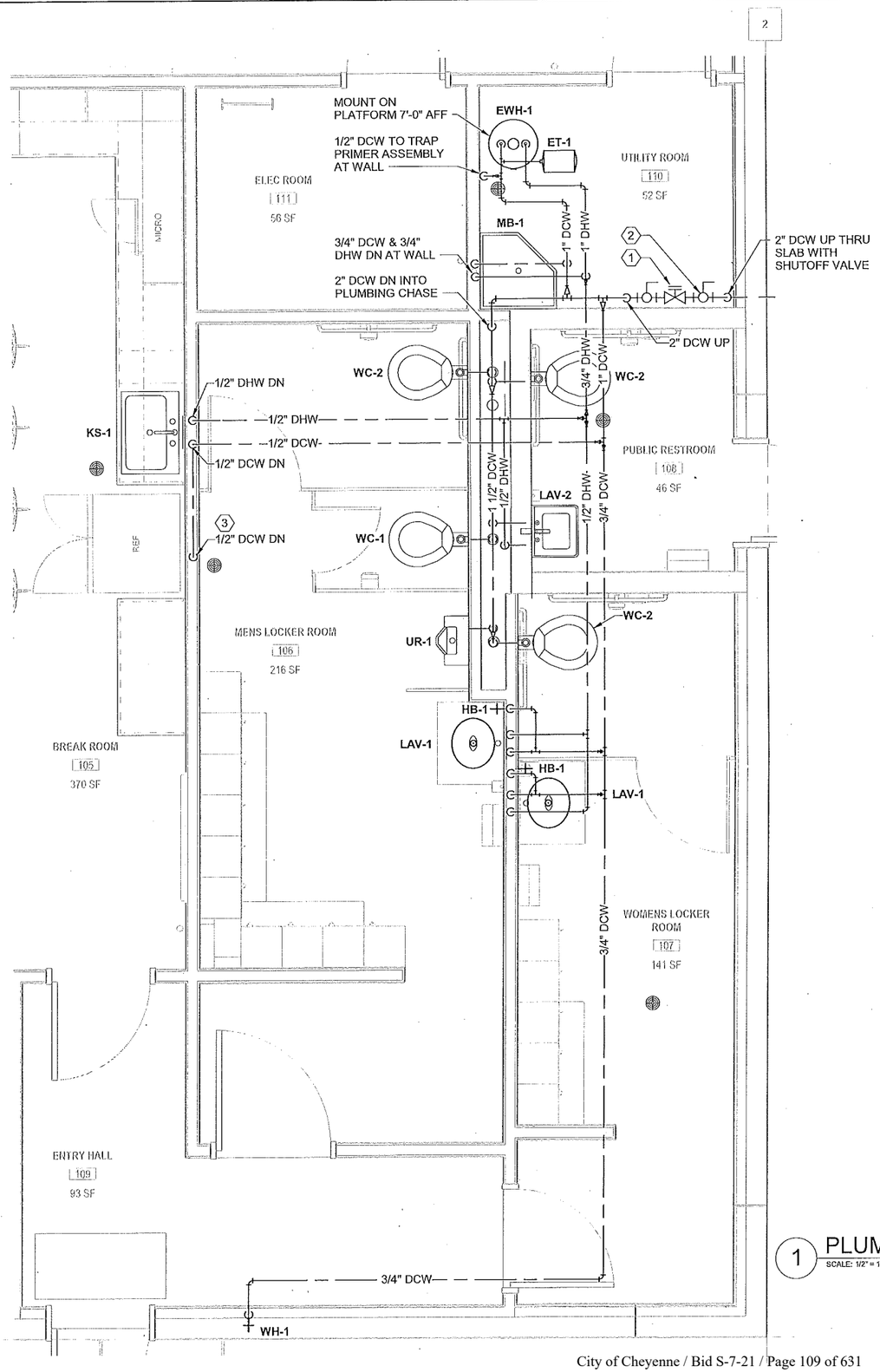
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Professional Engineer (Mechanical) ROBERT T. DARNELL 11676 Date WYOMING

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1 PLUMBING DOMESTIC WATER PLAN
SCALE: 1/2" = 1'-0"

N

GENERAL NOTES:

1. FOR PLUMBING NOTES, LEGEND, SYMBOLS & ABBREVIATIONS, SEE P-001.
2. SEE PLUMBING RISER DIAGRAMS ON P-702 FOR ADDITIONAL PIPING CONEECTIONS, VALVES, AND SIZING.

KEYED NOTES:

1. 2" DOMESTIC WATER PRESSURE REDUCING VALVE SET TO 50 PSIG.
2. BALL SHUT OFF VALVES (TYPICAL).
3. INLINE BACKFLOW PREVENTER.

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0	7/10/20	CJH	GEJ	ISSUED FOR BID

N

ADMIN BLDG

SCALE BLDG

KEY PLAN

BURNS McDONNELL

9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	C. HALL
designed	checked
R. PEARSON	G. JOHNSON

CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
PLUMBING ENLARGED DOMESTIC WATER PLAN

project	contract
118706	

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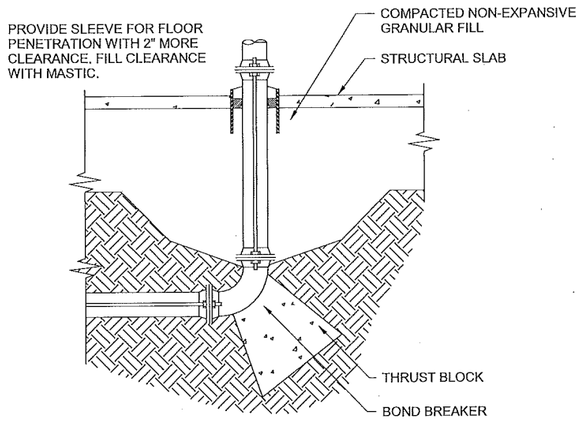
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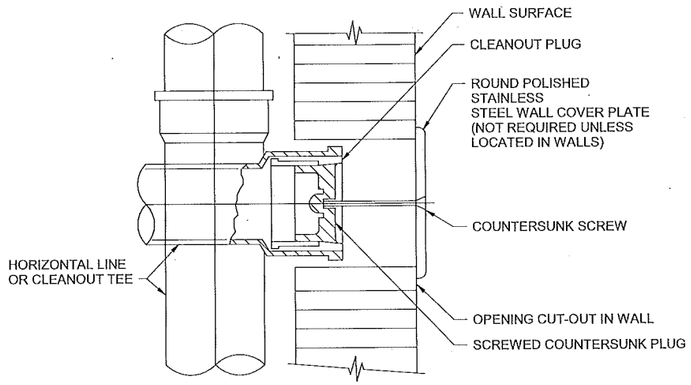
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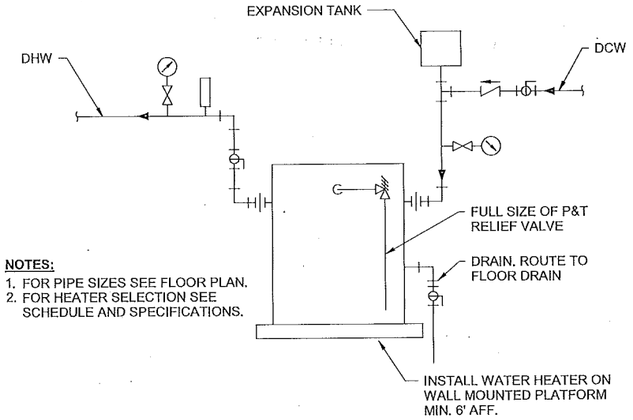
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1 PIPE THROUGH SLAB
SCALE:NTS

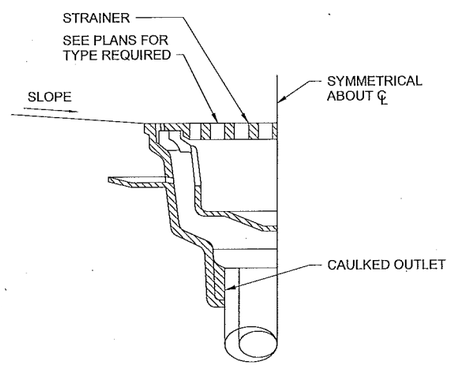


2 WALL CLEANOUT
SCALE:NTS

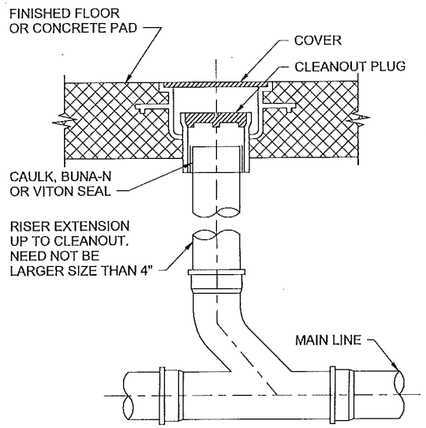


NOTES:
1. FOR PIPE SIZES SEE FLOOR PLAN.
2. FOR HEATER SELECTION SEE SCHEDULE AND SPECIFICATIONS.

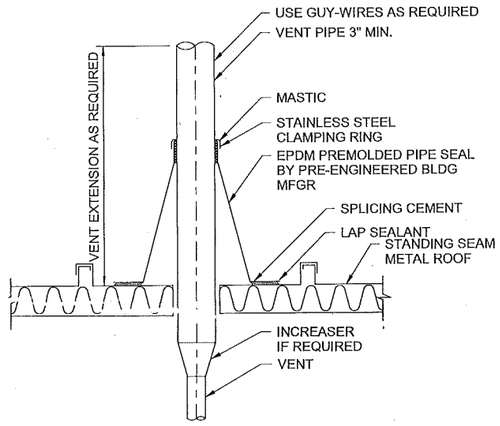
3 ELECTRIC WATER HEATER
SCALE: 12" = 1'-0"



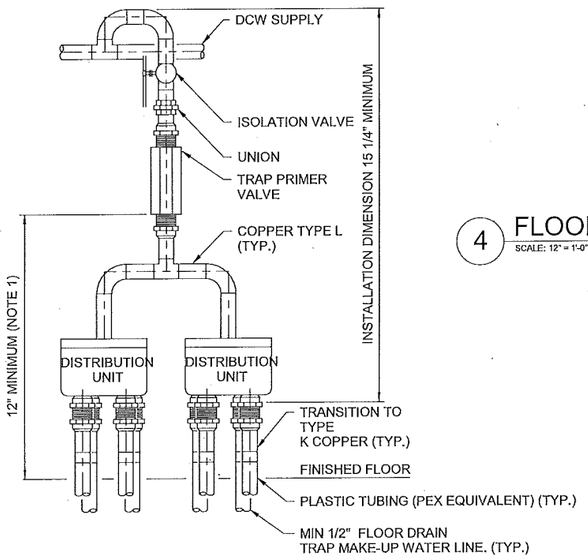
4 FLOOR DRAIN IN GROUND FLOOR
SCALE: 12" = 1'-0"



5 FLOOR CLEANOUT
SCALE: 12" = 1'-0"

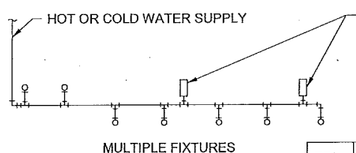


6 VENT FLASHING - STANDING SEAM
SCALE:NTS



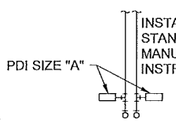
NOTES:
1. TRAP PRIMER VALVE SHOULD BE MOUNTED ONE FOOT ABOVE THE FINISHED FLOOR FOR EVERY 20 FOOT OF PRIME LINE.
2. A METERED AMOUNT OF WATER FROM THE FLOOR DRAIN TRAP PRIMER IS DISTRIBUTED TO AS MANY AS (8) INDIVIDUAL FLOOR DRAIN TRAPS.
3. INSTALL ASSEMBLY WITH ACCESS FOR PERIODIC INSPECTION.

7 TRAP PRIMER
SCALE: 12" = 1'-0"



MULTIPLE FIXTURES

PDI SIZE	PIPE SIZE	FIXTURE UNIT LOAD
A	1/2"	1-11
B	3/4"	12-32
C	1"	33-60
D	1-1/4"	61-113
E	1-1/2"	114-154
F	2"	154-330



SINGLE FIXTURE

FIXTURE UNIT TABULATION		
FIXTURE	COLD	HOT
VALVE WATER CLOSET	6.0	--
URINAL	5.0	--
SINK	1.5	1.5
LAVATORY	1.5	1.5
JANITOR'S SINK	2.25	2.25
SHOWER	2.0	2.0
DISHWASHER	--	1.4

* REFER TO IPC TABLE E103.3(2)

NOTE:
PROVIDE WATER HAMMER ARRESTERS. INSTALL IN HORIZONTAL OR VERTICAL POSITION, BUT NEVER UPSIDE DOWN. INSTALL IN LINE WITH WATER FLOW DIRECTION IF POSSIBLE. SIZE THE UNITS AS SHOWN ON THE DRAWINGS AND/OR PER THE TABLES SHOWN.

8 WATER HAMMER ARRESTORS
SCALE: 12" = 1'-0"



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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

PLUMBING DETAILS

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PLUMBING FIXTURE SCHEDULE

TAG NO.	DESCRIPTION	FIXTURE TYPE	FIXTURE SIZE	FITTING TYPE	FITTING SUPPLY	TRAP	CARRIER	REMARKS	MOUNTING HEIGHT	CONNECTION SIZE C.W.	H.W.	WASTE	VENT
HB-1	HOSE BIBB	INTERIOR HOSE BIBB	N/A	BRASS W/ANTI-SIPHON VACUUM BREAKER, TEE KEY HANDLE, AND HOSE CONNECTION	1/2"	N/A	N/A	WALL MOUNTED WITH POLISHED CHROME FINISH	48" AFF	1/2"	N/A	N/A	N/A
KS-1	SINGLE SINK W/ DISPOSAL	SINGLE BOWL, TYPE 304 18 GA SS, UNDERCOUNTER MOUNTED, WITH SOUND DEADENING	22 1/2" X 18 1/2" X 9" DEEP	SINGLE HOLE FAUCET, 8" SWIVEL SPOUT, SINGLE METAL LEVER HANDLE, AND 1.5 GPM AERATOR	1/2"	1-1/2"	N/A	PROVIDE SS BASKET STRAINER AND 1/2 HP, 120V GARBAGE DISPOSAL, INSINKERATOR BADGER 5	HT. SET BY COUNTER TOP	1/2"	1/2"	2	1-1/2"
LAV-1	COUNTER MOUNTED LAVATORY	UNDERCOUNTER MOUNTED STAINLESS STEEL	19" DIA.	4" CENTERSET, DOUBLE BLADE HANDLES, MANUAL 0.5 GPM FAUCET AND PERFORATED GRID STRAINER	1/2"	2" W/CLEAN OUT PLUG	WALL CARRIER	PROVIDE WITH OVERFLOW	REFER TO ARCH. WALL ELEVATIONS	1/2"	1/2"	2"	1-1/2"
LAV-2	ADA WALL MOUNTED LAVATORY	PORCELAIN WALL MOUNTED WITH BACKSPLASH	20" X 18" X 12"	4" CENTERSET, DOUBLE LEVER HANDLES, MANUAL 0.5 GPM FAUCET AND PERFORATED GRID STRAINER	1/2"	2" W/CLEAN OUT PLUG	WALL CARRIER	PROVIDE WITH PIPE INSULATION COVER AND OVERFLOW	REFER TO ARCH. WALL ELEVATIONS	1/2"	1/2"	2"	1-1/2"
MB-1	CORNER MOP BASIN	PRECAST TERRAZO, MOLDED MARBLE CHIPS AND PORTLAND CEMENT BASIN WITH DROPPED THRESHOLD AND SS SPLASH PANELS	24" X 24" X 12" DEEP	WALL-MOUNTED FAUCET, 8" CENTERS, VACCUUM BREAKER SPOUT, PAIL HOOK WALL BRACE, AND 3/4" MALE THREAD HOSE CONNECTION, 36" HOSE, AND SS WALL HOOK	3/4"	3"	N/A	INTEGRAL CORROSION-RESISTANT METAL DRAIN WITH REMOVABLE STRAINER AND 3" BOTTOM OUTLET	FAUCET: 36" AFF & BASIN - FLOOR MOUNTED	3/4"	3/4"	3"	1-1/2"
UR-1	ADA URINAL	0.125 GPF, BACK OUTLET, WHITE VITREOUS CHINA	3/4" SPUD	MANUAL FLUSHOMETER	3/4"	INTEGRAL	WALL CARRIER	NONE	RIM 17" AFF	3/4"	N/A	2"	1-1/2"
WC-1	WATER CLOSET	1.28 GPF, ELONGATED BOWL, WALL MOUNT BACK DISCHARGE WHITE VITREOUS CHINA	1-1/2" SPUD	MANUAL FLUSHOMETER	1"	INTEGRAL	WATER CLOSET CARRIER	PROVIDE SOLID PLASTIC, OPEN FRONT SEAT (LESS COVER)	RIM 15" AFF	1-1/4	N/A	4	2
WC-2	WATER CLOSET ACCESSIBLE	1.28 GPF, ELONGATED BOWL, WALL MOUNT BACK DISCHARGE WHITE VITREOUS CHINA. ABA/ADA	1-1/2" SPUD	MANUAL FLUSHOMETER	1"	INTEGRAL	WATER CLOSET CARRIER	PROVIDE SOLID PLASTIC, OPEN FRONT SEAT (LESS COVER)	RIM 17" AFF	1-1/4	N/A	4	2
WH-1	WALL HYDRANT	EXTERIOR WALL HYDRANT	N/A	BRASS AUTOMATIC DRAINING, FREEZELESS, WITH ANTI-SIPHON VACUUM BREAKER, TEE KEY HANDLE, AND HOSE CONNECTION	3/4"	N/A	N/A	WALL SURFACE MOUNTED W/BRASS FINISH	48" AFF	3/4"	N/A	N/A	N/A

WATER HEATER SCHEDULE (WH)

TAG	LOCATION	SERVING	INPUT (kW)	TEMP SETTING (°F)	TANK CAPACITY (GAL)	RECOVERY RATE (GPH @ 90°F RISE)	ELECTRICAL V/PH/HZ	ELECTRICAL DISCONNECT BY	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	WEIGHT (LBS)	NOTES
EWH-1	110 - UTILITY ROOM	DOMESTIC HOT WATER	6	140	10	27	240/1/60	DIV. 26	AO SMITH	DES-10A	116	1

NOTES:
1. ASME TANK, WALL MOUNTED ON PLATFORM.

FLOOR DRAIN SCHEDULE (FD)

TAG	DESCRIPTION	TYPE	STRAINER	BASIS OF DESIGN MFR	BASIS OF DESIGN MODEL	NOTES
FD-1	CAST IRON, TWO-PIECE BODY, INTEGRAL CLAMPING COLLAR, TRAP PRIMER CONNECTION	FLOOR DRAIN - ROUND	5" DIAMETER ADJUSTABLE, NICKEL-BRONZE	JAY R. SMITH	2005-A	1, 2
FD-2	CAST IRON, TWO-PIECE BODY, INTEGRAL CLAMPING COLLAR, TRAP PRIMER CONNECTION	FLOOR DRAIN - ROUND HEAVY DUTY	8" DIAMETER STRAINER WITH 4" FUNNEL	JAY R. SMITH	3510	1, 2

NOTES:
1. SIZE AS REQUIRED BY CODE.
2. NEOPRENE GASKETED PUSH-ON OUTLET.

CLEANOUT SCHEDULE (CO)

TAG	TYPE	COVER	BASIS OF DESIGN: MFR	BASIS OF DESIGN: MODEL	NOTES
FCO	FLOOR	SQUARE NICKEL BRONZE TOP	JAY R. SMITH	4051	1, 2, 3
WCO	WALL	STAINLESS STEEL ACCESS COVER	JAY R. SMITH	4505	1, 2, 3

NOTES:
1. SIZE AS REQUIRED BY CODE.
2. COUNTERSUNK PLUG AND INTERNAL THREADING FOR TEST PLUG USE.
3. COORDINATE COVER TYPE WITH ARCHITECTURAL FINISHES.

EXPANSION TANK SCHEDULE (ET)

TAG NO.	TYPE	LOCATION	SYSTEM	MIN. TANK VOLUME (GAL)	MIN. TANK ACCEPTANCE VOLUME (GAL)	DESIGN TEMP. (DEG. F.)	MAX. DESIGN PRESS. (PSI)	FULL WEIGHT (LBS)	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL
ET-1	BLADDER	110	DHW	10	10	240	150	40	WESSELS	TXA 35

no.	date	by	ckd	description
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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

PLUMBING SCHEDULES

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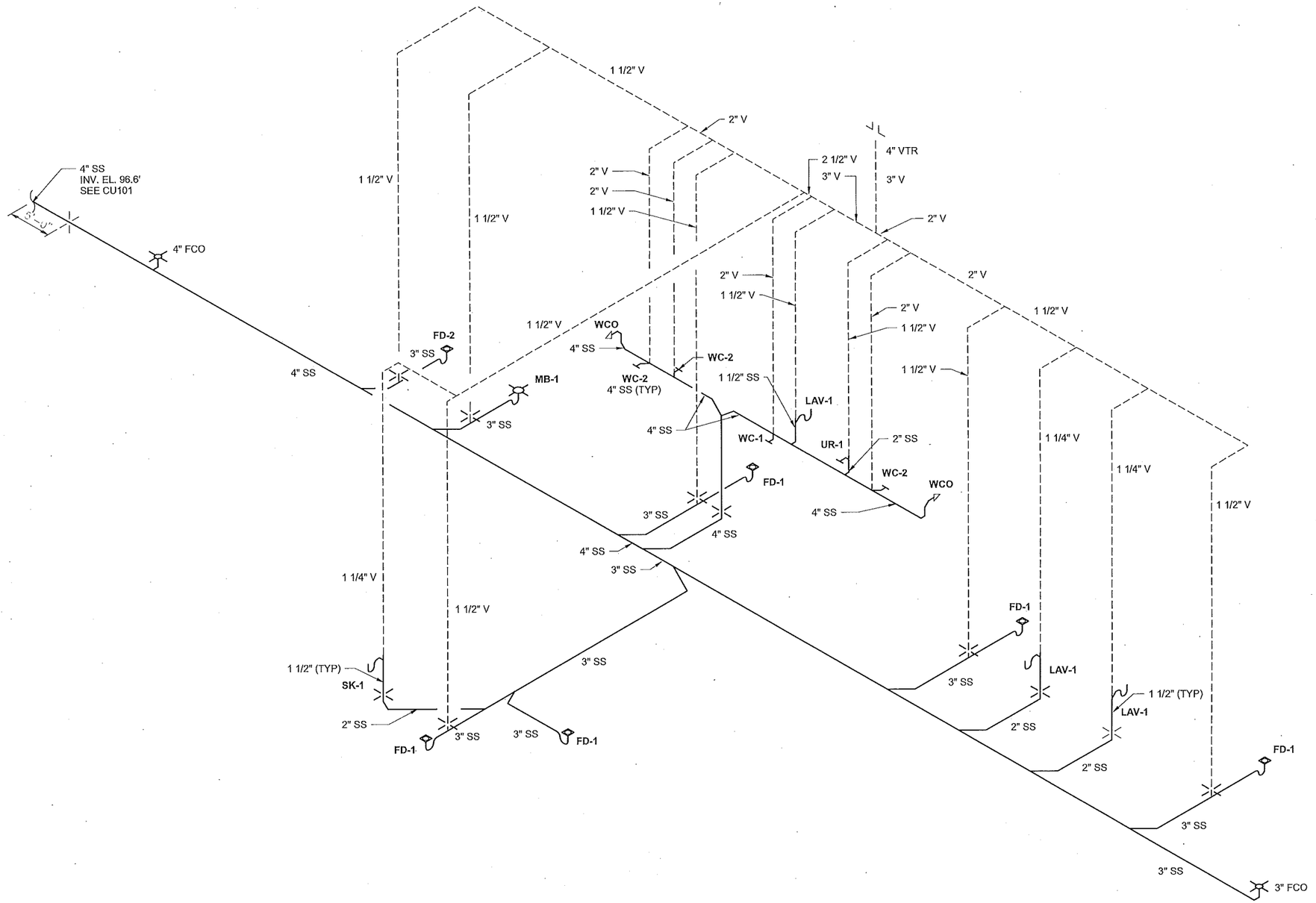
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1 SANITARY WASTE & VENT RISER DIAGRAM
SCALE:NTS

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PLUMBING RISER DIAGRAMS

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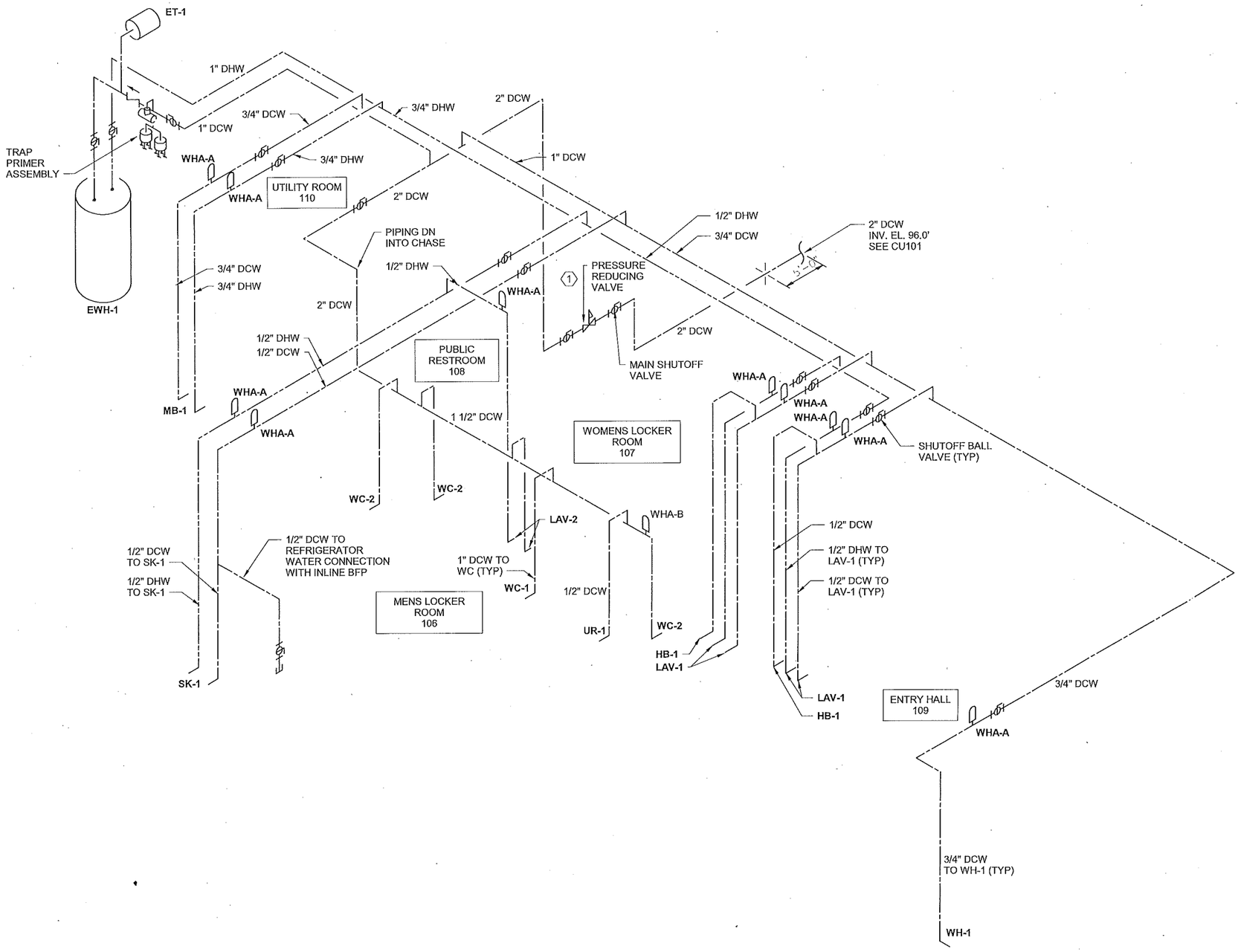
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1 DOMESTIC WATER RISER DIAGRAM
SCALE:NTS

GENERAL NOTES:

1. FOR PLUMBING NOTES, LEGEND, SYMBOLS & ABBREVIATIONS, SEE P-001.
2. FINISHED FLOOR ELEVATION IS 100.0'.
3. WATER SHUTOFF VALVES SHALL BE LOCATED WHERE ACCESSIBLE. COORDINATE ACCESS PANELS FOR SHUTOFF VALVES WITH ARCHITECTURAL DRAWINGS.
4. ROUTE DOMESTIC COLD WATER LINE TO TRAP PRIMER CONNECTION AT ALL FLOOR DRAINS.

KEYED NOTES:

(1) PRESSURE REDUCING VALVE SHALL BE SET TO 50 PSI.

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PLUMBING RISER DIAGRAMS

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CONDUIT

- INDICATES EXISTING TO REMAIN, UNLESS OTHERWISE NOTED
- INDICATES NEW WORK
- EXISTING ELECTRICAL DUCTBANK
- EXISTING COMMUNICATIONS DUCTBANK
- ELECTRICAL DUCTBANK
- COMMUNICATIONS DUCTBANK
- CONTINUATION
- OHU OVERHEAD UTILITY
- FENCE
- UNDERGROUND WATER

SYMBOLS - COMMUNICATIONS PLAN

- TYPICAL WALL MOUNTED DATA OUTLET BOX. NUMBER INDICATES OUTLET TYPE. (2) RJ-45 JACKS WITH (2) SPARES. MOUNT 18" AFF UON. SEE S01 FOR DETAILS.
- WAP CEILING MOUNTED WIRELESS ACCESS POINT (WAP). SEE E501 FOR DETAILS.
- DATA RACK

SYMBOLS - ONE-LINE DIAGRAM

- CONNECTION
- CONTINUATION
- SEPARABLE CONNECTOR OR CONNECTION FOR DRAWOUT ASSEMBLIES
- FUSED DISCONNECT SWITCH
- TRANSFORMER
- GROUND
- Δ / Y DELTA - WYE TRANSFORMER CONNECTION
- DM DIGITAL METER
- SPD SURGE PROTECTION DEVICE
- VFD VARIABLE FREQUENCY DRIVE
- ST SHUNT TRIP
- CIRCUIT BREAKER
- SWITCH
- DISCONNECT SWITCH
- SPECIAL RECEPTACLE
- PANEL NAME PANELBOARD

SYMBOLS - POWER PLAN

RECEPTACLES (NEMA 5-20R UON)

- RECESSED DUPLEX
- RECESSED DUPLEX MOUNTED HORIZONTALLY
- RECESSED QUAD
- DUPLEX, CEILING MTD
- SPECIAL RECEPTACLE (REFER TO DRAWINGS FOR NEMA CONFIGURATION)
- SURFACE DUPLEX
- SURFACE QUAD
- RECESSED SIMPLEX
- P DUPLEX RECEPTACLE (ELEVATION VIEW)
- COMBINATION FLOOR BOX SEE DETAIL 1/E501 FOR MORE DETAIL

JUNCTION BOXES

- RECESSED JBOX, WALL MOUNTED
- SURFACE JBOX, WALL MOUNTED
- J JBOX MOUNTED ABOVE CEILING (UNLESS OTHERWISE INDICATED)
- M MECHANICAL EQUIPMENT CONNECTION
- E EQUIPMENT CONNECTION

DISCONNECT SWITCHES (NEMA 1, 30A/3P, 480V UON)

- DISCONNECT SWITCH
- COMBO MOTOR STARTER/DISCONNECT
- MOTOR STARTER
- S M MOTOR-RATED SWITCH

POWER DEVICES GENERAL INFORMATION

- PANELBOARD - CIRCUIT
- LP-x / J / [EF-x] ANY RECEPTACLE OR JBOX LISTED ABOVE
- EQUIPMENT IDENTIFICATION (FOR MECHANICAL EQUIPMENT CONNECTIONS)
- D30/F30 FUSE SIZE (IF INDICATED)
- EQUIPMENT RATED AMPACITY
- TYPE (D=DISCONNECT)

MISCELLANEOUS ELECTRICAL DEVICES

- PANELBOARD

GROUNDING AND LIGHTNING PROTECTION DEVICES

- 3/4" X 10' COPPER-CLAD STEEL GROUND ROD
- GROUND TEST WELL
- GROUND PLATE CONNECTION (TO BUILDING STEEL OR EQUIPMENT)
- AIR TERMINAL * TYPE A - DETAIL 5 ON SHEET E500
- DOWN CONDUCTOR, DETAIL 4 ON SHEET E500
- GB GROUND BUS
- MGB MAIN GROUND BUS
- TMGB TELECOMMUNICATIONS MAIN GROUND BUS
- TGB TELECOMMUNICATIONS GROUND BUS
- MGB MULTIPOINT GROUND (AND STATIC)
- GROUNDING COUNTERPOISE/CONDUCTOR -BURIED, BARE CABLE (EXTERIOR) -COPPER, #4/0 AWG MINIMUM, UON
- LIGHTNING PROTECTION CONDUCTOR

LIGHTNING PROTECTION NOTES

1. PROVIDE A FRANKLIN ROD TYPE LIGHTNING PROTECTION SYSTEM IN ACCORDANCE WITH NFPA 780 AND UL 96. ALL LIGHTNING PROTECTION DOWN CONDUCTORS SHALL BE CONCEALED.
2. ALL SYSTEM MATERIALS SHALL BE UL LISTED FOR LIGHTNING PROTECTION SYSTEMS. ALL CONDUCTORS SHALL BE LABELED EVERY 10' WITH UL LISTINGS.
3. THE COMPLETED SYSTEM SHALL BEAR THE UL MASTER LABEL, WHICH SHALL BE PROVIDED TO THE GOVERNMENT NO LATER THAN 30 DAYS AFTER COMPLETION.
4. CONTRACTOR SHALL ENSURE THAT MATERIALS USED ARE COMPATIBLE WITH THE ROOFING SYSTEM. DISSIMILAR METALS SHALL NOT BE UTILIZED.

SYMBOLS - LIGHTING PLAN

- CLASSROOM ← ROOM / SPACE TAG
- 101

LIGHTING FIXTURES (REFER TO DRAWINGS FOR SIZES)

**LIGHTING FIXTURE SHAPES VARY ON DRAWINGS. REFER TO FIXTURE SCHEDULE FOR FIXTURE TYPE DIMENSIONS AND DESCRIPTIONS*

- TYPICAL FIXTURE (HATCHING DENOTES EMERGENCY EGRESS FIXTURE)
- LINEAR PENDANT LIGHT FIXTURE
- WALLPACK FIXTURE
- DOWNLIGHT (HATCHING DENOTES EMERGENCY EGRESS FIXTURE)
- EXIT SIGNS, CEILING: ARROW INDICATES EGRESS
- EXIT SIGNS, WALL: ARROW INDICATES EGRESS. MOUNT FIXTURE AT 8'-0" AFF, UON.
- OS VS CEILING MOUNTED OCCUPANCY/VACANCY SENSORS, UON
- PC PHOTOCELL

FIXTURE GENERAL INFORMATION

- FIXTURE TYPE
- F1 / LP-1 a LOWER CASE LETTER DENOTES SWITCH 'LEG'. THE SWITCH WITH THE SAME LETTER IN THE SAME SPACE OPERATES THIS FIXTURE. 'NL' INDICATES THE FIXTURE SHALL BE CIRCUITED AS AN UNSWITCHED NIGHT LIGHT.
- PANELBOARD - CIRCUIT NUMBER

LIGHTING CONTROL DEVICES GENERAL INFORMATION

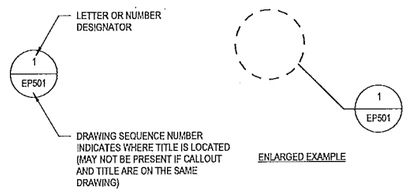
- SWITCH — S 3 a
- SWITCH 'LEG' DESIGNATION. NUMBER OF DESIGNATIONS INDICATES NUMBER OF SWITCHES AT THAT LOCATION.

DEMARCATION
- K: KEYED
- 3: 3-WAY
- 4: 4-WAY
- T: DIGITAL TIMER SWITCH
- P: PILOT LIGHT
- EP: EXPLOSION PROOF
- OS: OCCUPANCY SENSOR
- VS: VACANCY SENSOR

LIGHTING CONTROL NOTES:

1. NO DEMARCATION OR SWITCH 'LEG' INDICATES THAT THE SWITCH CONTROLS ALL OF THE FIXTURES WITHIN THE SAME ROOM.
2. REFER TO SPECIFICATIONS FOR USE OF LINE VOLTAGE VS LOW VOLTAGE LIGHTING CONTROLS.

CALLOUT IDENTIFICATION



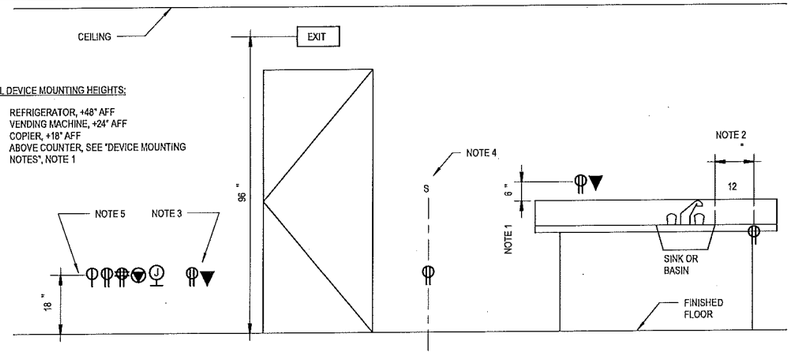
ACRONYMS/ABBREVIATIONS

A	AMPERES	GFI / GFCI	GROUND FAULT CIRCUIT INTERRUPTER	PDU	POWER DISTRIBUTION UNIT
AC	ABOVE COUNTER	G OR GND	GROUND	POE	POWER OVER ETHERNET
AFF	ABOVE FINISHED FLOOR	GFR	GROUND FAULT RELAY	PVC	POLYVINYL CHLORIDE
AIC	AMPERES INTERRUPTING CAPACITY	GFP	GROUND FAULT PROTECTION	REF	REFRIGERATOR
ATS	AUTOMATIC TRANSFER SWITCH	GRS	GALVANIZED RIGID STEEL CONDUIT	RGS	RIGID GALVANIZED STEEL CONDUIT
AV	AUDIO/VIDEO	HZ	HERTZ	RMC	RIGID METAL CONDUIT
AWG	AMERICAN WIRE GAUGE	IG	ISOLATED GROUND	SCCR	SHORT CIRCUIT CURRENT RATING
BMS	BUILDING MANAGEMENT SYSTEM	KCMIL	THOUSAND CIRCULAR MILS	SM	SINGLE MODE
C	CONDUIT	KV	KILOVOLT	SPD	SURGE PROTECTION DEVICE
CAT	CATEGORY	KVA	KILOVOLT AMPERES	SPECS	CONTRACT SPECIFICATIONS
COMM	COMMUNICATIONS	KW	KILOWATT	SPST	SINGLE POLE SINGLE THROW
CPP	COPPER HORIZONTAL PATCH PANEL	KWH	KILOWATT HOURS	STP	SHIELDED TWISTED PAIR
CT	CABLE TRAY	MAX	MAXIMUM	T	TRANSFORMER
CU	COPPER	MCB	MAIN CIRCUIT BREAKER	TV	TELEVISION
EF	EXHAUST FAN	MDP	MAIN DISTRIBUTION PANEL	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
EGC	EQUIPMENT GROUNDING CONDUCTOR	MICRO	MICROWAVE	TYP	TYPICAL
EMNL	EMERGENCY / NIGHT LIGHT	MLO	MAIN LUGS ONLY	UL	UNDERWRITERS' LABORATORIES
EMT	ELECTRICAL METALLIC TUBING	MM	MULTIMODE	UON	UNLESS OTHERWISE NOTED
EPO	EMERGENCY POWER OFF	N	NEUTRAL CONDUCTOR	UTP	UNSHIELDED TWISTED PAIR
ETR	EXISTING TO REMAIN	N.C.	NORMALLY CLOSED	V	VOLTS
EX OR EXP	EXPLOSION PROOF	NEC	NATIONAL ELECTRICAL CODE	VA	VOLT AMPERES
FA	FIRE ALARM	NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION	VFD	VARIABLE FREQUENCY DRIVE
FAAP	FIRE ALARM ANNUNCIATOR PANEL	NIC	NOT IN CONTRACT	W	WATT
FACP	FIRE ALARM CONTROL PANEL	N.O.	NORMALLY OPEN	WAP	WIRELESS ACCESS POINT
FBO	FURNISHED BY OTHERS	NTS	NOT TO SCALE	WPIU	WEATHERPROOF WHILE IN USE
FPP	FIBER OPTIC PATCH PANEL	P	POLE	XFMR	TRANSFORMER
FT	FEET OR FOOT	PDU	POWER DISTRIBUTION UNIT	Z	IMPEDANCE
GBG	GARBAGE DISPOSAL				

GENERAL NOTES

1. THE ELECTRICAL CONTRACTOR SHALL VISIT THE SITE AND BECOME FAMILIAR WITH THE EXISTING SITE CONDITIONS PRIOR TO COMMENCING WORK. EXISTING DEVICES, EQUIPMENT, AND THEIR LOCATIONS ARE BASED OFF EXISTING DATA AND ARE SUBJECT TO FIELD VERIFICATION BY THE ELECTRICAL CONTRACTOR. UNLESS INDICATED AS EXISTING, ALL MATERIALS AND LABOR SHALL BE CONSIDERED NEW.
2. ALL EXISTING EQUIPMENT AND DEVICES TO REMAIN SHALL STAY IN-TACT AND OPERATIONAL DURING THE CONSTRUCTION PROCESS. IF A DEVICE REQUIRING POWER IS DISTURBED OR INTERRUPTED, RESTORE THE DEVICE TO IT'S ORIGINAL OPERATIONAL STATE. ANY DEMOLITION WORK REQUIRING MODIFICATION OF EXISTING ELECTRICAL SYSTEMS SHALL NOT COMPROMISE THE SYSTEMS TO REMAIN. INSTALL NEW CONDUIT AND WIRING WHERE NECESSARY TO RESTORE POWER PER NEC REQUIREMENTS.
3. CIRCUITING SHOWN IS DIAGRAMMATIC ONLY. EXACT ROUTING MAY VARY AND MAY REQUIRE ADDITIONAL JUNCTION BOXES AND/OR SPECIAL FITTINGS.
4. ALL CONDUCTORS SHALL BE RUN IN CONDUIT, AND ALL CONDUIT SHALL BE CONCEALED UNLESS OTHERWISE NOTED ON THE DRAWINGS.
5. ALL NEW SWITCHBOARDS AND PANELBOARDS SHALL BE FIELD MARKED TO WARN QUALIFIED PERSONS OF POTENTIAL ELECTRIC ARC FLASH HAZARD IN ACCORDANCE WITH NFPA 70 AND 70E.
6. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH MECHANICAL CONTRACTOR REGARDING ELECTRICAL REQUIREMENTS OF ACTUAL EQUIPMENT PROVIDED.
7. MOUNTING HEIGHT FOR LIGHT FIXTURES SHALL BE FROM THE BOTTOM OF FIXTURES TO THE FINISHED FLOOR.
8. COORDINATE EXACT PLACEMENT OF ALL DEVICES SHOWN ON ELECTRICAL CONSTRUCTION DOCUMENTS WITH ARCHITECTURAL, MECHANICAL, PLUMBING, STRUCTURAL, AND CIVIL DRAWINGS PRIOR TO FINAL PLACEMENT.
9. ALL SYSTEMS THAT REQUIRE COORDINATION BETWEEN TRADES SHALL BE TO THE SATISFACTION OF THE OWNER'S PROJECT MANAGER. ANY DEFICIENCIES, INCONSISTENCIES, OR POORLY COORDINATED INSTALLATIONS SHALL BE CORRECTED BY THE ELECTRICAL CONTRACTOR AT NO EXTRA COST TO THE OWNER.
10. ALL ELECTRICAL WORK SHALL COMPLY WITH NEC (NFPA 70), NFPA 72, NFPA 101, AND APPLICABLE CODES IN ADDITION TO LOCAL CODES AND ORDINANCES. ALL GROUNDING SHALL COMPLY WITH NFPA 70, ART. 250.
11. PROVIDE A GREEN CONTINUOUS INSULATED #6 MIN. EQUIPMENT GROUNDING CONDUCTOR TO ALL ELECTRICAL, TELECOMMUNICATIONS AND SECURITY EQUIPMENT SIZED PER NEC 250.122 AND EIA/TIA.
12. NOT ALL SYMBOLS AND ACRONYMS/ABBREVIATIONS SHOWN ON THIS DRAWING WILL BE USED.
13. WHEN REFERRING TO CONDUIT CALLOUTS, (2) 1-1/2"C OR (TWO) 1-1/2"C SHALL MEAN QUANTITY OF TWO, ONE AND ONE HALF INCH CONDUITS, FOR EXAMPLE.
14. REFER TO ARCHITECTURAL DRAWINGS FOR FIRE RATINGS OF WALLS AND PROVIDE APPROPRIATE RATED SEALANT AND FIRESTOPPING AS REQUIRED.
15. ALL NEW OVERCURRENT PROTECTION DEVICES SHALL MATCH THE TYPE AND AIC RATING OF THE EQUIPMENT THEY ARE BEING INSTALLED IN.
16. COORDINATE ALL CONNECTION REQUIREMENTS FOR OWNER PROVIDED EQUIPMENT.
17. FOR DEMOLITION DRAWINGS, ALL ELEMENTS SHOWN HALF-TONE ARE EXISTING TO REMAIN, AND ALL SHOWN BOLD SHALL BE DEMOLISHED, UNLESS OTHERWISE NOTED. FOR NEW WORK DRAWINGS, ALL ELEMENTS SHOWN HALF-TONE ARE EXISTING TO REMAIN AND ALL SHOWN BOLD ARE NEW WORK, UNLESS OTHERWISE NOTED.
18. ALL ELEMENTS REMOVED DURING DEMOLITION PHASE FOR REUSE DURING NEW WORK PHASE SHALL BE CAREFULLY STORED PRIOR TO REINSTALLATION. ANY DAMAGED ELEMENTS SHALL BE REPAIRED OR REPLACED AT NO COST TO THE OWNER.

TYPICAL DEVICE MOUNTING DETAIL



TYPICAL DEVICE MOUNTING HEIGHTS:

REF	REFRIGERATOR, +48" AFF
VM	VENDING MACHINE, +24" AFF
CO	COPIER, +18" AFF
AC	ABOVE COUNTER, SEE "DEVICE MOUNTING NOTES", NOTE 1

DEVICE MOUNTING NOTES:

1. COORDINATE ABOVE COUNTER DEVICES AND RECEPTACLES WITH CASEWORK OR COUNTERS SUCH THAT THE DEVICES AND RECEPTACLES ARE LOCATED AT +42" AFF OR 6" ABOVE THE COUNTERTOP OR BACKSPLASH.
2. ALL RECEPTACLES INSTALLED WITHIN 6'-0" OF ANY SINK OR BASIN SHALL HAVE GFI PROTECTION. DO NOT INSTALL RECEPTACLES WITHIN 12" OF THE EDGE OF A SINK OR BASIN.
3. COORDINATE WITH THE COMMUNICATIONS DRAWINGS TO ENSURE THAT A DUPLEX RECEPTACLE IS INSTALLED WITHIN 18" HORIZONTAL TO ALL SIGNAL AND DATA DEVICE LOCATIONS.
4. SWITCHES AND OTHER FLUSH WALL-MOUNTED DEVICES SHALL BE MOUNTED WITHIN 16" OF DOORFRAME OR ADJACENT TO SIDELIGHT FRAME. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR DOORS WITH ADJACENT SIDELIGHTS. WHERE DEVICES ARE SHOWN ADJACENT TO THE DOOR ON THE HINGE-SIDE OF THE DOOR, AND THE DOOR SWINGS IN A MANNER THAT SHALL BLOCK THE DEVICE, MOUNT THE DEVICE 12" BEYOND THE DOOR SWING. COORDINATE ROUGH-IN LOCATIONS WITH DIV. 23, 27, AND 28 DEVICES AS WELL. COORDINATE MOUNTING LOCATION WITH OTHER TRADES TO ENSURE A UNIFORM MOUNTING AND AESTHETICALLY-PLEASING APPEARANCE. COORDINATE WITH TACKABLE SURFACES, WHITEBOARDS, AND OTHER WALL-MOUNTED FURNISHINGS.
5. MOUNTING HEIGHT INDICATED IN LEGEND AND ON THE DRAWINGS SHALL BE THE DISTANCE MEASURED FROM THE CENTER OF THE DEVICE TO THE FINISHED FLOOR.

Professional Engineer MICHAEL S. ROACH 14557 Date WYOMING

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CITY OF CHEYENNE LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL LEGEND AND ABBREVIATIONS

project	contract
118706	

drawing **E001** — rev. **0**

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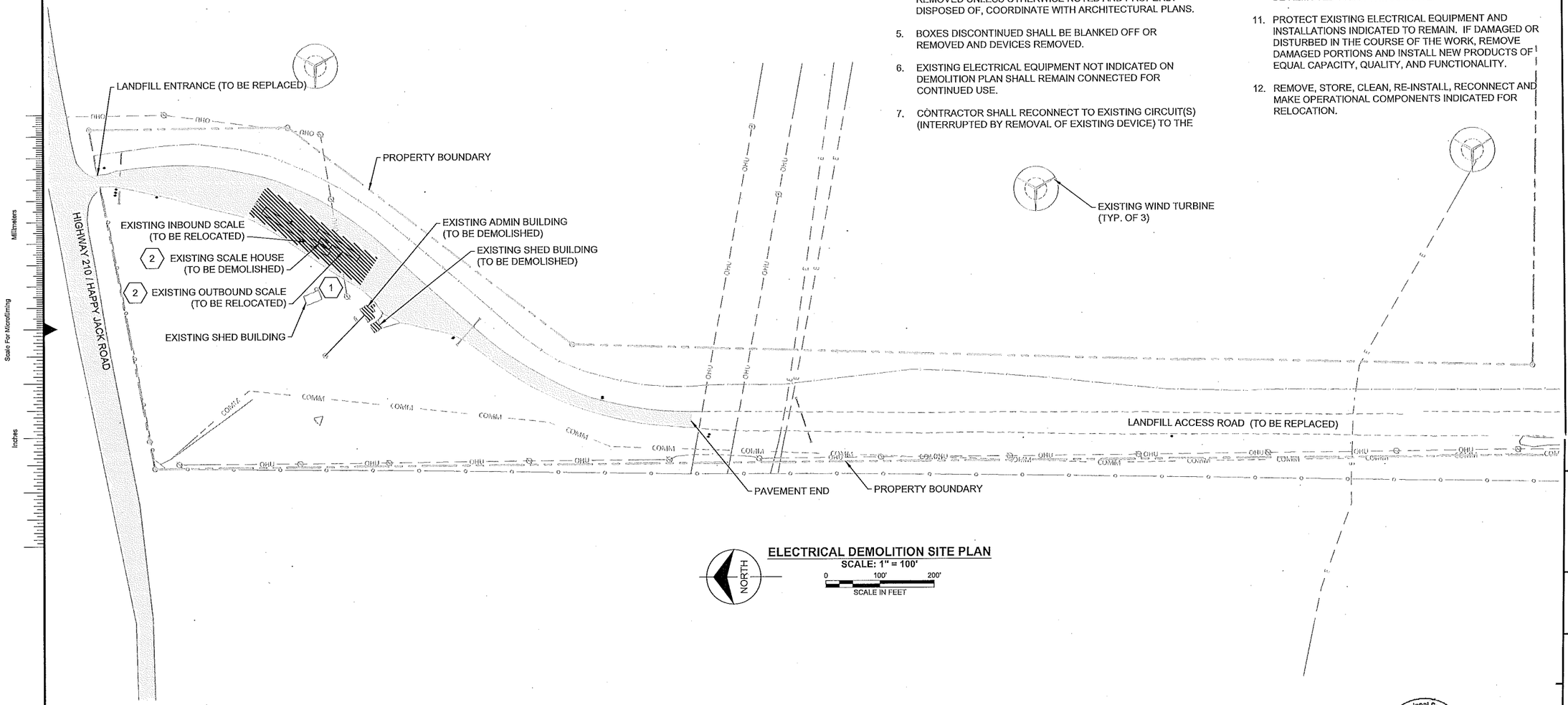
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KEYED DEMO NOTES: ⟨#⟩

1. DEMOLISH FEEDER TO UTILITY TRANSFORMER. COORDINATE WITH BLACK HILLS TO DE-ENERGIZE TRANSFORMER AND TO DISCONNECT AT TRANSFORMER.
2. SCALES SHALL BE DISCONNECTED FOR RELOCATION. CABLES SHALL BE COILED AND STORED SAFELY FOR FUTURE USE.

GENERAL DEMO NOTES:

1. REFER TO E-001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. THE ELECTRICAL DEMOLITION SHEETS SHOW EXISTING CONDITIONS THAT HAVE BEEN PREPARED BASED ON FIELD OBSERVATIONS AND ORIGINAL DRAWINGS. ADDITIONAL COMPONENTS AND CONDITIONS THAT ARE NOT SHOWN ON THE DRAWINGS MAY EXIST AND MAY REQUIRE CERTAIN REMODELING OR ADJUSTMENTS THAT ARE NOT NOTED ON THE DRAWINGS. FIELD VERIFY THE LOCATIONS OF ALL EXISTING EQUIPMENT AND DEVICES SHOWN ON THE DRAWINGS PRIOR TO BIDDING.
3. EQUIPMENT SHOWN HATCHED SHALL BE REMOVED, UON.
4. ALL ELECTRICAL DEVICES, CONDUIT, CONDUCTORS, FIXTURES, PANELBOARDS FROM EXISTING FACILITIES (ADMIN BUILDING, SHED, AND SCALE HOUSE) SHALL BE REMOVED UNLESS OTHERWISE NOTED AND PROPERLY DISPOSED OF, COORDINATE WITH ARCHITECTURAL PLANS.
5. BOXES DISCONTINUED SHALL BE BLANKED OFF OR REMOVED AND DEVICES REMOVED.
6. EXISTING ELECTRICAL EQUIPMENT NOT INDICATED ON DEMOLITION PLAN SHALL REMAIN CONNECTED FOR CONTINUED USE.
7. CONTRACTOR SHALL RECONNECT TO EXISTING CIRCUIT(S) (INTERRUPTED BY REMOVAL OF EXISTING DEVICE) TO THE REMAINING ELECTRICAL EQUIPMENT LOCATED DOWNSTREAM FROM THE POINT OF INTERRUPTION.
8. ALL MATERIALS REMOVED UNDER DEMOLITION SHALL BECOME PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED COMPLETELY OFF SITE, UON.
9. COORDINATE WITH OWNER PRIOR TO SHUTTING OFF SERVICES OR SYSTEMS WHICH MAY AFFECT OTHER AREAS BEYOND THE LIMITS OF THE DEMOLITION AREA.
10. ALL ELECTRICAL EQUIPMENT AND DEVICES IN THE ADMIN BUILDING, SHED, AND SCALE HOUSE SHALL BE REMOVED: COMPLETELY REMOVE ALL CONDUCTORS AND EXPOSED CONDUIT TO THE DEVICE. BURIED RACEWAY SHALL BE ABANDONED, REMOVED 2" BELOW SURFACE, CAP AND PATCH SURFACE TO MATCH EXISTING SURFACE FINISH. WHERE BACKBOXES CANNOT BE REMOVED, PROVIDE A BLANK COVERPLATE. ALL REMOVED CONDUIT, OLD BOXES, WIRING, AND MISCELLANEOUS ELECTRICAL SCRAP SHALL BE REMOVED FROM THE JOB SITE.
11. PROTECT EXISTING ELECTRICAL EQUIPMENT AND INSTALLATIONS INDICATED TO REMAIN. IF DAMAGED OR DISTURBED IN THE COURSE OF THE WORK, REMOVE DAMAGED PORTIONS AND INSTALL NEW PRODUCTS OF EQUAL CAPACITY, QUALITY, AND FUNCTIONALITY.
12. REMOVE, STORE, CLEAN, RE-INSTALL, RECONNECT AND MAKE OPERATIONAL COMPONENTS INDICATED FOR RELOCATION.



ELECTRICAL DEMOLITION SITE PLAN
SCALE: 1" = 100'

Professional Engineer MICHAEL S. ROVEY 14557 WYOMING Date

7/15/2020 3:02 PM

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CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
ELECTRICAL DEMOLITION SITE PLAN

project	contract
118706	7042

drawing ED101 — rev. 0

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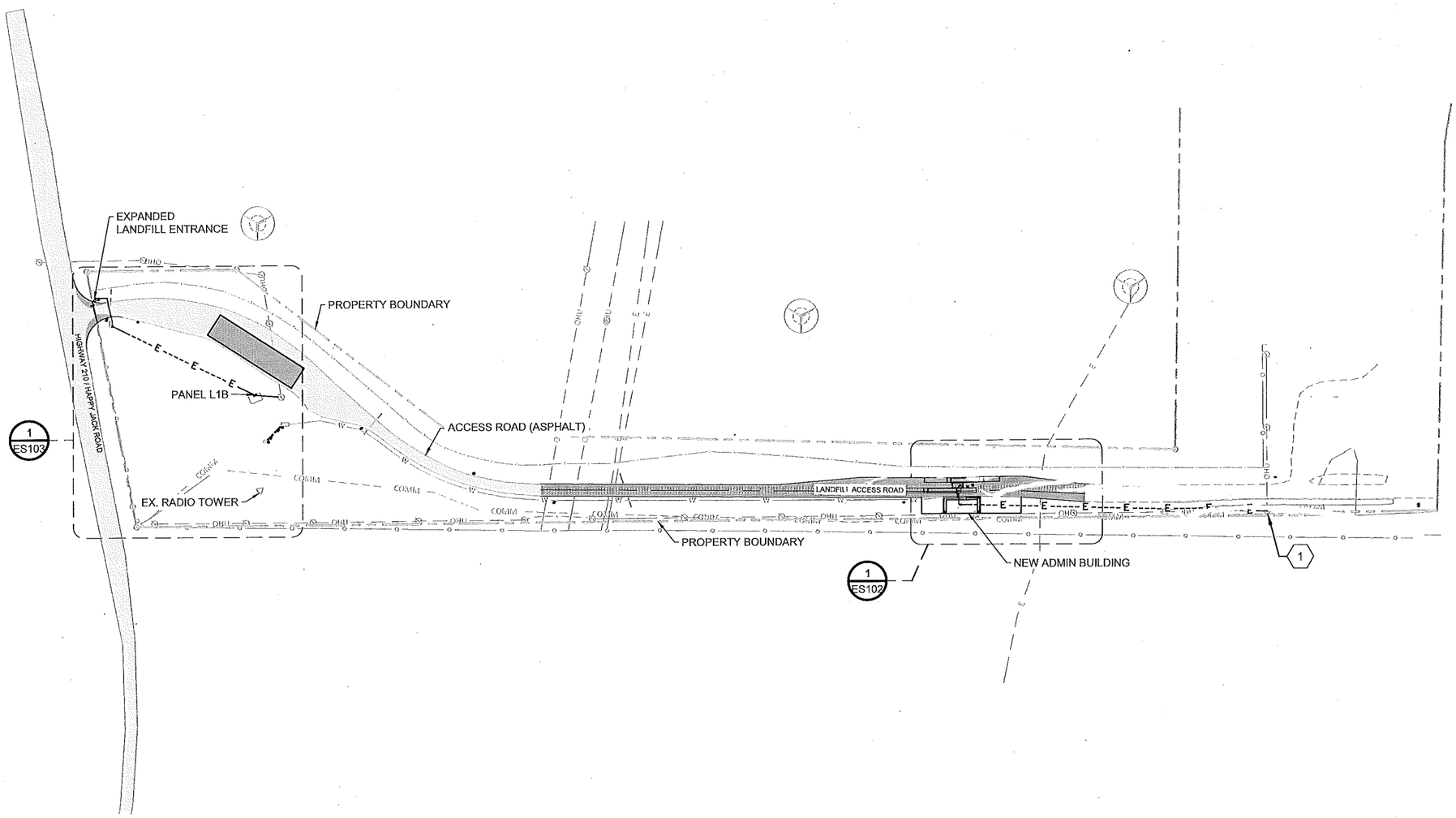
Scale For Microfilming: Millimeters / Inches

GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.

KEYED NOTES: (#)

1. CONTRACTOR SHALL CONFIRM EXACT LOCATION OF POLE MOUNTED TRANSFORMER ON SITE PRIOR TO WORK. PROVIDE AND INSTALL DIRECT BURIED FEEDER IN CONCRETE ENCASED DUCTBANK FROM TRANSFORMER TO ADMIN BUILDING AS SHOWN ON ONE-LINE ON SHEET E601.



NORTH

ELECTRICAL SITE PLAN
SCALE: 1" = 150'

0 150' 300'
SCALE IN FEET

Professional Engineer
MICHAEL S. ROACH
14557
Date
WYOMING

7/15/2020 3:02 PM

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
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ELECTRICAL SITE PLAN

project	contract
118706	7042

drawing ES101 – rev. 0

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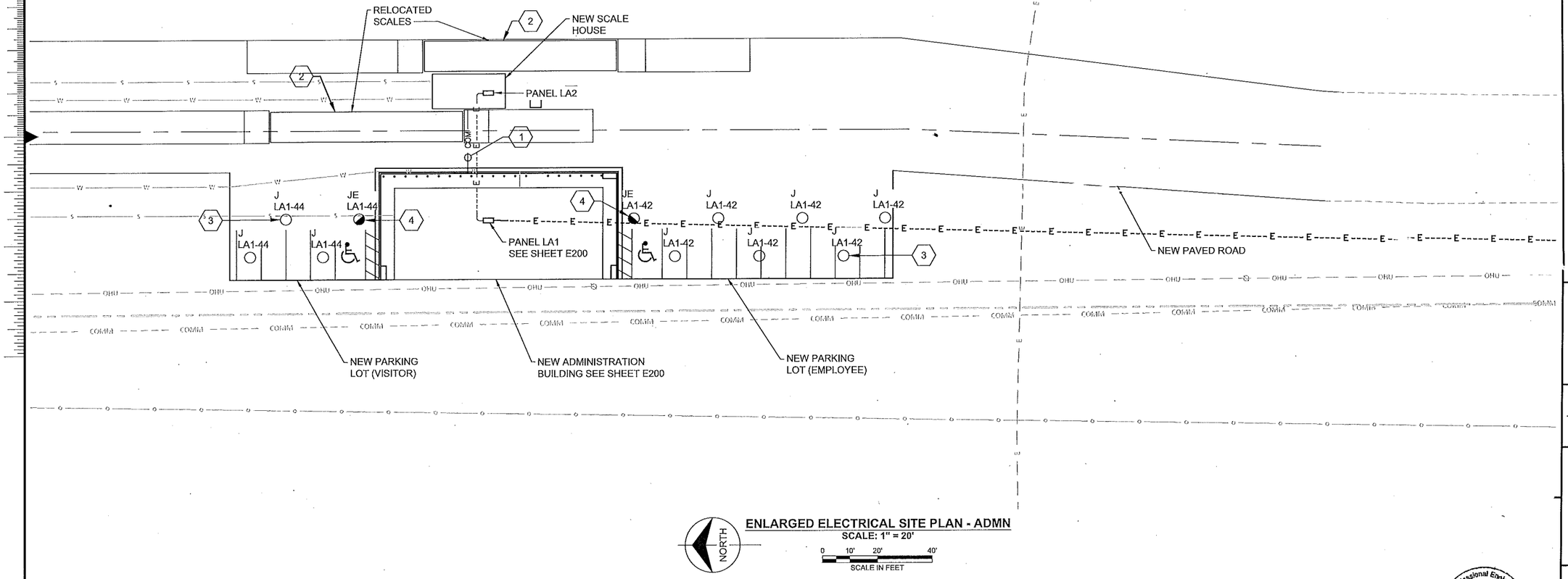
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GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.

KEYED NOTES: (#)

1. PROVIDE (1) 3" CONCRETE ENCASED CONDUIT FROM SCALE HOUSE TO ADMIN BUILDING, SEE DETAIL 7/E501. PROVIDE (4) OSP UTP CAT6 CABLES FROM TELECOM RACK IN ADMIN BUILDING TO END DEVICES IN SCALE HOUSE ALONG NORTH WALL.
2. PROVIDE AND INSTALL (1)TSP #18 WIRE FROM THE INDICATORS LOCATED IN SCALE HOUSE TO EACH OF THE LOAD CELLS. PROVIDE POWER WIRE SIMILAR TO EXISTING FROM SCALE HOUSE PANELS TO SCALES.
3. ELECTRICAL CONTRACTOR TO SURFACE MOUNT FIXTURES TO STRUCTURE. REFER TO LIGHT FIXTURE SCHEDULE ON E-600 FOR LUMINERE MODELS.
4. EMERGENCY FIXTURES TO BE MOUNTED WITHIN 10' OF ADMIN BUILDING EGRESS EXIT DOORS.



NORTH

ENLARGED ELECTRICAL SITE PLAN - ADMN
SCALE: 1" = 20'

0 10' 20' 40'
SCALE IN FEET

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
ENLARGED ELECTRICAL SITE PLAN - ADMN

project	contract
118706	7042

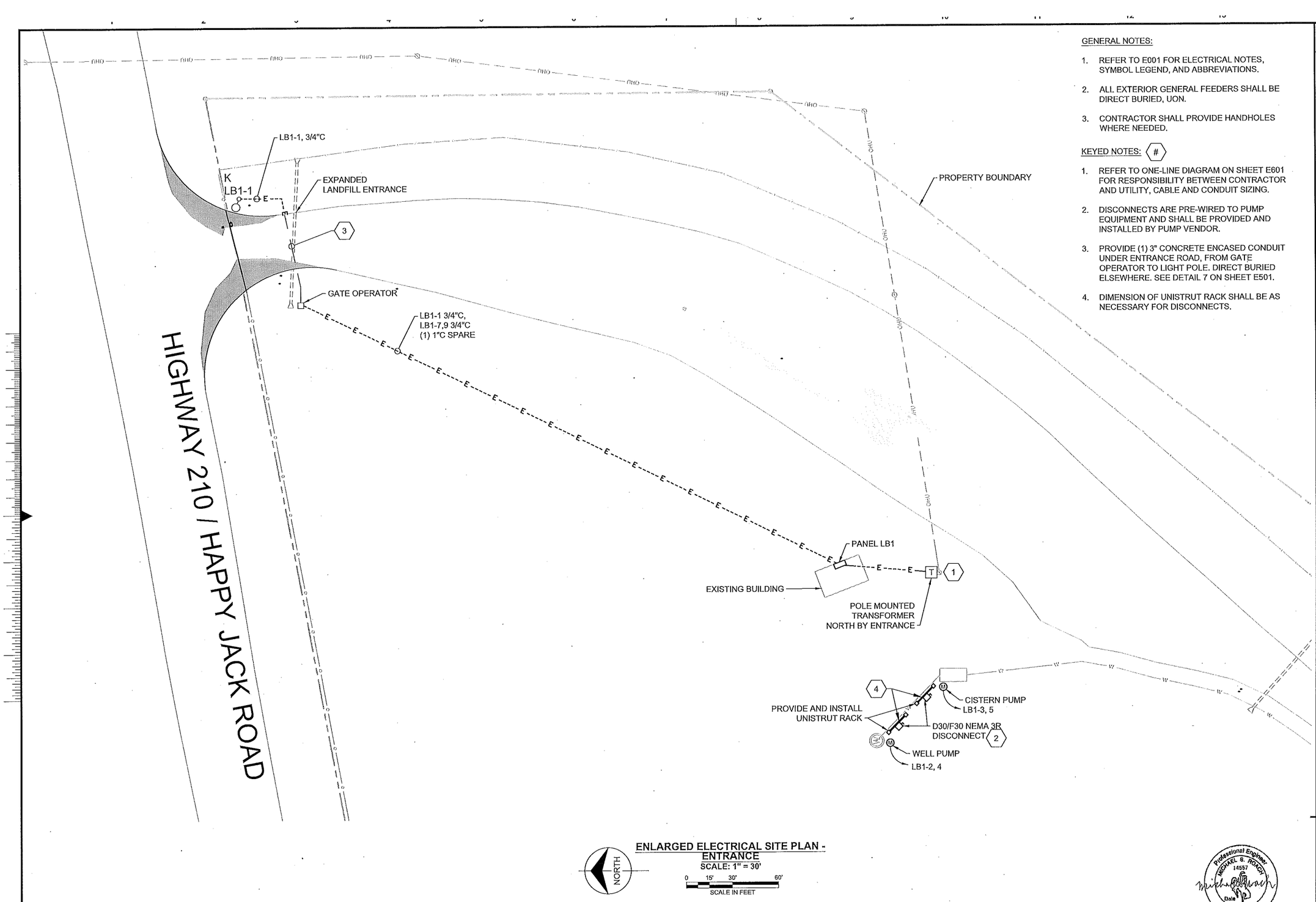
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Professional Engineer MICHAEL B. FOSTER 14557 WYOMING Date 7/15/20

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NORTH

ENLARGED ELECTRICAL SITE PLAN - ENTRANCE
SCALE: 1" = 30'

0 15' 30' 60'
SCALE IN FEET

GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. ALL EXTERIOR GENERAL FEEDERS SHALL BE DIRECT BURIED, UON.
3. CONTRACTOR SHALL PROVIDE HANDHOLES WHERE NEEDED.

KEYED NOTES: (#)

1. REFER TO ONE-LINE DIAGRAM ON SHEET E601 FOR RESPONSIBILITY BETWEEN CONTRACTOR AND UTILITY, CABLE AND CONDUIT SIZING.
2. DISCONNECTS ARE PRE-WIRED TO PUMP EQUIPMENT AND SHALL BE PROVIDED AND INSTALLED BY PUMP VENDOR.
3. PROVIDE (1) 3" CONCRETE ENCASED CONDUIT UNDER ENTRANCE ROAD, FROM GATE OPERATOR TO LIGHT POLE. DIRECT BURIED ELSEWHERE. SEE DETAIL 7 ON SHEET E501.
4. DIMENSION OF UNISTRUT RACK SHALL BE AS NECESSARY FOR DISCONNECTS.

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID

Professional Engineer
MICHAEL G. ROADY
14557
Date
WYOMING

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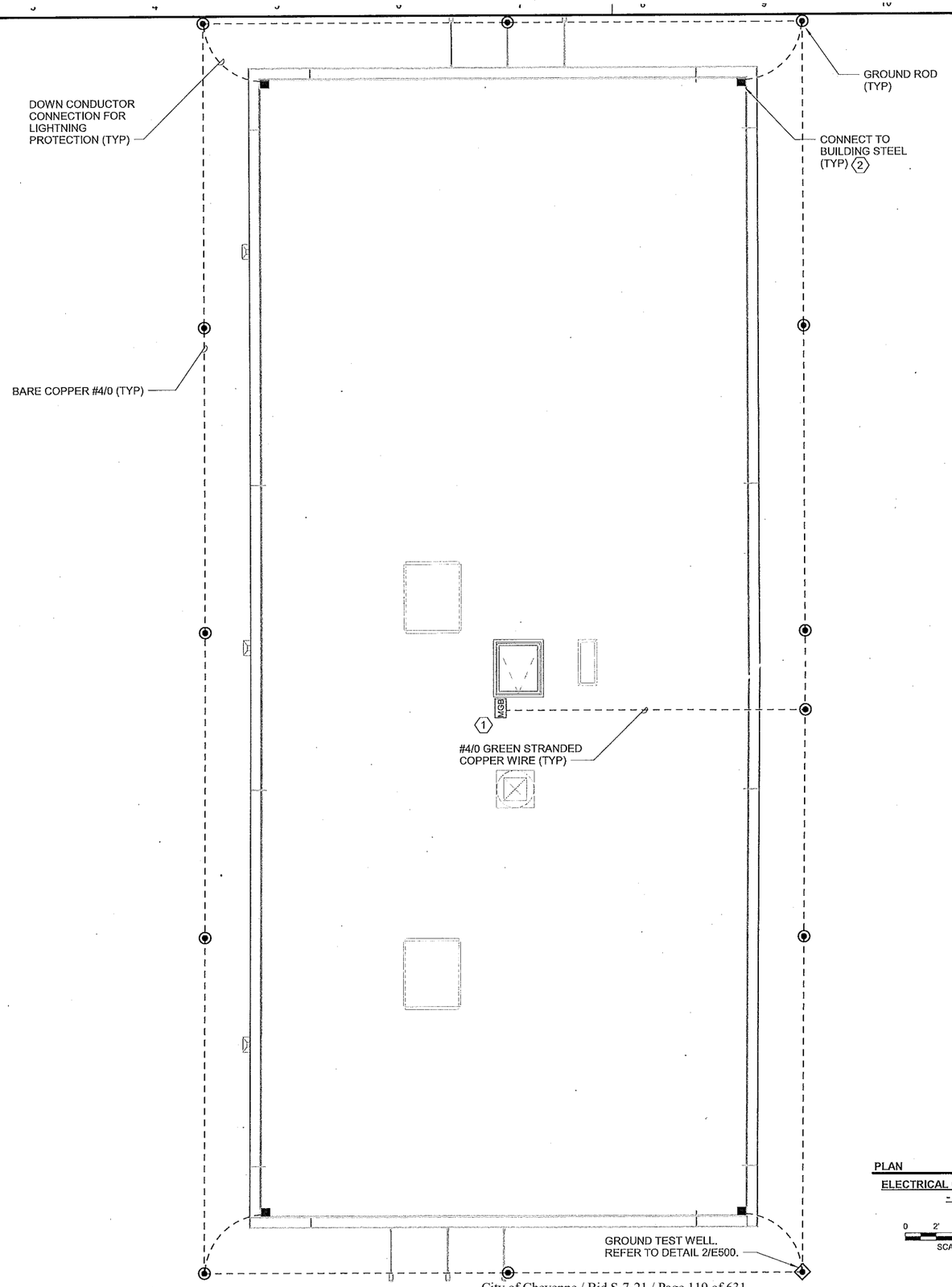
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ENLARGED ELECTRICAL SITE PLAN - ENTRANCE

project	contract
118706	7042

drawing **ES103** – rev. **0**

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GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. REFER TO DRAWING E500 FOR DETAILS.
3. GROUND CONDUCTOR PASSING THROUGH CONCRETE WALLS OR SLAB SHALL BE INSTALLED IN PVC CONDUIT SLEEVE OR RIGID GALVANIZED STEEL WITH GROUND BUSHING.
4. PROVIDE GROUND CONNECTION TO BUILDING STEEL, MAIN WATER LINE PIPE AND MAIN GROUND BUSBAR LOCATED IN ELECTRICAL ROOM.
5. BOND LIGHTNING PROTECTION SYSTEM TO THE STRUCTURAL STEEL WHERE REQUIRED.
6. THE DRAWING IS PROVIDED FOR PLANNING PURPOSES ONLY. CONTRACTOR SHALL LOCATE GROUND RODS WHERE REQUIRED.

KEYED NOTES: ⟨#⟩

1. MAIN GROUND BUS BAR. REFER TO GROUNDING DETAILS ON E500 AND E501.
2. BOND TO BUILDING STEEL. REFER TO DETAIL 5/E501.

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID

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ADMIN BLDG

SCALE BLDG

KEY PLAN

PLAN 1
ELECTRICAL GROUNDING PLAN - ADMN

0 2' 4' 8'
SCALE IN FEET

NORTH

7/15/2020 3:04 PM

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FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL GROUNDING PLAN - ADMN

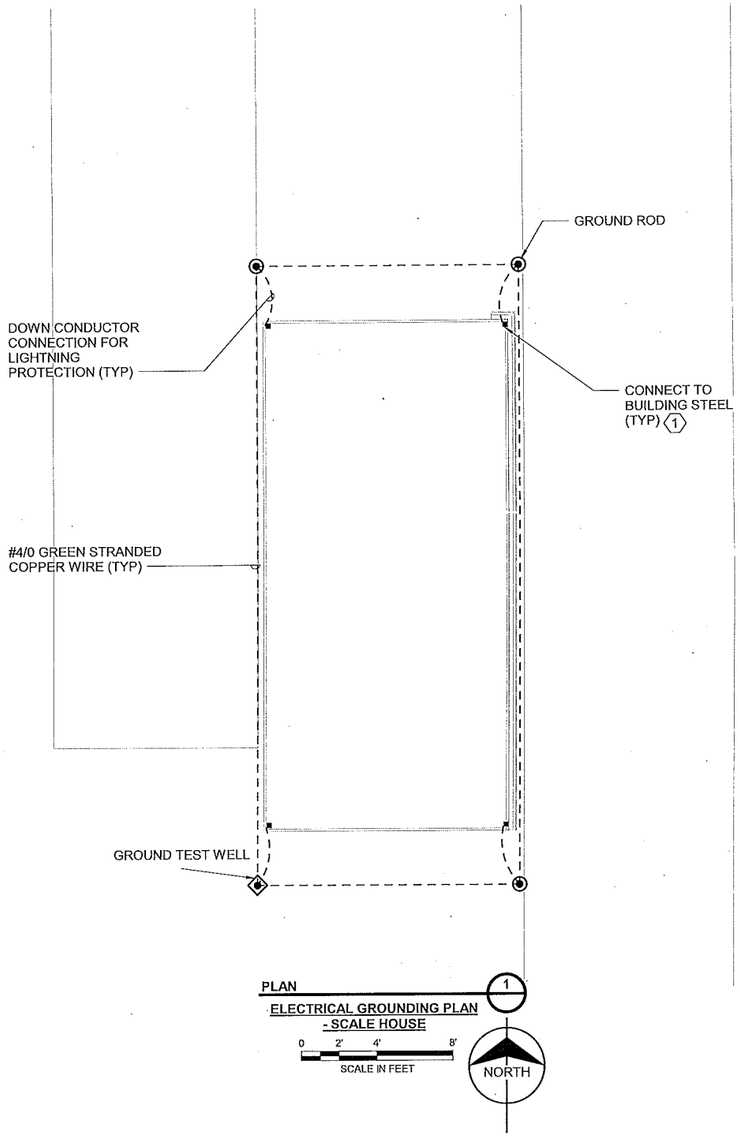
project	contract
118706	

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PLAN 1

ELECTRICAL GROUNDING PLAN - SCALE HOUSE

0 2' 4' 8'

SCALE IN FEET

GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. REFER TO DRAWING E500 FOR DETAILS.
3. GROUND CONDUCTOR PASSING THROUGH CONCRETE WALLS OR SLAB SHALL BE INSTALLED IN PVC CONDUIT SLEEVE OR RIGID GALVANIZED STEEL WITH GROUND BUSHING.
4. PROVIDE GROUND CONNECTION TO BUILDING STEEL, MAIN WATER LINE PIPE AND MAIN GROUND BUSBAR LOCATED IN ELECTRICAL ROOM.
5. BOND LIGHTNING PROTECTION SYSTEM TO THE STRUCTURAL STEEL WHERE REQUIRED.
6. THE DRAWING IS PROVIDED FOR PLANNING PURPOSES ONLY. CONTRACTOR SHALL LOCATE GROUND RODS WHERE REQUIRED.

KEYED NOTES: ⟨#⟩

1. BOND TO BUILDING STEEL. REFER TO DETAIL 5/E501.

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ADMIN BLDG

SCALE BLDG

KEY PLAN

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FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL GROUNDING PLAN - SCALE HOUSE

project	contract
118706	

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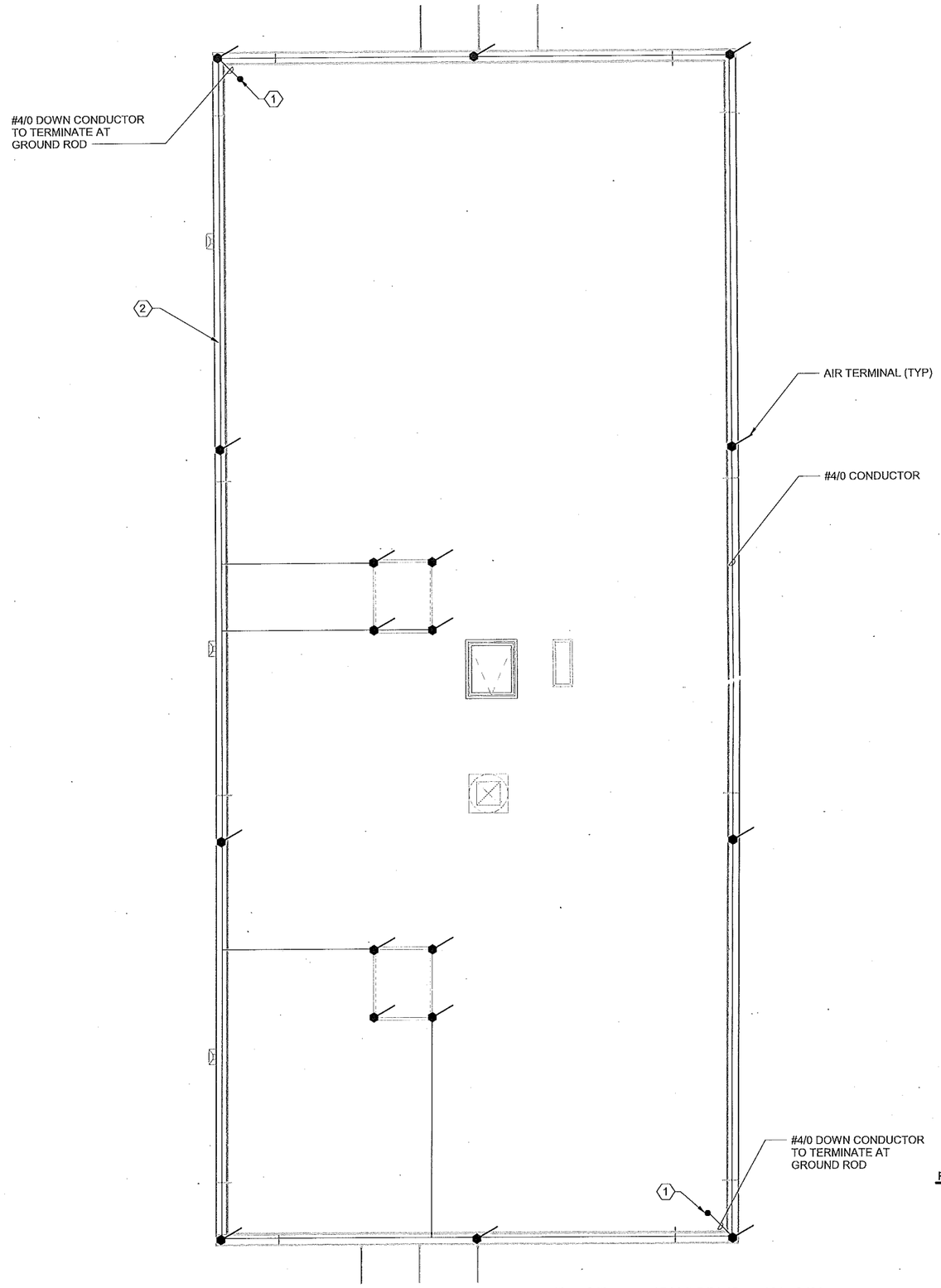
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Professional Engineer MICHAEL S. ROACH 14557 WYOMING Date

7/15/2020 3:04 PM

7/13/2020 12:28:42 PM



PLAN 1

ELECTRICAL LIGHTNING PROTECTION PLAN - ADMN

0 2' 4' 8'

SCALE IN FEET

NORTH

GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.
2. THIS DRAWING DEPICTS ANTICIPATED QUANTITIES AND LOCATIONS OF LIGHTNING PROTECTION SYSTEM DEVICES AND IS NOT INTENDED TO ILLUSTRATE OR COMPLETE DESIGNED SYSTEM.
3. CONTRACTOR SHALL FURNISH AND INSTALL A COMPLETE LIGHTNING PROTECTION SYSTEM. THE SYSTEM SHALL BE DESIGNED AND INSTALLATION SUPERVISED BY A FIRM THAT IS APPROVED AND LISTED BY UL INC. THE SYSTEM SHALL COMPLY WITH THE LATEST EDITION OF UL 96A AND NFPA 780.
4. CONFIRM EXACT MOUNTING LOCATION OF ALL MECHANICAL EQUIPMENT WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN.
5. AT COMPLETION OF THE LIGHTNING PROTECTION SYSTEM INSTALLATION ALL UL MASTER LABEL SHALL BE ACQUIRED IN THE CORPORATIONS NAME VERIFYING THE INSTALLATION MEETS THE REQUIREMENTS FOR A UL MASTER LABEL PER UL OR A. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
6. INSTALL LIGHTNING PROTECTION SYSTEM IN COMPLIANCE WITH NFPA 780, UL 96, AND UL 96A.
7. CONTRACTOR SHALL COMPLY WITH AFI-32-1065 REQUIREMENT. LIGHTNING PROTECTION SYSTEM (LPS) SHALL BE INSPECTED BY THIRD PARTY INSPECTOR WHOSE SOLE WORK IS LIGHTNING PROTECTION. LPS SHALL BE CERTIFIED BY THIRD PARTY INSPECTOR.

KEYED NOTES: (#)

1. BOND LIGHTNING PROTECTION SYSTEM DOWN CONDUCTOR TO NEW GROUNDING GRID AT APPROXIMATE LOCATION SHOWN. DOWN CONDUCTOR SHALL BE FULLY CONCEALED IN PVC SCHEDULE 40. CONDUIT WITHIN THE BUILDING WALLS AND THE SYSTEM SHALL BE INSTALLED TO PRESERVE THE ARCHITECTURAL AESTHETICS OF THE BUILDING WHILE BEING IN CONFORMANCE WITH APPLICABLE CODES. REFERENCE DRAWING E100 FOR GROUNDING LAYOUT. REFER TO DETAIL 4/E500.
2. MAIN CONDUCTOR TO BE SIZED ACCORDING TO NFPA 780 CHAPTER 4 TABLE 4.1.1.1.1 (MINIMUM CLASS 1 MATERIAL REQUIREMENT).

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ADMIN BLDG

SCALE BLDG

KEY PLAN

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LARAMIE COUNTY, WYOMING

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LIGHTNING PROTECTION - ADMN

project	contract
118706	

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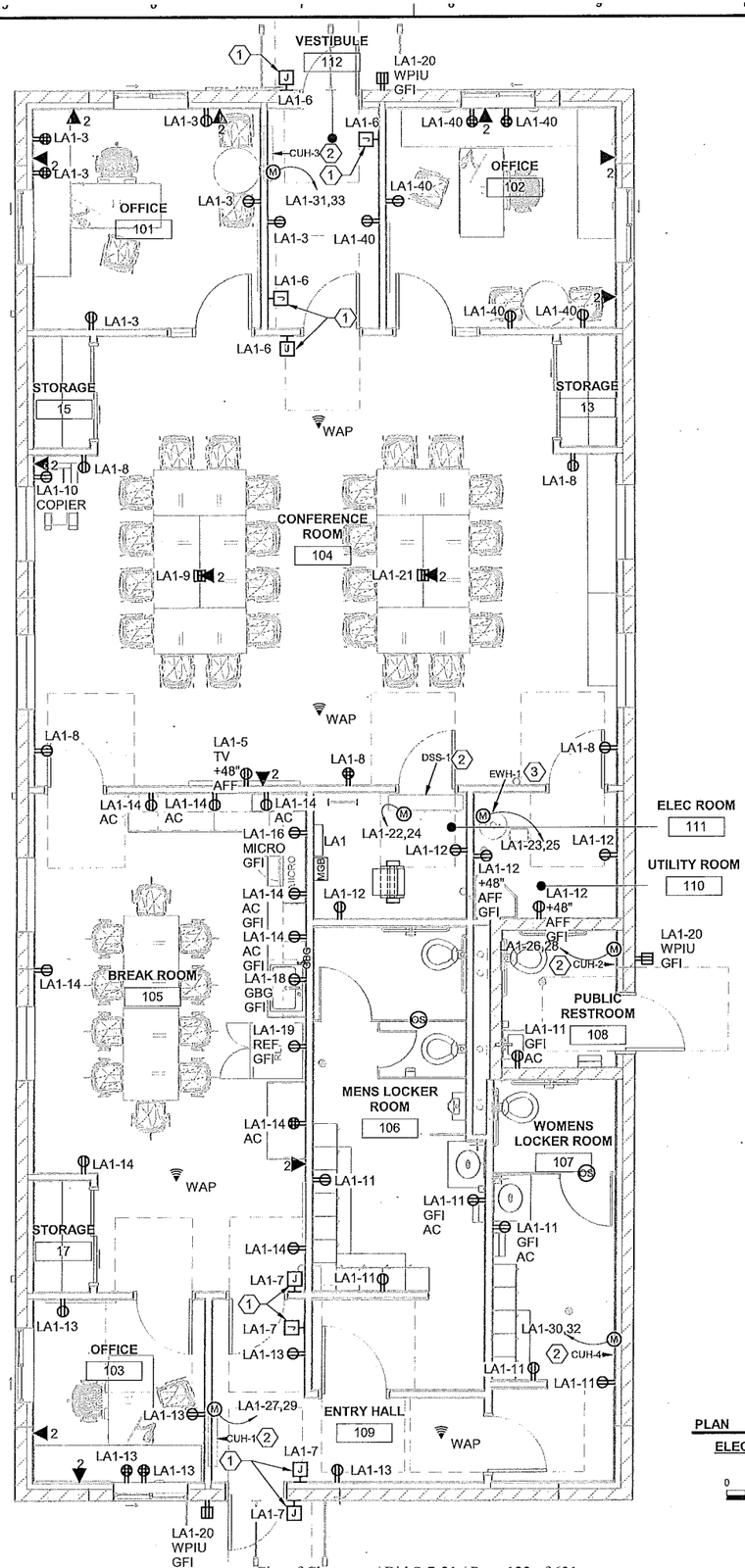
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Professional Engineer MICHAEL S. ROACH 14557 WYOMING Date

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GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.

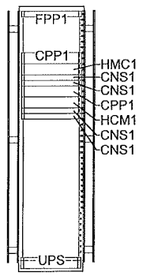
KEYED NOTES: (#)

1. POWER AND CONDUIT SHALL BE ROUTED TO DOOR PUSH BUTTON AND DOOR OPERATOR FOR AUTOMATIC ENTRY.
2. DIVISION 23 SHALL PROVIDE DISCONNECT SWITCHES FOR MECHANICAL AND PLUMBING EQUIPMENT. REFER TO MECHANICAL AND PLUMBING SCHEDULES FOR MORE INFORMATION.
3. DIVISION 26 SHALL PROVIDE DISCONNECT SWITCHES FOR MECHANICAL AND PLUMBING EQUIPMENT. REFER TO MECHANICAL AND PLUMBING SCHEDULES FOR MORE INFORMATION.

COMMUNICATIONS DROPS - ELEC ROOM 111

ROOM NO.	ROOM NAME	OUTLET TYPE	OUTLET QUANTITY	COMM DROPS CAT6
	SCALE HOUSE	2	1	2
101	OFFICE	2	3	6
102	OFFICE	2	3	6
103	OFFICE	2	2	4
104	CONFERENCE ROOM	2	4	8
104	CONFERENCE ROOM	WAP	2	2
105	BREAK ROOM	2	1	2
105	BREAK ROOM	WAP	1	1
109	ENTRY HALL	WAP	1	1
Grand total: 18			18	32

DATA DEVICE SCHEDULE	
RACK EQUIPMENT IDENTIFICATION	EQUIPMENT DESCRIPTION
CNS1	COPPER NETWORK SWITCH (NIC/GFGI)
CPP1	48 PORT CATEGORY 6 PATCH PANEL
FPP1	72 PORT LC DUPLEX FIBER PATCH PANEL
HCM1	HORIZONTAL CABLE MANAGEMENT
UPS1	UPS (NIC/OFOI)



PLAN 2
TELECOMMUNICATIONS ELEVATION - ELEC RM 111
0 1' 2' 4'
SCALE IN FEET

PLAN 1
ELECTRICAL POWER PLAN - ADMN
0 2' 4' 8'
SCALE IN FEET
NORTH

7/15/2020 3:05 PM

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID

N
ADMIN BLDG
SCALE BLDG

KEY PLAN

BURNS McDONNELL
9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

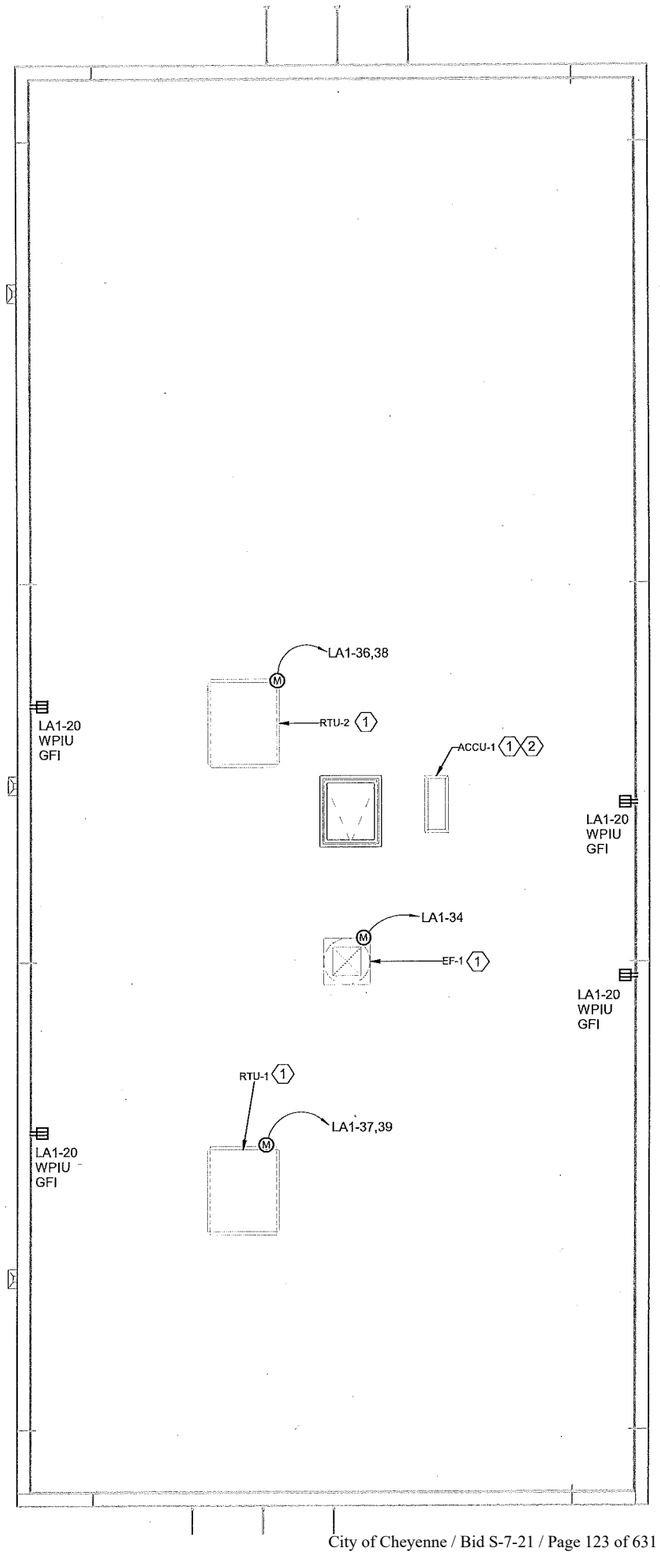
date: JULY 2020	detailed: L. FOSTER
designed: J. STOUP	checked: L. MERSMANN

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
ELECTRICAL POWER AND DATA PLAN - ADMN

project: 118706	contract:
drawing: E200	rev.: 0
sheet:	of: sheets
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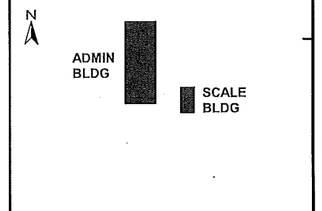
GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.

KEYED NOTES:

1. DIVISION 23 SHALL PROVIDE DISCONNECT SWITCHES FOR MECHANICAL AND PLUMBING EQUIPMENT. REFER TO MECHANICAL AND PLUMBING SCHEDULES FOR MORE INFORMATION.
2. PROVIDE FIELD WIRING FROM OUTDOOR UNIT ACCU-1 TO INDOOR UNIT DSS-1 PER MANUFACTURER'S INSTRUCTIONS.

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID



KEY PLAN

PLAN 1
ELECTRICAL POWER PLAN ROOF - ADMN
0 2' 4' 8'
SCALE IN FEET
NORTH

BURNS McDONNELL
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Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	L. FOSTER
designed	checked
J. STOUP	L. MERSMANN

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL POWER PLAN ROOF - ADMN

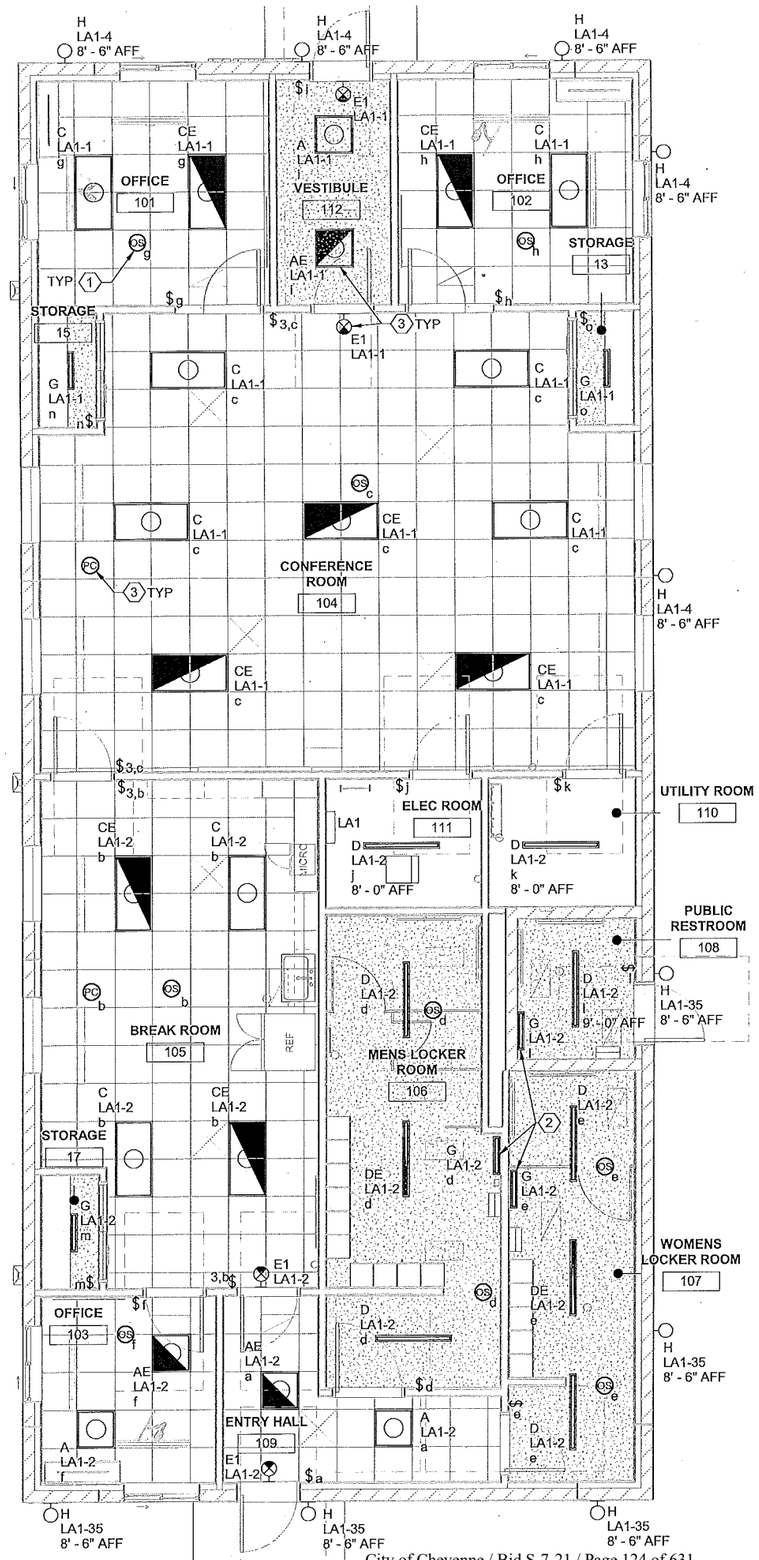
project	contract
118706	

drawing E202 — rev. 0

sheet of sheets
file

Professional Engineer MICHAEL B. ROACH 14557 Date WYOMING
7/15/2020 3:05 PM

7/13/2020 12:28:50 PM



PLAN
ELECTRICAL LIGHTING PLAN - ADMN

0 2' 4' 8'
SCALE IN FEET

NORTH

7/15/2020 3:06 PM

GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.

KEYED NOTES: (#)

1. PROVIDE WIRELESS CEILING OR PENDANT MOUNTED OCCUPANCY SENSOR TO CONTROL SWITCH LEGS INDICATED.
2. MOUNT ON WALL 3" ABOVE MIRROR.
3. CONNECT EXIT SIGNS AND EMERGENCY LIGHTS TO UNSWITCHED HOT OF SAME CIRCUIT SERVING NORMAL LIGHTING WITHIN ROOM.
4. PROVIDE PHOTOSENSOR TO AUTOMATICALLY DIM FIXTURES INDICATED UPON SENSING DAYLIGHT. DIMMING LEVELS SHALL BE MANUALLY ADJUSTABLE WITH WALL SWITCH.

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID

N

ADMIN BLDG

SCALE BLDG

KEY PLAN

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9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	L. FOSTER
designed	checked
N. JAMES	L. MERSMANN

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LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL LIGHTING PLAN - ADMN

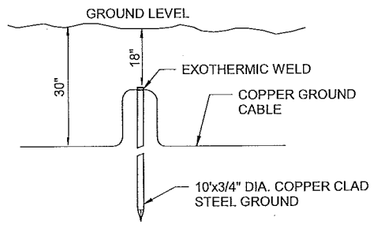
project	contract
118706	

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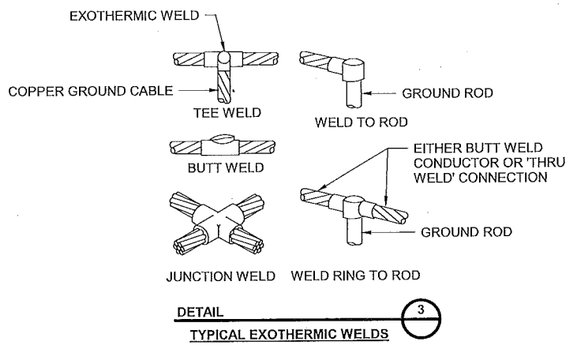
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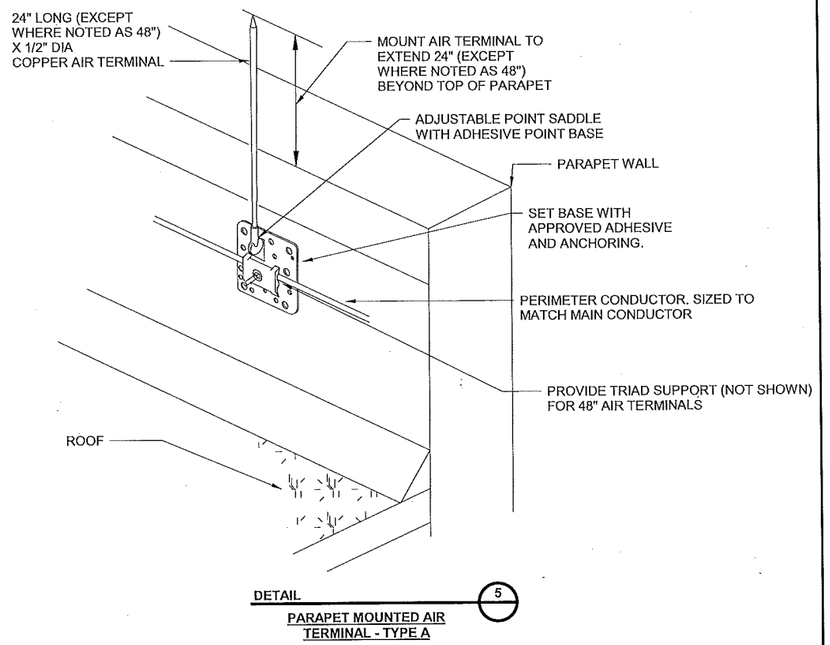
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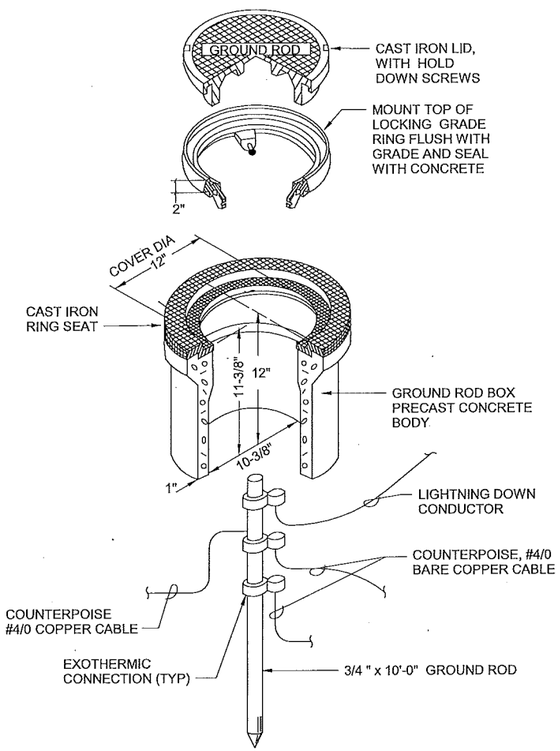
DETAIL 1
TYPICAL GROUND ROD CONNECTION



DETAIL 3
TYPICAL EXOTHERMIC WELDS



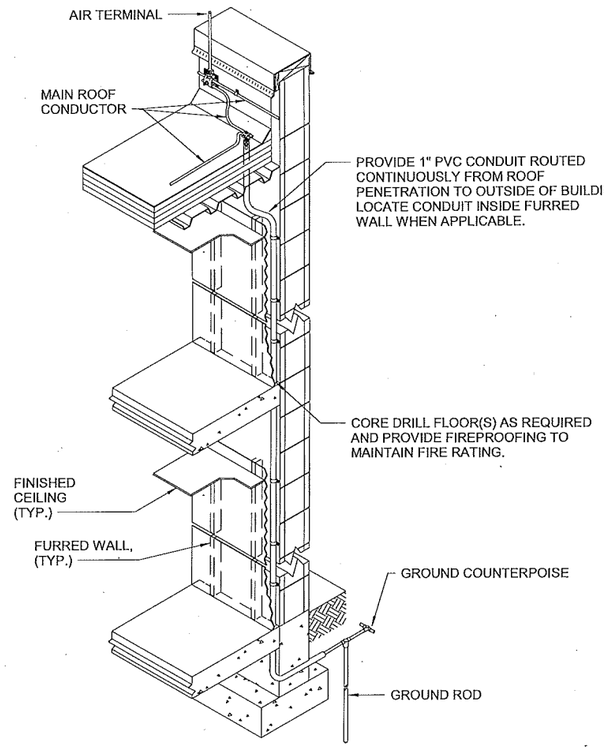
DETAIL 5
PARAPET MOUNTED AIR TERMINAL - TYPE A



NOTE:

1. THE COUNTERPOISE GROUND RING OF THE FACILITY SHALL HAVE A RESISTANCE OF 5 OHMS OR LESS PER IEEE STANDARD #143, "GREEN BOOK". ADDITIONAL GROUND RODS SHALL BE DRIVEN AS REQUIRED TO ACHIEVE THE PROPER RESISTANCE.

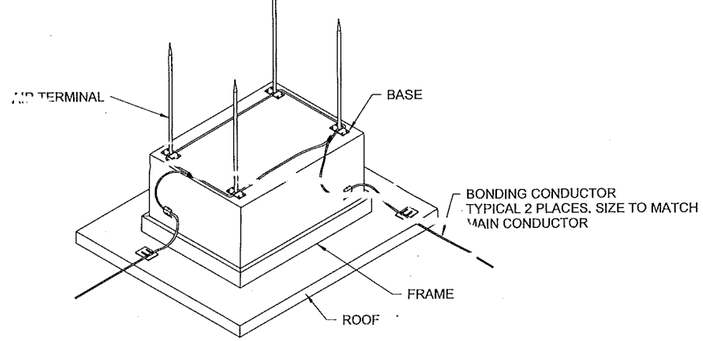
DETAIL 2
TYPICAL GROUND TEST WELL



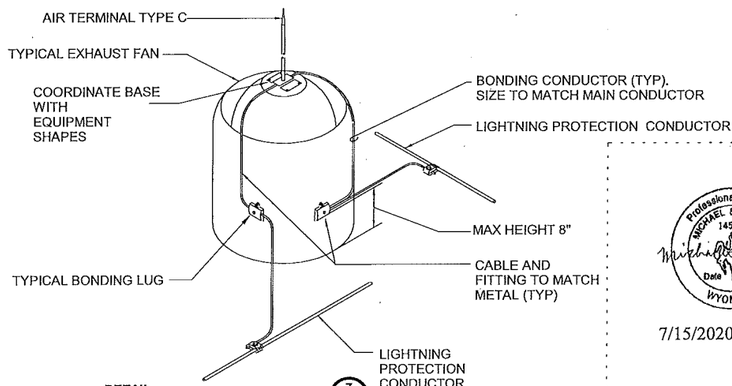
NOTES:

1. LIGHTNING PROTECTION DOWN CONDUCTOR SHALL NOT BE EXPOSED INSIDE THE BUILDING.
2. LIGHTNING DOWN CONDUCTORS SHALL BE BONDED TO STRUCTURAL STEEL.
3. 8" MIN. BEND RADIUS FOR ALL ROOF AND DOWN CONDUCTORS.

DETAIL 4
DOWN CONDUCTOR DETAIL



DETAIL 6
TYPICAL MECH EQUIPMENT LP DETAIL



DETAIL 7
TYPICAL FAN BONDING DETAIL

Professional Engineer MICHAEL S. ROACH 14557 Date WYOMING

7/15/2020 3:07 PM

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Centennial, CO 80112
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date	detailed
JULY 2020	L. FOSTER
designed	checked
N. JAMES	L. MERSMANN

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL DETAILS

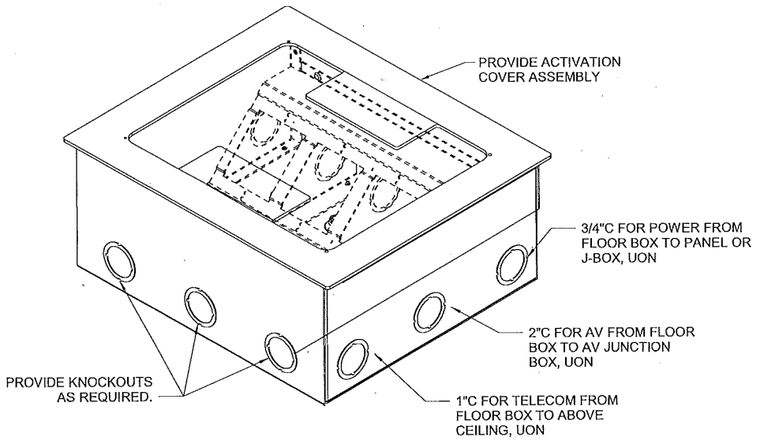
project	contract
118706	

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sheet of sheets

file

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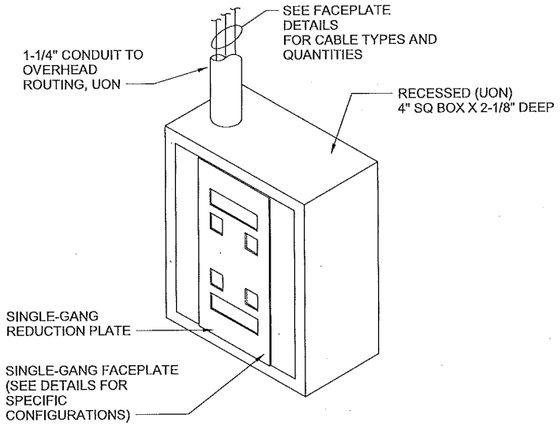
NOTES:

1. COORDINATE WITH POWER AND TELECOM DRAWINGS FOR COMBINATION COMM/POWER FLOOR BOX LOCATION. SEE SHEETS E SERIES FOR ELECTRICAL AND TELECOM.
2. ROUTE ALL CONDUITS TO/FROM FLOOR BOX AT MINIMUM OF 24" BELOW SLAB, AVOID ROUTING CONDUITS HORIZONTALLY THRU SLAB. COORDINATE WITH STRUCTURAL DRAWINGS FOR SLAB DEPTHS.
3. CAST IN PLACE AND POKE THRU BOXES MUST MAINTAIN FIRE RATING OF FLOOR ASSEMBLY.
4. PROVIDE KNOCKOUTS AS REQUIRED.
5. PROVIDE ACTIVATION COVER THAT COORDINATES WITH USE. ACTIVATION COVERS SHALL HAVE INSERT TO MATCH ARCHITECTURAL FINISHES.

JUNCTION BOX TYPE:

(1) AV. 2"C
(1) TELECOM. 1"C. STANDARD #2 DROP
(2) POWER. (1) 3/4"C. QUADPLEX RECEPTACLE.

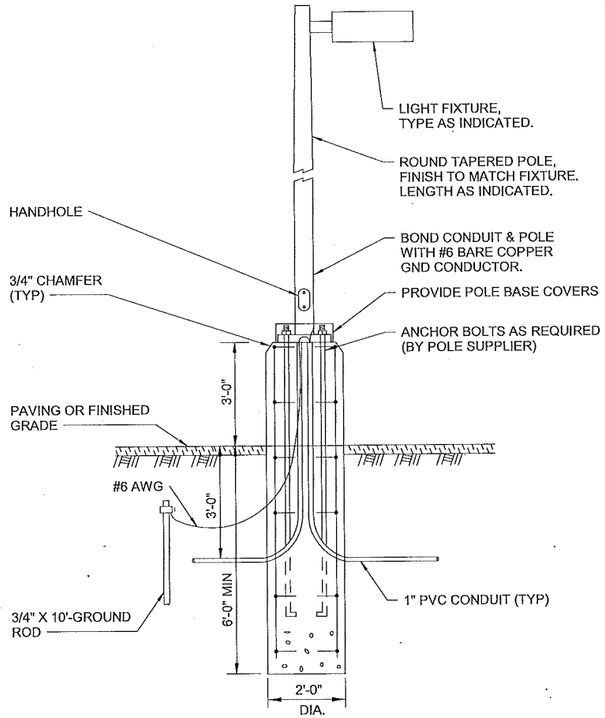
DETAIL 1
TYPICAL FLOORBOX



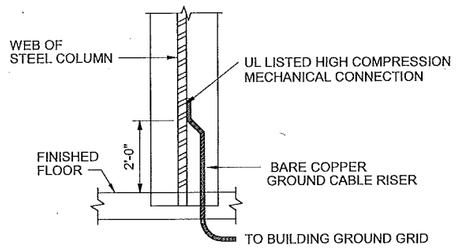
NOTES:

1. MOUNT OUTLET BOX AT 18" AFF UON.

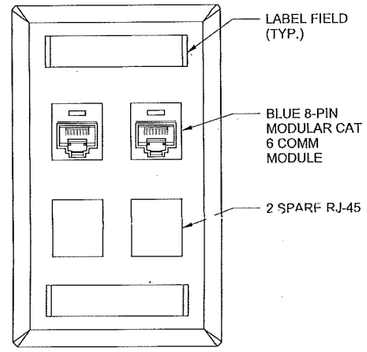
DETAIL 2
TYPICAL TELECOMMUNICATIONS BACKBOX



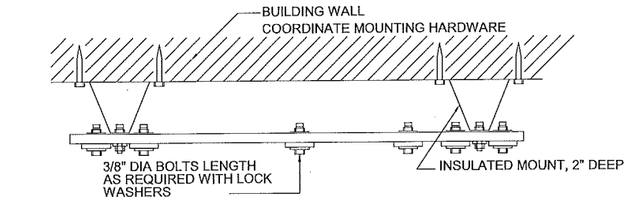
DETAIL 3
FRONT GATE LIGHTING POLEBASE

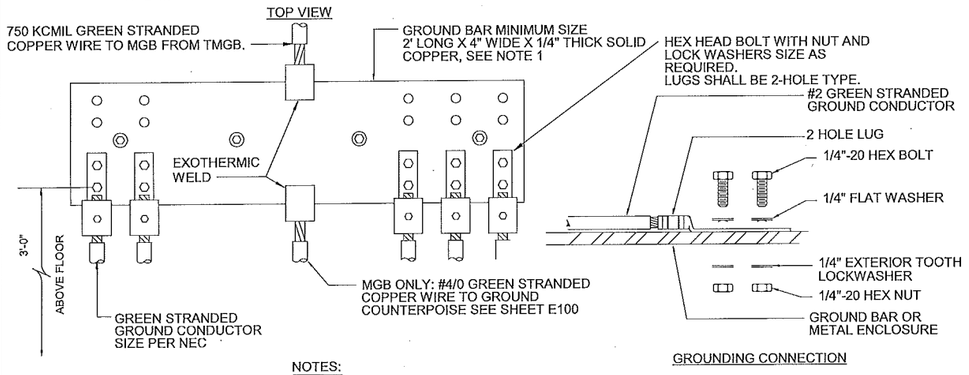


DETAIL 5
TYPICAL CONNECTION TO STEEL



DETAIL 6
TYPICAL COMM OUTLET TYPE 2 WALL MOUNTED



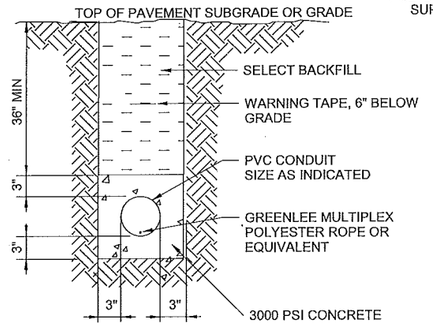


GROUNDING CONNECTION

NOTES:

1. PROVIDE NUMBER AND SIZE OF CONNECTORS AND GROUND CONDUCTORS AND LENGTH OF GROUND BAR AS REQUIRED FOR EACH GROUND BAR LOCATION.
2. SEE DETAIL 3 ON SHEET E-500 FOR EXOTHERMIC WELDS.

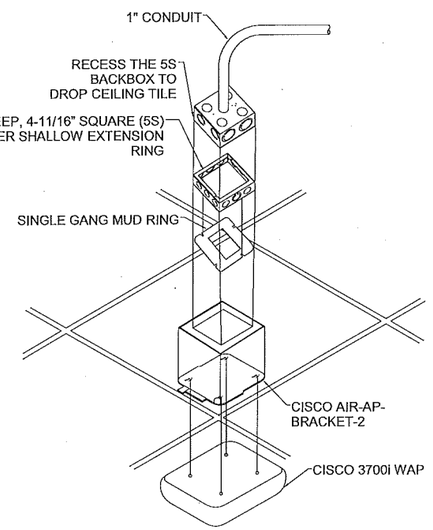
DETAIL 4
TYPICAL MAIN GROUND BUS DETAIL (TMGB, MGB)



NOTES:

1. USE PLASTIC CONDUIT SPACERS AT 5'-0" OC.

DETAIL 7
TYPICAL CONCRETE ENCASED DUCTBANK



DETAIL 8
TYPICAL WAP MOUNTING DETAIL - CEILING TILE

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID

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9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	L. FOSTER
designed	checked
N. JAMES	L. MERSMANN

CITY OF CHEYENNE
LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL DETAILS

project	contract
118706	

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Professional Engineer MICHAEL S. ROMER 14557 Date WYOMING

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7/13/2020 12:28:57 PM

LIGHT FIXTURE SCHEDULE

TYPE	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	LAMP TYPE	LUMENS	COLOR TEMP	VOLTAGE	WATTAGE	DESIGN LOAD	MOUNTING
A	2' X 2' VOLUMETRIC TROFFER, MINIMUM 80% OPTICAL EFFICIENCY, ACRYLIC LAMP SHIELD, HIGHLY REFLECTIVE WHITE POWDERCOATED REFLECTOR	LITHONIA	BLC-2X2-3300LM-35K-ADSM	LED	3382	3500	MVOLT	30 W	33 VA	CEILING, RECESSED
AE	2' X 2' VOLUMETRIC TROFFER, MINIMUM 80% OPTICAL EFFICIENCY, ACRYLIC LAMP SHIELD, WITH 10W 90 MIN LED EMERGENCY BATTERY PACK	LITHONIA	BLC-2X2-3300LM-35K-ADSM-PS1050	LED	3382	3500	MVOLT	30 W	33 VA	CEILING, RECESSED
C	2' X 4' VOLUMETRIC TROFFER, MINIMUM 80% OPTICAL EFFICIENCY, ACRYLIC LAMP SHIELD, HIGHLY REFLECTIVE WHITE POWDERCOATED REFLECTOR	LITHONIA	BLC-2X4-5000LM-35K-ADSM	LED	4999	3500	MVOLT	42 W	47 VA	CEILING, RECESSED
CE	2' X 4' VOLUMETRIC TROFFER, MINIMUM 80% OPTICAL EFFICIENCY, ACRYLIC LAMP SHIELD, WITH 10W 90 MIN LED EMERGENCY BATTERY PACK	LITHONIA	BLC-2X4-5000LM-35K-ADSM-PS1050	LED	4999	3500	MVOLT	42 W	47 VA	CEILING, RECESSED
D	4' SURFACE MOUNT LED	LITHONIA	WL4-40L-GZ10-LP835	LED	4325	3500	MVOLT	40 W	44 VA	SURFACE/PENDANT
DE	4' SURFACE MOUNT LED - EM	LITHONIA	WL4-40L-GZ10-LP835-E10WLCP	LED	4325	3500	MVOLT	40 W	44 VA	SURFACE
E1	EXIT SIGN	H.E. WILLIAMS	EXIT-G-AC-WHT	LED	N/A	GREEN	MVOLT	5 W	5 VA	CEILING/SURFACE/WALL
G	2' SURFACE MOUNT LED	LITHONIA	WL2-12L-GZ10-LP835	LED	1311	3500	MVOLT	12 W	13 VA	WALL/SURFACE
H	OLAW23 GENERAL PURPOSE OUTDOOR LED AREA/WALL LIGHT WITH ADJUSTABLE PHOTOCELL	LITHONIA	OLAW23-53K-120-PE-BZ	LED	2304	5000	MVOLT	35 W	39 VA	WALL/SURFACE
J	VCPG LED PARKING GARAGE LUMINAIRE FOR SOLAR CANOPY	LITHONIA	VCPG LED-V4-P2-35K-70CRI-MVOLT-SRM	LED	4626	3500	MVOLT	34 W	38 VA	CEILING/SURFACE
JE	VCPG LED PARKING GARAGE LUMINAIRE FOR SOLAR CANOPY WITH "EGRESS MODE"	LITHONIA	VCPG LED-V4-P2-35K-70CRI-MVOLT-SRM-PIR3FC3V924	LED	4626	3500	MVOLT	34 W	38 VA	CEILING/SURFACE
K	RSX LED AREA LUMINAIRE	LITHONIA	RSX1 LED-P1-40K-R4-MVOLT-RPA-PER7-DBLXD	LED	6543	4000	MVOLT	51 W	56 VA	POLE MOUNTED ⟨1⟩

KEYED NOTES: ⟨#⟩

1. ELECTRICAL CONTRACTOR TO FURNISH AND INSTALL FIXTURE WITH LITHONIA RTA POLE. CATALOG NUMBER: 20-5C-DM19AS-DBLXD

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID

BURNS McDONNELL

9785 Maroon Circle, Suite 400
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date	detailed
JULY 2020	L. FOSTER
designed	checked
N. JAMES	L. MERSMANN

CITY OF CHEYENNE

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE

ELECTRICAL LIGHT FIXTURE SCHEDULE

project	contract
118706	

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sheet of sheets

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Professional Engineer MICHAEL S. ROACH 14557 Date WYOMING

7/15/2020 3:07 PM

7/13/2020 12:28:57 PM

PANELBOARD: LA1

LOCATION: ELEC ROOM 111
SUPPLY FROM: POLE MTD XFMR SOUTH BY ADMN
MOUNTING: SURFACE
ENCLOSURE: NEMA 1

VOLTAGE: 120/240 Single
PHASE: 1
WIRES: 3

A.I.C. RATING: 10 kAIC
MAINS TYPE: MCB
MAINS RATING: 225 A
MCB RATING: 225 A

NOTES:

#	BKR	P	LOAD SERVED	WIRE / GROUND / CONDUIT	A		B		WIRE / GROUND / CONDUIT	LOAD SERVED	P	BKR	#
1	20	1	LIGHTING OFFICE 101	#12 / #12 / 3/4"	619	778			#12 / #12 / 3/4"	LIGHTING ROOM 111, 108, 110, 106, 109	1	20	2
3	20	1	RECEPT OFFICE 101	#12 / #12 / 3/4"			1440	195	#12 / #12 / 3/4"	NORTH EXTERIOR LIGHTING	1	20	4
5	20	1	RECEPT CONFERENCE ROOM...	#12 / #12 / 3/4"	130	720			#12 / #12 / 3/4"	ADA PUSHBUTTON 112	1	20	6
7	20	1	ADA PUSHBUTTON 109	#12 / #12 / 3/4"			720	1080	#12 / #12 / 3/4"	RECEPT CONFERENCE ROOM 104	1	20	8
9	20	1	RECEPT CONFERENCE ROOM 104	#12 / #12 / 3/4"	500	500			#12 / #12 / 3/4"	COPIER RECEPT CONFERENCE ROOM...	1	20	10
11	20	1	RECEPT MENS LOCKER ROOM 106, 107	#12 / #12 / 3/4"			1260	900	#12 / #12 / 3/4"	RECEPT ELEC ROOM 111, & 110	1	20	12
13	20	1	RECEPT ENTRY HALL...	#12 / #12 / 3/4"	1440	1800			#12 / #12 / 3/4"	RECEPT BREAK ROOM 105	1	20	14
15	30	2	LA2	REFER TO ONE-LINE			3600	1200	#12 / #12 / 3/4"	MICRO RECEPT BREAK ROOM 105	1	20	16
17	--	--	--	--	3600	370			#12 / #12 / 3/4"	GBG RECEPT BREAK ROOM 105	1	20	18
19	20	1	REF RECEPT BREAK ROOM 105	#12 / #12 / 3/4"			900	1260	#12 / #12 / 3/4"	EXTERIOR RECEPT ON ROOF	1	20	20
21	20	1	RECEPT CONFERENCE ROOM 104	#12 / #12 / 3/4"	500	2196			#12 / #12 / 3/4"	DSS-1/ACCU-1	2	20	22
23	30	2	EWH-1	#12 / #12 / 3/4"			3000	2196	--	--	--	--	24
25	--	--	--	--	3000	1500			#12 / #12 / 3/4"	CUH-2	2	20	26
27	20	2	CUH-1	#12 / #12 / 3/4"			1000	1500	--	--	--	--	28
29	--	--	--	--	1000	1500			#12 / #12 / 3/4"	CUH-4	2	20	30
31	20	2	CUH-3	#12 / #12 / 3/4"			1000	1500	--	--	--	--	32
33	--	--	--	--	1000	120			#12 / #12 / 3/4"	EF-1	1	20	34
35	20	1	SOUTH EXTERIOR LIGHTING	#12 / #12 / 3/4"			195	1370	#12 / #12 / 3/4"	RTU-2	2	20	36
37	20	2	RTU-1	#12 / #12 / 3/4"	1370	1370			--	--	--	--	38
39	--	--	--	--			1370	1440	#12 / #12 / 3/4"	RECEPT OFFICE 102	1	20	40
41	20	1	SPARE		0	266			#12 / #12 / 3/4"	SOUTH SOLAR CANOPY LIGHTING	1	20	42
43	20	1	SPARE				0	152	#12 / #12 / 3/4"	NORTH SOLAR CANOPY LIGHTING	1	20	44
45	20	1	SPARE		0	0				SPARE	1	20	46
47	20	1	SPARE				0	0		SPARE	1	20	48
49	20	1	SPARE		0	0				SPARE	1	20	50
51	20	1	SPARE				0	0		SPARE	1	20	52
53	20	1	SPARE		0	0				SPARE	1	20	54
				TOTAL LOAD:	24279 VA		27278 VA						
				TOTAL AMPS:	202 A		227 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
POWER	27482 VA	100.00%	27482 VA		
LIGHTING	2205 VA	100.00%	2205 VA	TOTAL CONNECTED LOAD:	51557 VA
RECEPT	21870 VA	72.86%	15935 VA	TOTAL ESTIMATED DEMAND LOAD:	45622 VA
				TOTAL CONNECTED CURRENT:	215 A
				TOTAL ESTIMATED DEMAND...	190 A
				DEMAND WITH EXPANSION:	228 A

PANELBOARD: LB1

LOCATION: ENTRANCE
SUPPLY FROM: POLE MTD XFMR NORTH BY ENTRANCE
MOUNTING: SURFACE
ENCLOSURE: NEMA 12

VOLTAGE: 120/240 Single
PHASE: 1
WIRES: 3

A.I.C. RATING: 10 kAIC
MAINS TYPE: MCB
MAINS RATING: 100 A
MCB RATING: 30 A

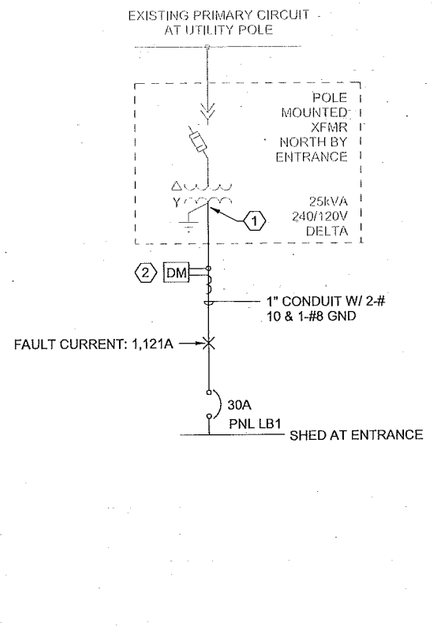
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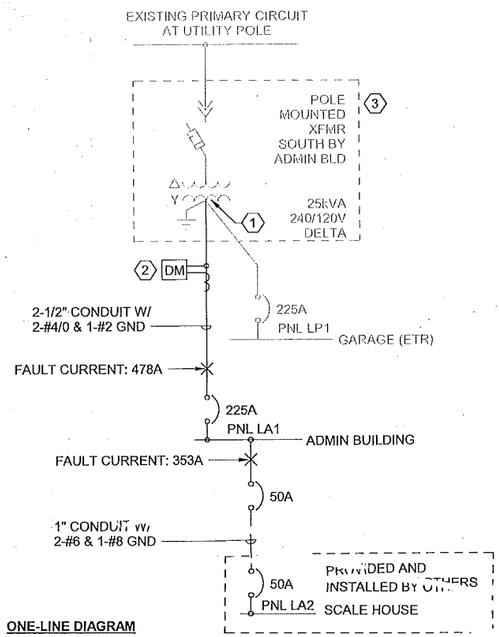
#	BKR	P	LOAD SERVED	WIRE / GROUND / CONDUIT	A		B		WIRE / GROUND / CONDUIT	LOAD SERVED	P	BKR	#
1	20	1	GATE LIGHT	#12 / #12 / 3/4"	56	280			#12 / #12 / 3/4"	WELL PUMP	2	20	2
3	20	2	CISTERN PUMP	#12 / #12 / 3/4"			280	280	--	--	--	--	4
5	--	--	--	--	280	0				SPARE	1	20	6
7	20	2	GATE	#12 / #12 / 3/4"			550	0		SPARE	1	20	8
9	--	--	--	--	550	0				SPARE	1	20	10
11	20	1	SPARE				0	0		SPARE	1	20	12
				TOTAL LOAD:	1166 VA		1110 VA						
				TOTAL AMPS:	10 A		9 A						

LOAD CLASSIFICATION	CONNECTED LOAD	DEMAND FACTOR	ESTIMATED DEMAND	PANEL TOTALS	
POWER	2220 VA	100.00%	2220 VA		
LIGHTING	56 VA	100.00%	56 VA	TOTAL CONNECTED LOAD:	2276 VA
				TOTAL ESTIMATED DEMAND LOAD:	2276 VA
				TOTAL CONNECTED CURRENT:	9 A
				TOTAL ESTIMATED DEMAND...	9 A
				DEMAND WITH EXPANSION:	11 A

MECHANICAL/ELECTRICAL CONNECTION SCHEDULE

EQUIPMENT NAME	ROOM NAME	ROOM NUMBER	VOLTS	APPARENT LOAD	POLES	PANEL	CIRCUIT NUMBER	DISCONNECT BY
CISTERN PUMP	SW OF EXISTING SHED		240 V	560 VA	2	LB1	3,5	DIV. 23
CUH-1	ENTRY HALL	109	240 V	2000 VA	2	LA1	27,29	DIV. 23
CUH-2	PUBLIC RESTROOM	108	240 V	3000 VA	2	LA1	26,28	DIV. 23
CUH-3	VESTIBULE	112	240 V	2000 VA	2	LA1	31,33	DIV. 23
CUH-4	WOMENS LOCKER ROOM	107	240 V	3000 VA	2	LA1	30,32	DIV. 23
DSS-1/ACCU-1	ELEC ROOM	111	240 V	4392 VA	2	LA1	22,24	DIV. 23
EF-1	ADMIN BLDG ROOF		120 V	120 VA	1	LA1	34	DIV. 23
EWH-1	UTILITY ROOM	110	240 V	6000 VA	2	LA1	23,25	DIV. 26
GATE	ENTRANCE BY SCALEHOUSE		240 V	1100 VA	2	LB1	7,9	DIV. 23
RTU-1	ADMIN BLDG ROOF		240 V	2740 VA	2	LA1	37,39	DIV. 23
RTU-2	ADMIN BLDG ROOF		240 V	2740 VA	2	LA1	36,38	DIV. 23
SCALES	ENTRANCE BY SCALEHOUSE		120 V	50 VA	1	LA2	-	-
WELL PUMP	SW OF EXISTING SHED		240 V	560 VA	2	LB1	2,4	DIV. 23





ONE-LINE DIAGRAM

GENERAL NOTES:

1. REFER TO E001 FOR ELECTRICAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS.

KEYED NOTES: (#)

1. CONTRACTOR SHALL PROVIDE WIRE AND RACEWAY. UTILITY TO TERMINATE AT SECONDARY OF TRANSFORMER.
2. CONTRACTOR SHALL PROVIDE METER AND SOCKET AND SHALL COORDINATE WITH BLACK HILLS ENERGY FOR APPROVED METER AND SOCKET MODELS.
3. UTILITY SHALL ANALYZE POWER NEEDS TO NEW ADMIN AND SCALEHOUSE AND UPGRADE TRANSFORMER IF NECESSARY.

no.	date	by	ckd	description
0	7/10/20	LJF	LM	ISSUED FOR BID

BURNS McDONNELL
9785 Maroon Circle, Suite 400
Centennial, CO 80112
303-721-9292

date	detailed
JULY 2020	L. FOSTER
designed	checked
J. STOUP	L. MERSMANN

LARAMIE COUNTY, WYOMING

HAPPY JACK LANDFILL
FRONT ENTRANCE AND SCALE HOUSE
ELECTRICAL ONE-LINE DIAGRAM AND PANEL SCHEDULES

project	contract
118706	

drawing E601 — rev. 0

sheet of sheets
file

Professional Engineer MICHAEL G. RONCO 14557 Date WYOMING

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7/13/2020 12:28:59 PM

CLIENT NAME	City of Cheyenne, Wyoming
PROJECT NAME	Cheyenne Landfill Entrance Design
CONTRACT NO./NAME	7042
PROJECT NO.	118706

DOCUMENT 00 01 07 – INDEX AND CERTIFICATION PAGE

SPECIFICATION INDEX

DOCUMENT/ DIVISION	DESCRIPTION
	City of Cheyenne Construction Specifications
	City of Cheyenne Traffic Control Manual
02	Existing Conditions
03	Concrete
04	Masonry
05	Metals
06	Woods, Plastics and Composites
07	Thermal and Moisture Protection
08	Openings
09	Finishes
10	Specialties
12	Furnishings
13	Special Construction
22	Plumbing
23	Heating, Ventilation and Cooling
26	Electrical
48	Electrical Power Generation

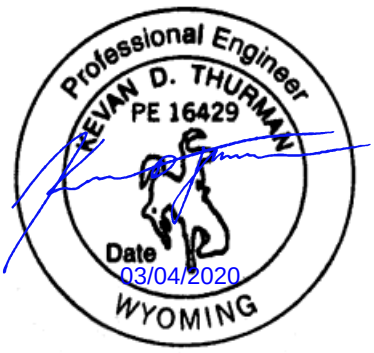


DIV 22, 23

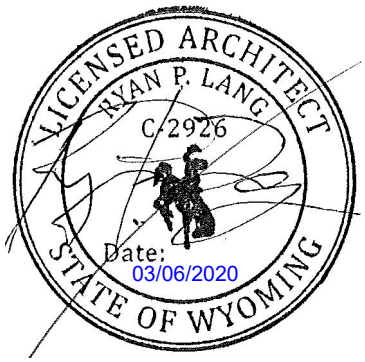
CERTIFICATION(S)



DIV 02



DIV 03, 04, 05, 13



DIV 06, 07, 08, 09, 10, 12



DIV 26, 27, 48

END OF DOCUMENT 00 01 07

SECTION 02 41 16 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Demolition and removal of buildings and site improvements.
   2. Disconnecting, capping or sealing, and abandoning in-place site utilities.
   3. Salvaging items for reuse by Owner.

1.03 RELATED REQUIREMENTS:

1.04 REFERENCE STANDARDS:

A. The American Society of Safety Engineers
   1. ASSE A10.6-2006: Safety Requirements for Demolition Operations (ANSI)
B. Code of Federal Regulations
   1. 40 CFR 82-2012: Protection of Stratospheric Ozone
C. NFPA
   1. NFPA 241-2013: Safeguarding Construction, Alteration, and Demolition Operations

1.05 DEFINITIONS:

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.

1.06 MATERIALS OWNERSHIP:

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

1.07 PREINSTALLATION MEETINGS:

A. Predemolition Conference: Conduct conference at Project SITE.
   1. Inspect and discuss condition of construction to be demolished.
   2. Review structural load limitations of existing structures.
   3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review and finalize protection requirements.
   5. Review procedures for dust control.
   6. Review procedures for protection of adjacent buildings.
   7. Review items to be salvaged and returned to Owner.

1.08 SUBMITTALS:

A. Qualification Data: For refrigerant recovery technician.
B. Engineering Survey: Submit engineering survey of condition of building.

C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.
D. Schedule of Building Demolition Activities: Indicate the following:
   1. Detailed sequence of demolition work, with starting and ending dates for each activity.
   2. Temporary interruption of utility services.
   3. Shutoff and capping of utility services.
E. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.
F. 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.
G. Inventory: Submit a list of items that have been removed and salvaged.

1.09 QUALITY ASSURANCE:
A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.10 FIELD CONDITIONS:
A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

1.11 COORDINATION:
A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

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

PART 3 - EXECUTION

3.01 EXAMINATION:
A. Verify that utilities have been disconnected and capped before starting demolition operations.

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

3.03 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS:

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

3.04 PROTECTION:

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.

3.05 DEMOLITION, GENERAL:

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
   2. Maintain fire watch during and for at least four hours after flame-cutting operations.
   3. Maintain adequate ventilation when using cutting torches.
   4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
   2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.06 DEMOLITION BY MECHANICAL MEANS:

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
C. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.
D. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.
   1. Remove below-grade construction, including foundation walls and footings completely.
E. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.
F. Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet outside footprint indicated for new construction. Abandon utilities outside this area.
   1. Fill abandoned utility structures with satisfactory soil materials.
G. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.07 SITE RESTORATION:

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in specifications.
C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.08 REPAIRS:

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.09 DISPOSAL OF DEMOLISHED MATERIALS:

A. Remove demolition waste materials from Project Site and dispose of them in the Owner's construction and demolition waste landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
B. Do not burn demolished materials.

3.10 CLEANING:

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
   1. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16

SECTION 03 10 00 – CONCRETE FORMWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes formwork for cast-in-place concrete.

1.03 RELATED REQUIREMENTS:

A. Section 03 23 00 – Concrete Reinforcement.
B. Section 03 30 00 – Concrete.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American Concrete Institute (ACI):
      a. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
      b. ACI 301 - Specifications for Structural Concrete.
      c. ACI 318 - Building Code Requirements for Reinforced Concrete.
      d. ACI 347R - Guide to Formwork for Concrete.
   2. ASTM International (ASTM):
      a. ASTM C31/C31M REV A – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
      b. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      c. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

PART 2 - PRODUCTS

2.01 MATERIALS FOR FACING:

A. Where concrete will be exposed to view after construction:
   1. Use exterior grade plywood at least 5/8-inch-thick or steel forms capable of producing a smooth, uniform appearance.
   2. Do not use form-facing materials with raised grain, torn surfaces, worn edges, dents, or other defects that will impair the texture of concrete surfaces.
B. Where concrete will not be exposed to view after construction:
   1. Exterior grade plywood at least 5/8 inch thick.
   2. Steel.
   3. Wood fiberboard.
   4. Dressed lumber free of loose knots.
C. Treat forms with commercially available form releasing agents that will not bond with, stain, or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion, nor shall it impede the wetting of surfaces to be cured with water or curing compounds. Form releasing agents shall be VOC compliant with a maximum VOC content of 3.8 lbs./gal. (450 g/L), or less where area restrictions are more stringent.
D. Clean forms of sawdust, dust, dirt, and other foreign materials.

2.02 FORM TIES:

A. Break back, coil, or screw type, except where otherwise specified.
B. Use water-seal coil type in walls below grade and in walls of water bearing structures.
C. Coil type shall leave conical depression in concrete.
D. Space as required against pressure of fresh concrete.
E. The portion of the form tie remaining in place shall provide for a clearance of two times the minimum dimension of the tie, but not less than 3/4 inch, from the formed surface.

2.03 CHAMFER STRIPS:

A. Chamfer: 3/4 inch except where otherwise indicated.
B. Place in all forms to provide chamfer where concrete will have exposed projecting corners.

PART 3 - EXECUTION

3.01 FORM CONSTRUCTION:

A. Conform to ACI 301, 318, and 347R, except Shop Drawings for formwork, shoring, and reshoring shall not be submitted for approval.
B. Adequately brace, stiffen, and support forms to prevent perceptible deflection or settlement, and to hold plumb, level, and true to line.
C. Construct and maintain forms to the tolerances given in ACI 117.
D. Construct sufficiently tight to prevent mortar leakage.
E. Avoid offsets between adjacent forms and construct so that shores, braces, and stiffening members are in line with those below.
F. Space studs and stringers as required to support facing against concrete pressure, but not more than 12 inches for 5/8-inch plywood or 16 inches for 3/4-inch plywood. Maximum deflection of facing materials reflected on concrete surfaces exposed to view shall be 1/240 of the span between structural members of the formwork.
G. Use wales, strongbacks, shores, and bracing as required.
H. Form all necessary openings or chases for piping, ductwork, and similar items where indicated or as required for the Work.
I. Construct forms to be removable in sections without marring concrete surface.
J. Surface of forms shall provide a smooth, dense, plane surface to finished concrete where exposed to view.
K. Contractor shall be responsible for structural adequacy, design, engineering, and construction of the formwork.
L. Stay-in-place metal forms shall not be used.

3.02 TIME-IN-PLACE FOR FORMS:

A. It is the responsibility of Contractor to consider all applicable factors and leave the formwork in place until it is safe to remove them.
B. All removal shall be performed in a manner which will prevent damage to the concrete and ensure the complete safety of the structure.
C. Where forms support more than one element, the forms shall not be removed until the form removal criteria are met by all supported elements.
D. Evidence that concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders. All control cylinders shall be stored in the structure or as near the structure as possible, so they receive the same curing conditions and protection methods as given those portions of the structure they represent. Control cylinders shall be removed from the molds at an age of no more than 24 hours. All control cylinders shall be

prepared and tested in accordance with ASTM C31/C31M REV A and ASTM C39/C39M at the expense of Contractor by an independent laboratory that complies with ASTM C1077. Control cylinders shall be tested within 4 hours after removal from the Site.

E. Forms shall not be removed unless the minimum time or minimum compressive strength requirements below are met.
   1. Formwork Not Supporting Weight of Concrete:
      a. Formwork for walls, columns, sides of beams, gravity structures, slabs-on-ground and other vertical type formwork not supporting the weight of concrete shall remain in place 24-hours minimum after concrete placement is completed.
   2. Formwork Supporting Weight of Concrete:
      a. Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected. As a minimum, no forms or shoring shall be loosened or removed until control concrete test cylinders indicate the concrete has attained the following compressive strengths for the respective structural members:

Structural Member	Percent of Design Compressive Strength
Unshored slab and beam forms or forms which can be removed without disturbing shores	70
Slab or beam shoring	85

END OF SECTION 03 10 00

SECTION 03 15 50 – VAPOR RETARDER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes vapor retarder under concrete slabs on grade.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03 30 00 - Concrete.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R - Guide to Concrete Floor and Slab Construction
      b. 302.2R - Guide for Slabs that Receive Moisture-Sensitive Flooring Materials
   2. American Society for Testing and Materials (ASTM):
      a. E96 - Test Methods for Water Vapor Transmission of Materials.
      b. E154 - Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
      c. E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
      d. E1745 - Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Include, but not limited to, the following:
   1. Product specification and data.
   2. Installation instructions.

PART 2 - PRODUCTS

2.01 VAPOR RETARDER:

A. Flexible, preformed sheet membrane material conforming to ASTM E1745, Class A or B having a minimum thickness of 15 mils.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install in accordance with ASTM E1643 and the following.
B. Remove sharp edges, projecting materials, and roughness which might penetrate vapor retarder.
C. Level and tamp or roll granular base.
D. Place vapor retarder sheeting with the longest dimension parallel with the direction of the concrete pour.

E. Lap vapor retarder over footing or seal to foundation wall, or both, and seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at the slab perimeter.
F. Lap joints 6 inches, or as instructed by the manufacturer, and seal with the manufacturer's recommended adhesive or pressure sensitive tape, or both.
G. Take precaution to protect vapor retarder from damage during installation of reinforcing steel and utilities and during placement of concrete.
H. Use only concrete brick type reinforcing bar supports, or provide 6-inch by 6-inch protective pads of asphaltic hardboard or other material recommended by the vapor retarder manufacturer to protect the vapor retarder from puncture.
I. Do not drive stakes through the vapor retarder.
J. Repair vapor retarder damaged during placement of reinforcing or concrete as instructed by manufacturer.

END OF SECTION 03 15 50

SECTION 03 20 00 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes steel reinforcement bars, ties, welded wire fabric, bolsters, chair supports, and accessories.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03 10 00 - Concrete Formwork.
B. Section 03 30 00 - Concrete.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American Society for Testing and Materials (ASTM):
      a. A615/A615M - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
      b. A706/A706M - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      c. A1064/A1064M – Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   2. American Concrete Institute (ACI):
      a. 301 - Specifications for Structural Concrete.
      b. SP 66 - Detailing Manual.
      c. 318 - Building Code Requirements for Structural Concrete.
      d. 117 - Specifications for Tolerances for Concrete Construction and Materials.
   3. American Welding Society (AWS):
      a. A5.5 - Low Alloy Steel Electrodes for Shielded Metal Arc Welding.
      b. B2.1 - Welding Procedure and Performance Qualification.
      c. D1.4 - Structural Welding Code Reinforcing Steel.
   4. Concrete Reinforcing Steel Institute (CRSI):
      a. Manual of Standard Practice.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Include, but not limited to, the following:
   1. Complete bar schedule, bar details, and erection drawings to conform to ACI SP 66.
   2. Drawing with each type of bent bar marked with identification mark. Straight bars shall have mark number or be identified by size and length.
   3. Erection drawings shall be clear, easily legible, and to a minimum scale of:
      a. 1/4 inch = 1 foot (1:50).
      b. 1/8 inch = 1 foot (1:100) if bars in each face are shown in separate views.
   4. Size and location of all openings.
   5. Concrete protective cover.
   6. Grade of steel.
   7. Lap splice lengths.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Store steel reinforcement blocked up off the ground and in orderly stacks.
B. Store only bars with the same identifying label in the same stack.

1.07 TESTING:

A. Perform at the mill for each heat.
B. Submit certified test results upon request.

PART 2 - PRODUCTS

2.01 REINFORCEMENT BARS, TIES, AND STIRRUPS:

A. Materials:
   1. Conform to ASTM A615, Grade 60, except as otherwise specified.
   2. Cold-drawn wire for spiral column ties shall conform to ASTM A82.
   3. Reinforcement indicated or specified to be welded shall conform to ASTM A706.
B. Fabrication of Bars:
   1. Fabricate with cold bends conforming to the recommended dimensions shown in ACI 318.
   2. Fabricate bars according to the tolerances given in ACI 117.
   3. Field fabrication will be allowed only if Contractor has equipment to properly fabricate steel.
   4. Attach metal or plastic tags with identifying mark or length corresponding to mark number or length on Drawing. Straight bars shall have mark number or size and length. Bent bars shall have mark number.
   5. Contractor may, at his option, continue steel reinforcement through openings in walls and slabs, then field-cut the opening so that there will be the required concrete cover between ends of bars and edge of opening.

2.02 WELDED WIRE REINFORCEMENT:

A. Conform to ASTM 1064.
B. Wire sizes W1.4 and smaller shall be galvanized.
C. Provide mats only. Rolled fabric is not acceptable.

2.03 BOLSTERS, CHAIRS, AND ACCESSORIES:

A. Conform to ACI SP 66 and the CRSI Manual of Standard Practice.
B. Provide all spacers, bolsters, chairs, ties, and other devices necessary to properly space, place, support, and fasten steel reinforcement in place during the concrete placement.
C. Metal accessories shall be galvanized or plastic-coated where legs will be exposed in finished concrete surfaces.
D. Do not use rocks, broken bricks, wood blocks, or concrete fragments for support of steel reinforcement.

2.04 PRECAST CONCRETE BLOCK BAR SUPPORTS:

A. May be used only for bar supports in slabs on ground.
B. Conform to ACI SP-66 and the CRSI Manual of Standard Practice.
C. Each block shall have a minimum of 9 square inches (5800 square millimeters) of bearing area. Space as required by the particular condition of weight, bearing surface, and rigidity of the steel reinforcement.

PART 3 - EXECUTION

3.01 PLACEMENT OF STEEL REINFORCEMENT:

A. Place all steel reinforcement before concrete is cast in accordance with approved erection drawings, ACI 117, ACI 318, and the CRSI Manual of Standard Practice.
B. Remove oil, mill scale, pitting, mud, loose rust, ice, and other materials that would reduce bond from bars before placing.
C. Tie securely with 16 gage (1.6 mm) or larger annealed iron wire.
D. Place to maintain concrete cover to conform to ACI 117 and ACI 318, unless otherwise indicated.
E. Splice steel where indicated. Splices shall be in full contact and shall conform to ACI 318.
    1. Unless otherwise indicated, lap splices shall be Class B as defined by ACI 318.
    2. Splice steel using Cadweld Series T-splices where indicated or approved.
        a. Provide a manufacturer's representative to give on site instructions to all welders who will perform the splices in the field.
        b. Contractor shall have the manufacturer's representative instruct, observe, and approve in writing those persons doing the welding.
        c. Contractor shall arrange for the manufacturer's representative to return at the request of the Engineer.
    3. Lenton Mechanical Splices:
        a. Lenton mechanical splices shall be used where indicated or approved by Engineer.
        b. The Lenton mechanical splices shall develop in tension and compression at least 125% of the yield strength (Fy) of the bar spliced.
        c. Lenton mechanical splices shall be positive locking, taper threaded type coupler.
    4. Any additional Contractor-proposed splice shall be submitted for acceptance of location and splice length.
F. Lap welded wire reinforcement in accordance with ACI 318, but not less than the length of one mesh plus 2 inches (50 mm).
G. Connection of reinforcement bars to steel shapes or plate shall be with a Cadweld Series B-splice.
H. Do not bend bars embedded in hardened or partially hardened concrete without approval from Engineer. If bending is permitted, conform to procedures of ACI 301 unless otherwise prescribed by the governing building code.
I. Do not weld reinforcing bars unless specifically indicated. Where welding is indicated, provide bars conforming to ASTM A706/A706M and comply with AWS D1.4.

END OF SECTION 03 20 00

SECTION 03 30 00 – CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes concrete and related items.

1.03 RELATED REQUIREMENTS:

A. Section 03 10 00 – Concrete Formwork.
B. Section 03 15 50 – Vapor Retarder.
C. Section 03 20 00 – Concrete Reinforcement.
D. Section 05 50 00 – Embedded Steel.
E. Section 07 12 00 – Insulation.
F. Section 09 90 00 – Protective Coatings.

1.04 REFERENCE STANDARDS:

A. Comply with the provisions of the following codes, specifications, and standards, except as otherwise indicated.
B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
    1. American Concrete Institute (ACI):
        a. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
        b. ACI 301 - Specifications for Structural Concrete.
        c. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
        d. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
        e. ACI 305.1 – Specification for Hot Weather Concreting.
        f. ACI 305R – Guide to Hot Weather Concreting.
        g. ACI 306.1 – Specification for Cold Weather Concreting.
        h. ACI 306R – Guide to Cold Weather Concreting.
        i. ACI 308.1 - Specification for Curing Concrete.
        j. ACI 309R - Guide for Consolidation of Concrete.
        k. ACI 318 - Building Code Requirements for Structural Concrete.
        l. ACI 506.2 - Specification for Shotcrete.
    2. ASTM International (ASTM):
        a. ASTM C31/C31M REV A – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
        b. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
        c. ASTM C39/C39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
        d. ASTM C40/C40M – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
        e. ASTM C42/C42M – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
        f. ASTM C78/C78M REV B - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

g. ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
h. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete.
i. ASTM C114 – Standard Test Methods for Chemical Analysis of Hydraulic Cement.
j. ASTM C117 – Standard Test Method for Material Finer than 75µ (No. 200) Sieve in Mineral Aggregates by Washing.
k. ASTM C136/C136M – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
l. ASTM C142/C142M – Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
m. ASTM C143/C143M REV A – Standard Test Method for Slump of Hydraulic Cement Concrete.
n. ASTM C150/C150M – Standard Specification for Portland Cement.
o. ASTM C172/AC172M REV A – Standard Practice for Sampling Freshly Mixed Concrete.
p. ASTM C192/C192M – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
q. ASTM C231/C231M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
r. ASTM C233/C233M - Standard Test Methods for Air-Entraining Admixtures for Concrete.
s. ASTM C260/C260M REVA – Standard Specification for Air-Entraining Admixtures for Concrete.
t. ASTM C295/C295M – Standard Guide for Petrographic Examination of Aggregates for Concrete.
u. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
v. ASTM C430 – Standard Test Method for Fineness of Hydraulic Cement by the 45µ (No. 325) Sieve.
w. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
x. ASTM C566 –Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying.
y. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
z. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
aa. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
bb. ASTM C1107/C1107M REVA - Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink).
cc. ASTM C1193 – Standard Guide for Use of Joint Sealants.
dd. ASTM C1218/C1218M - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
ee. ASTM C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates Mortar-Bar Method
ff. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
gg. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types).

hh. ASTM D1752 REVA - Standard Specification for Standard Specification for - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
ii. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

3. Concrete Plant Manufacturers Bureau (CPMB):
   a. 100 - Concrete Plant Standards.
   b. 102 - Recommended Guide Specifications for Batching Equipment and Control Systems in Concrete Batch Plants.
4. Plant Mixer Manufacturers Division (PMMD):
   a. 100 - Concrete Plant Mixer Standards.
5. Federal Specification (FS):
   a. SS-S-200 - Sealants, Joint: Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement.
   b. TT-S-227 - Sealing Compound: Elastomeric Type, Multi-Component (for Calking, Sealing, and Glazing in Buildings and Other Structures).
6. National Bureau of Standards (NBS) Specifications for Scales.
7. Truck Mixer Manufacturers Bureau (TMMB):
   a. Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards.

1.05 SUBMITTALS:

A. Submit as specified in Division 01.
B. Include, but not limited to, product data and Shop Drawings of the following:
   1. Nonshrink grouts.
   2. Admixtures.
   3. Bonding agents.
   4. Curing agents.
   5. Concrete floor hardeners, sealers, and coloring compounds.
   6. Expansion joint materials.
   7. Joint sealants.
   8. Aggregate Concrete Floor Hardener.
C. Mill Certificates:
   1. Submit to Engineer a minimum of one copy for each cement shipment.
D. Concrete Mix Design Proportions:
   1. Submit as specified in PART 2, Paragraph 2.01.D - Mix Proportions, this Section.
   2. Submit for each mix design, including aggregate gradation data.
   3. Resubmit for any change in each mix design.
E. Production Test Reports: Submit as specified in Division 01 and PART 2, Paragraph 2.01.E. - Measurement of Materials, this Section.
F. Laboratory Test Reports: Submit as specified in Division 01 and PART 2, Paragraph 3.08. C – Laboratory Testing of Aggregates and Concrete During Construction, this Section.

1.06 QUALITY ASSURANCE:

A. Field Testing: Shall be performed by an ACI Concrete Field-Testing Technician Grade 1.
B. Submit qualification records of field testing and finishing technicians prior to placing concrete.

PART 2 - PRODUCTS

2.01 CONCRETE:

A. Materials:

1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   a. Portland cement: ASTM C150, Type I/II
      (1) Fly ash: ASTM C618, Class F or C.
      (2) Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
   b. The maximum amount retained on the No. 325 sieve shall be 10% as determined in accordance with ASTM C430.
   c. The maximum amount of alkalis ($NA_2O + 0.658\ K_2O$) shall be 0.60% determined in accordance with ASTM C114. A running average of three Samples shall not exceed a maximum of 0.50%.
2. Fine Aggregate:
   a. Conform to ASTM C33.
   b. Approved service record of 3 years with a history indicating that the fine aggregate is not chemically reactive.
   c. For a new fine aggregate source, or when 3 years' approved service records are not available, or when the service records are unacceptable; the aggregate shall be evaluated for potential reactivity. Aggregate must be considered innocuous in accordance with petrographic examination by ASTM C295.
   d. Fine aggregate considered deleterious or potentially deleterious shall not be used without approval.
   e. Maintain fine aggregate free of ice and frozen lumps.
   f. Fineness modulus shall be between 2.3 and 3.1.
3. Coarse Aggregate:
   a. Conform to ASTM C33.
      (1) Limits for deleterious substances and physical property requirements shall conform to Table 3 and applicable class designation 5S, 5M, or 1N.
   b. Approved service record of 3 years with a history indicating that the coarse aggregate is not chemically reactive.
   c. For a new coarse-aggregate source, when 3 years' approved service records are not available, or when the service records are unacceptable; the aggregate shall be evaluated for potential reactivity. Aggregate must be considered innocuous in accordance with petrographic examination by ASTM C295 and tests conforming to ASTM C1260.
   d. Coarse aggregate considered deleterious or potentially deleterious shall not be used without approval.
   e. Blast furnace slag will not be permitted.
   f. Maintain coarse aggregate free of ice and frozen lumps.
   g. Grading Requirements:
      (1) Size No. 57, from 1-inch (25-mm) to No. 4 (4.75-mm) sieve for all concrete unless otherwise specified.
4. Mixing Water:
   a. Only potable water will be acceptable.
5. Admixtures:
   a. Water-Reducing Type:
      (1) Conform to ASTM C494, Type A.

(2) Conform to manufacturer's recommendations for use.
(3) Technical assistance of the manufacturer's field representative shall be furnished upon request.

b. Air-Entraining Type:
(1) Conform to ASTM C260.
(2) Conform to manufacturer's recommendations for use.
(3) Technical assistance of the manufacturer's field representative shall be furnished upon request.
(4) Testing of air-entraining admixtures shall conform to ASTM C233.

c. Other Admixtures: Use only with Engineer's written concurrence.
(1) Water-Reducing, Retarding Type: Conform to ASTM C494, Type D.

d. Admixtures shall not contain any chloride ions.

e. Storage: Admixtures shall be stored in such a manner as to avoid contamination, evaporation, freezing, temperature changes, settling, or any damage which would adversely affect their characteristics.

B. Laboratory Testing of Materials for Use in Concrete:

1. An approved independent testing laboratory shall be selected and paid by Contractor to perform all required laboratory tests of materials proposed for use in the production of concrete and to determine mix proportions when laboratory trial batches are required.

2. Contractor shall deliver representative Samples of all proposed concrete materials to the laboratory for the following testing:

a. Fine Aggregate:
(1) ASTM C33 (as amended by PART 2, Paragraph 2.01.A. - Materials, this Section).
(2) ASTM C40.
(3) ASTM C88.
(4) ASTM C117.
(5) ASTM C136.
(6) ASTM C142.
(7) Fineness modulus.

b. Coarse Aggregate:
(1) ASTM C33 (as amended by PART 2, Paragraph 2.01.A. - Materials, this Section).
(2) ASTM C88.
(3) ASTM C136.
(4) ASTM C142.

c. Air-entraining admixture shall be tested conforming to ASTM C233.

d. Mixing water: if other than potable water is proposed for use and in the opinion of Engineer there is reason to suspect its acceptability:
(1) With the design mix the laboratory shall make two concrete test cylinders using proposed water and two concrete test cylinders using potable water conforming to ASTM C192.
(2) All cylinders shall be tested conforming to ASTM C39. Age of cylinders at test shall be 28 days unless an earlier age is authorized.
(3) Concrete made with nonpotable water shall attain at least 95% of the compressive strength of similar specimens of the same mix design made with potable water.

3. The laboratory test results shall be part of the design mix submittal specified in this PART 2, Paragraph 2.01.D. - Mix Proportions.

C. Concrete Qualities Required:
   1. Minimum 28-day compressive strength:
      a. 4,500 psi (31 026 kPa) for all construction unless otherwise indicated.
      b. 2,000 psi (13 789 kPa) for fill concrete and seal slabs.
      c. 4,000psi for Electrical Duct Banks and Site Concrete.
      d. Compressive-strength determinations shall be made from 6-inch (150-mm) diameter by 12-inch (300-mm) long concrete cylinders tested in accordance with ASTM C39.
   2. Slump of concrete shall be between 4 inches (50 mm) and 6 inches (100 mm) as tested in accordance with ASTM C143.
   3. Air Content:
      a. 6% ±1.5% unless otherwise indicated or specified.
      b. 3% maximum for all concrete receiving steel-troweled finish.
      c. Testing shall be in accordance with ASTM C231.
   4. Water-Cementitious Materials Ratio:
      a. In addition to the aforementioned requirements, maximum water-cementitious materials ratio shall be limited as follows:
         (1) 0.45 for all concrete unless otherwise specified.
            (a) Includes Administration Building foundation and slab.
         (2) 0.40 for concrete exposed to freezing and thawing in a moist condition or to deicing chemicals.
            (a) Includes Scale House and Scale foundations and approach slabs.
   5. Chloride Ion Content:
      a. Maximum water-soluble chloride ion content, in percent by weight of cement:
         (1) 0.30 for all concrete unless otherwise specified.
      b. Testing shall be in accordance with ASTM C1218.

D. Mix Proportions:
   1. Concrete shall be homogeneous, readily placeable, uniformly workable, and finishable; proportioned to conform to ACI 211.1.
   2. Mix proportions for all concrete, unless otherwise specified, shall be selected preferably on the basis of field experience; but in the case where sufficient or suitable strength test data is not available, concrete shall be proportioned on the basis of laboratory trial mix design.
      a. Field experience using test results within the preceding year, with the materials and plant to be employed may be the basis of mix proportioning, provided that not less than 30 consecutive satisfactory compressive-strength tests on concrete using the proposed materials with a similar mix are available. A compressive-strength test is defined as the average 28-day compressive strength of two companion cylinders made conforming to ASTM C172 and ASTM C31 and tested conforming to ASTM C39.
         (1) The standard deviation of compressive-strength tests shall be computed as a basis for design of the mix. The design average compressive strength shall exceed the specified strength by at least:
            (a) 400 psi (2760 kPa) if standard deviation is less than 300 psi (2070 kPa).
            (b) 550 psi (3800 kPa) if standard deviation is 300 to 400 psi (2070 to 2760 kPa).
            (c) 700 psi (4830 kPa) if standard deviation is 400 to 500 psi (2760 to 3450 kPa).

(d) 900 psi (6200 kPa) if standard deviation is 500 to 600 psi (3450 to 4140 kPa).
(e) 1,200 psi (8275 kPa) if standard deviation is greater than 600 psi (4140 kPa).

(2) Submit the following test data to Engineer for approval prior to placing concrete:
(a) Fine Aggregate:
1). ASTM C33.
2). ASTM C40.
3). ASTM C88.
4). ASTM C117.
5). ASTM C136.
6). ASTM C142.
7). Fineness modulus.
(b) Coarse Aggregate:
1). ASTM C33.
2). ASTM C88.
3). ASTM C136.
4). ASTM C142.
5). ASTM C295 and ASTM C1260 or approved service records.
(c) Cement:
1). Mill certificate.
2). ASTM C430.
(d) Concrete:
1). Fine and coarse aggregate, water and cement sources.
2). Mix proportions, slump and air content.
3). Data on 30 consecutive satisfactory compressive strength tests and standard deviation calculations.

b. Laboratory Trial Batch: When laboratory trial batches are used as a basis for determining mix proportions, all such Work shall be performed by the laboratory as specified in PART 2, Paragraph 2.01.B. - Laboratory Testing of Materials for Use in Concrete, this Section.
(1) Laboratory trial batches shall be used to establish a water-cement ratio, compression-strength curve with at least three points, each representing the strength of a separate trial batch. At least one point shall be above and one below the strength required. Each point on the curve shall represent the average of at least three cylinders tested at 28 days or an earlier age when approved by Engineer. The slump and air content shall be at the maximum limits specified in PART 2, Paragraph 2.01.C. - Concrete Qualities Required, this Section.
(2) A point on the water-cement ratio, compressive-strength curve shall be selected that will provide an average compressive strength at least 1,200 psi (8275 kPa) greater than the specified minimum strength.
(3) Submit the following test data to Engineer for approval prior to placing concrete.
(a) Fine Aggregate:
1). ASTM C33.
2). ASTM C40.
3). ASTM C88.

4). ASTM C117.
5). ASTM C136.
6). ASTM C142.
7). Fineness modulus.
8). ASTM C295 and ASTM C1260 or approved service records.

(b) Coarse Aggregate:
1). ASTM C33.
2). ASTM C88.
3). ASTM C136.
4). ASTM C142.
5). ASTM C295 and ASTM C1260 or approved service records.

(c) Cement:
1). Mill certificate.
2). ASTM C430.

(d) Concrete:
1). Fine and coarse aggregate, water and cement sources.
2). Laboratory mix proportions, slump and air content.
3). Water-cement ratio, compressive-strength curve.
4). ASTM C1218.

3. Prior to placing any concrete, the laboratory selected by Contractor shall report the results of the testing and mix designs to the following:
   a. Engineer, Denver Office one copy.
   b. Contractor (copies as required).
   c. Concrete Supplier (copies as required).

E. Measurement of Materials:
1. General Requirements:
   a. Conform to ACI 304R.

F. Mixing and Delivery:
1. Conform to ACI 304R.
2. Cement temperature, when added to mix, shall not exceed 170ºF (77ºC).
3. Adjust the amount of mix water to compensate for the moisture content of the aggregates.
4. Concrete Plant:
   a. Conform to "Concrete Plant Mixer Standards" of the Plant Mixer Manufacturers Division, Concrete Plant Manufacturers Bureau, and "Concrete Plant Standards" of the Concrete Plant Manufacturers Bureau.
   b. Water added to concrete having a slump below the specified minimum shall be at Contractor's risk. If the water added produces a slump greater than the specified maximum, the concrete will be rejected. If water is added, the concrete shall be remixed for a minimum of 25 revolutions. Water shall not be added after the truck mixer has begun to discharge concrete.
   c. Truck mixer shall conform to "Truck Mixer, Agitator, and Front Discharge Concrete Carrier Standards" of the Truck Mixer Manufacturers Bureau.
   d. Ready-mixed concrete shall be produced and delivered conforming to ASTM C94 as applicable.
   e. Contractor shall furnish Owner with a concrete delivery ticket for each load of concrete. The ticket shall have the following information recorded:
      (1) Serial number of ticket.
      (2) Time batched.
      (3) Time arrived on jobsite.

(4) Amount of concrete (by volume).
(5) Mix number.
(6) Amount of all water added at jobsite by Contractor.
(7) Name of ready-mix batch plant.
(8) Date.
(9) Truck number.
(10) Name of purchaser.

5. Plant and truck mixer uniformity shall be tested according to ASTM C94. Frequency of tests shall be as specified in PART 3, this Section.

2.02 GROUT:

A. Grout for Dry Packing:
1. Volume: 1 part Portland cement to 2 parts sand.
2. Keep water to a minimum as required for placing by the dry packing method.
3. Place after the mixed grout has been allowed to stand for 2 hours.
4. The sand and cement shall be as specified for concrete.

B. Flowable Nonshrinking Grout:
1. Required for setting handrail posts, for setting equipment recommended by the manufacturer to be set with nonshrinking grout, and in other places indicated.
2. Grout shall be nonmetallic and conform to ASTM C1107.
3. Prepare and place conforming to manufacturer's printed instructions.
4. For equipment bases, the concrete surfaces shall be grit blasted or roughened with a chipping hammer prior to grouting. The foundation plates shall be cleaned of any grease, oil, paint, primers, or epoxy coatings.

C. Grout for Bonding:
1. Proportion (by weight): 1 part cement to 1-1/2 parts sand.
2. Keep water to a minimum.

2.03 BONDING AGENT:

A. Provide moisture-insensitive, epoxy-resin bonding agent conforming to ASTM C881, Type V.

2.04 CONCRETE ACCESSORIES:

A. Expansion Joints:
1. Expansion Joint Filler: Preformed asphalt-impregnated fiber of thickness indicated and conforming to ASTM D1751. Use where indicated.
2. Bond Breaker: Polyethylene tape or other plastic tape as recommended by sealant manufacturer.
3. Sealant Backer Rod: Provide closed cell backer rod or other backing material as recommended by sealant manufacturer.
4. Joint Sealants:
a. Multi-component sealant as follows:
(1) Joint Sealant - General Use:
(a) BASF Building Systems: Sonneborn Sonolastic NP 2 (vertical use) and Sonolastic SL 2 (horizontal use).
(b) Epoxy Systems Products Company: Product #11.
(c) Euclid Chemical Company: Eucolastic II.
(d) Pecora Corporation: NR-200, Dynatred.
(2) Joint Sealant - Traffic Grade (conforming to FS TT-S-227):
(a) BASF Building Systems: Sonneborn Sonolastic SL 2.

(b) Epoxy Systems Products Company: Product #913.
(c) Pecora Corporation: Dynatrol II SG.
(d) Sika Corporation: Sikaflex-2c NS TG.

B. Preformed Contraction Joints: Zip Joint T-shaped plastic strip as manufactured by BoMetals, Inc., Powder Springs, Georgia. Depth of preformed construction joint shall exceed 1/4 of the slab thickness.

2.05 CURING AGENT:

A. Apply to all concrete surfaces unless otherwise indicated or specified.
B. Curing agent shall conform as follows:
1. ASTM C309, Type 1: Use where concrete surface is not exposed to direct sunlight after placement.
2. ASTM C309, Type 1-D: Use where slabs are exposed to direct sunlight for a period of seven days minimum after placement. Curing and sealing agent with fugitive dye shall be readily distinguishable upon the concrete surface for at least four hours after application but shall be inconspicuous within seven days after application.
3. ASTM C309, Type 2: Use as specified in PART 3, Article 3.05 - Hot Weather Concreting, this Section.
C. Curing compound used on floors to be sealed, painted, tiled, topped, dampproofed, waterproofed, or covered with resilient floor covering shall be guaranteed not to interfere with application of sealer, paint, tile mortar, or tile adhesive after a 28-day curing period.
D. Curing compound shall be VOC compliant with a maximum VOC content of 2.9 lbs./gal (350 g/L), or less where Project location regulations are more stringent.

2.06 CONCRETE FLOOR CURING AND SEALING AGENT:

A. Apply to all interior concrete floor surfaces subject to vehicle or pedestrian traffic.
B. Curing and sealing agent shall conform as follows:
1. ASTM C1315, Type I, Class A: Use where slabs are not exposed to direct sunlight after placement.
2. ASTM C1315, Type I, Class A with Fugitive Dye: Use where slabs are exposed to direct sunlight for a period of seven days minimum after placement. Curing and sealing agent with fugitive dye shall be readily distinguishable upon the concrete surface for at least four hours after application but shall be inconspicuous within seven days after application.
3. ASTM C1315, Type II, Class A: Use as specified in PART 3, Article 3.05 - Hot Weather Concreting, this Section.
C. Apply as soon as possible and in conformance with manufacturer's written instructions.

PART 3 - EXECUTION

3.01 PREPARATION FOR CONCRETE PLACEMENT:

A. Openings Through Concrete: Provide openings through concrete as indicated and for the proper installation of all equipment, piping, wiring, ductwork and similar items, installed under this Contract.
B. Installation of Embedded Items:
1. Provide for accurate installation of embedded items installed under this Contract.
2. Securely fix floor drains in place to prevent flotation while placing concrete. Uniformly and accurately slope finish floor slab toward the drains.

3. Embedded items shall be as indicated or specified, or as selected by Contractor and approved by Engineer.
4. During cold weather, protect pipe sleeves, shear pockets, and blockouts from moisture which may freeze, expand, and crack the sleeve, pocket or blockout and concrete structure.
5. Grease or tape anchor bolt threads to protect from concrete splatter.

C. Installation of Joints:
1. Construction Joints:
a. Location:
(1) Locate joints, which are not indicated or specified, in conformance with ACI 318.
(2) Locate joints to limit the length of all concrete placements to not more than 40 feet.
(3) Obtain Engineer's approval of joints located by Contractor prior to preparation of reinforcing steel drawings.
b. Preparation and Installation:
(1) Clean and break laitance or other foreign material from bonding surface.
(2) Tighten forms remaining in place (where applicable) to prevent seepage between forms and hardened concrete.
2. Expansion Joints:
a. Install filler, backer rod and sealant in strict conformance with manufacturer's written instructions.
b. Reinforcing steel shall not extend through expansion joints unless indicated otherwise.
c. Attach rigid joint filler to the face of the joint prior to placing adjacent concrete. The filler shall occupy the entire width of the joint.
d. Install sealant backer rod for sealant except where indicated to be omitted. Install bond breaker where indicated.
e. Clean joints surface immediately before application of sealant.
f. Install joint sealants to conform to ASTM C1193. Tool sealants to provide smooth, uniform bead with a slightly concave surface, eliminate air pockets, and insure sealant contact and adhesion with sides of joint.
g. Protect joints from moisture and ice during freezing.
3. Contraction Joints: As specified in this PART 3, Article 3.03 - Finishing, this Section.

3.02 PLACING OF CONCRETE:

A. Conventional Placing:
1. General Requirements:
a. Conform to ACI 304R.
b. Bonding surfaces, including reinforcement, shall be clean, free of laitance and foreign materials.
c. Face horizontal bonding surfaces with 1-inch (25-mm) thick coat of fresh "grout for bonding." Wet all other surfaces.
d. Place concrete on properly prepared and unfrozen subgrade and only in dewatered excavation and forms.
e. Use forms for all concrete except where otherwise indicated or specified. Footings entirely below grade may be earth formed.
f. Do not place concrete that has partially hardened or has been contaminated by foreign materials.

g. Prevent mud or foreign materials from entering the concrete or forms during placement operations.

2. Conveying:
   a. Convey concrete from the mixer and deposit in place by methods which will prevent the segregation or loss of materials.
   b. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to provide a practically continuous flow of concrete at the delivery end.
   c. Aluminum conveying equipment shall not be used.
3. Depositing:
   a. Place concrete in continuous horizontal lifts not to exceed 2 feet (600 mm), and place concrete against bulkheads and keyways at vertical joints.
   b. Maximum free drop of concrete and grout for bonding shall be 5 feet (1.5 meters), in walls 10 inches (250 mm) or less in thickness, with 1-foot (300-mm) additional drop allowed for each inch (25 mm) of wall thickness over 10 inches (250 mm), with a maximum drop of 10 feet (3 meters).
   c. When vapor barrier is used, keep lapped joints closed and take precautions to avoid puncturing the barrier.
4. Consolidation of Concrete:
   a. Consolidate concrete in conformance with ACI 309R. Characteristics and application of concrete vibrators shall be as set forth in Table 5.1.5.
   b. Provide an adequate number of vibrators of sufficient capacity to keep up with the maximum rate of concrete placement. Keep on hand adequate standby equipment in good operating condition.
   c. Vibrate concrete only until the concrete is thoroughly consolidated and the voids filled, as evidenced by the leveled appearance of the concrete at the exposed surface and the embedment of the surface aggregate.
   d. Insert internal vibrators vertically to the full depth of the layer being placed and into the previous layer. Do not drag vibrators through the concrete. Insert and withdraw vibrator slowly with the vibrator running continuously so that no hole will be left in the concrete. Do not flow concrete from one location to another by use of a vibrator.
   e. Consolidate concrete layer to full depth when using a surface vibrator. Use thinner layers or a more powerful vibrator if necessary, to achieve complete consolidation.
   f. Use form vibrators only where sections are too thin or where sections are inaccessible for internal vibrators.
5. Time Requirements:
   a. Place concrete at a sufficient rate to assure that lifts below have not taken initial set before fresh concrete is deposited.
   b. Place concrete within 45 minutes after mixing. This period may be extended to 1 hour and 30 minutes provided that the combined air temperature, relative humidity, and wind velocity are such that the plasticity of the fresh concrete is satisfactory for placement and consolidation, and that the specified mixing water is not exceeded. Concrete which has partially set shall not be retempered but shall be discarded.

B. Placing Concrete at Joints:
   1. Take precautions to ensure tight, well-bonded construction joints with no air pockets or voids.

2. Delay construction at a joint a minimum of 16 hours where placement is continued past joint, except where otherwise indicated.

3.03 FINISHING:

A. Unformed Surfaces:

1. Screed Finish:
   a. Use as first stage for all concrete finishes.
   b. Use as final finish on surfaces that will be covered by additional concrete, grout placement, or mortar setting bed except as otherwise specified.
   c. Immediately after screeding, use a wood float, darby, or bullfloat to eliminate high and low spots and to embed large aggregate. This shall be done in a manner to produce even, uniform surfaces so that surface irregularities do not exceed 3/8 inch in 10 feet (9 mm in 3 meters) when used as final finish.
2. Floated Finish:
   a. Use as second stage of broomed, troweled, or magnesium-troweled finish.
   b. Use as final finish on all areas to receive quarry or ceramic tile with mortar setting bed.
   c. Float with mechanical float. Hand floating will be permitted only in areas inaccessible to mechanical float.
   d. On surfaces not to receive troweled or magnesium-troweled finish, finish with wood or cork float after mechanical floating to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet (3 mm in 3 meters), except at floor drains.
3. Broomed Finish:
   a. Use as final finish on all outdoor slabs including pavements, sidewalks and approach slabs.
   b. After floated finish, draw a stiff bristle broom across the surface making uniform corrugations, perpendicular to the direction of traffic, not more than 1/16 inch (1.6 mm) deep.
4. Troweled Finish:
   a. Use as final finish on inside floors and on all other unformed surfaces not otherwise indicated or specified.
   b. Trowel with mechanical steel trowel to obtain a smooth, dense finish. Hand steel trowel shall be used in areas not accessible by mechanical trowel. The final troweling shall be done after the concrete has become hard enough so that no mortar adheres to the edge of trowel and a ringing sound is produced as the trowel passes over the surface.
   c. Do not trowel before surface water has evaporated or has been removed with a squeegee.
   d. Finish to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet (3 mm in 3 meters), except at floor drains.
   e. Do not add sand or cement to the floor surface.
5. Contraction Joints:
   a. Locate as indicated.
   b. Maintain true alignment with straightedge.
   c. Slab on grade joints shall be sawed.
   d. Sawed Joints:

(1) Cut joints with power blade as soon as concrete surface is firm enough to resist tearing or damage by the blade and before random shrinkage cracks can occur. (Usually required 4 to 12 hours after finishing.)
(2) Make joints approximately 1/8 inch (3 mm) wide with depth equal to 1/4 the slab thickness unless otherwise indicated.
(3) Seal where indicated with the same type sealant specified for expansion joint sealant.

6. Floor Flatness and Levelness:
   a. Applicable for steel and magnesium troweled finish floors, and other floors as indicated or specified.
   b. Finish to a true uniform surface. Contractor shall engage an independent testing agency to conduct floor tolerance tests (floor flatness and floor levelness tests) in accordance with ASTM E1155. Floor tolerance tests shall be made in the presence of Owner and Contractor within 16 hours after completion of the final troweling operation, and before floor forms and shores have been removed. Floor tolerance tests shall be conducted with an electronic floor profiler instrument equal to a Dipstick Floor Profiler as manufactured by the Edward W. Face Company, Inc. The minimum acceptable ACI F-number tolerances are:
      (1) Specified Overall Value: $F_F = 35$, $F_L = 25$.
      (2) Minimum Local Value: $F_F = 35$, $F_L = 25$.
   c. All slabs on grade not meeting the above minimum tolerance tests shall be removed and replaced at Contractor's expense.

B. Formed Surfaces:
   1. Repair surface defects as specified in PART 3, Paragraph 3.03.C. - Repair of Defective Surfaces, this Section.
   2. Burlap Finish:
      a. Apply burlap surface treatment to the following formed surfaces:
         (1) Scale House walls above finished grade.
      b. Remove forms as soon as permitted in accordance with Section 03 10 00.
      c. Wet and fill all voids using mortar with the same sand-cement ratio as original concrete. Blend with white cement to match concrete color.
      d. Strike off all excess mortar flush with the surface using a burlap or canvas cloth with a circular motion.
      e. Remove all rough spots and rub with cloth to leave a surface of uniform texture and appearance.
      f. Finish shall result in a coating of mortar that will fill all small voids and air holes, leaving a smooth surface.
      g. Cure as specified in this PART 3, Article 3.04 - Curing, this Section.

C. Repair of Defective Surfaces:
   1. Defined as any concrete surface showing misalignment, rock pockets, poor joints, holes from ties, voids, honeycomb, or any other defective area.
   2. Repairing:
      a. Repair as soon as forms have been removed.
      b. Chip surface back to minimum depth of 1/2 inch (13 mm), chip edges perpendicular to surface, prewet depression and brush with neat cement immediately before patching.
      c. Patch surfaces using stiff mortar with same sand-cement ratio as original concrete and with minimum water for placing. Blend with white cement to match concrete color.

d. Compact mortar into depressions so that after curing, hole is filled and mortar is flush with surface. Use hammer and ramming rod for compacting the holes.
e. Moist-cure for 3 days or use curing compound.
f. Engineer shall be notified of areas containing defects or where reinforcing steel is exposed, prior to determination of repair method.

3.04 CURING:

A. Cure concrete by one of the following methods in accordance with ACI 308.1:
1. Leaving in forms for a minimum of 7 days. Keep formwork wet to prevent drying of concrete surfaces.
2. Using one coat of a liquid membrane forming compound as specified. Apply immediately after removal of forms (which have been continuously wet); or in case of a slab, after the concrete has been finished and is hardened sufficiently to walk on.
3. Curing of concrete during hot or cold weather shall conform to PART 3 - Hot Weather Concreting and Cold Weather Concreting, this Section.

3.05 HOT WEATHER CONCRETING:

A. Follow the recommendations of ACI Specification 305.1 if any of the following conditions occur:
1. When the temperature is 90ºF (32ºC) or above.
2. When the temperature is likely to rise above 90ºF (32ºC) within the 24-hour period after concrete placement.
3. When there is any combination of high air temperature, low relative humidity, and wind velocity which would impair either concrete strength or quality.
B. Concrete shall have a maximum temperature of 85ºF (29ºC) during placement.
C. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
D. Protect freshly placed concrete immediately after placement so that the rate of evaporation as determined by ACI 305.1 Equations 3.1.3 does not exceed 0.2 pound per square foot (1.0 kg per square meter) per hour.
E. Protect concrete with suitable insulation if rapidly decreasing nighttime temperatures occur, which would cause thermal shock to concrete placed during warm daytime temperatures.
F. Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
G. Begin curing unformed surfaces immediately after finishing and continue for 24 hours. Curing shall consist of application and maintenance of water-saturated material to all exposed surfaces; horizontal, vertical, and otherwise. After the 24-hour interval, continue curing using one of the following methods:
1. Moist curing for 6 days.
2. Application of one coat of curing compound as specified.
3. Application and maintenance of curing paper or heat-reflecting plastic sheets for 6 more days.
H. Begin curing formed concrete immediately after placing. Curing shall consist of keeping forms continuously wet for 24 hours. Thereafter, continue curing using one of the following methods:
1. Loosen forms and position soaker hose so that water runs down along concrete surfaces. Continue for 6 days.
2. Strip forms and apply curing compound as specified. Do not allow concrete surfaces to dry prior to application of curing compound.

3.06 COLD WEATHER CONCRETING:

A. Work shall conform to all requirements of ACI 306.1, Standard Specifcation for Cold Weather Concreting, except as modified by the requirements of these Contract Documents.
   1. Modification to Section 3.2.2: Temperature shall be measured twice per day until protection may be terminated
   2. Modification to Section 3.4.5: Refer to Section 03 10 00 to determine when forms may be removed.

B. When the temperature is 40ºF (4.4ºC) or is likely to fall below 40ºF (4.4ºC) during the 24-hour period after concrete placement, follow the recommendations of ACI 306.1 to prevent loss of concrete strength or quality.

C. Minimum temperature for concrete as mixed shall be as indicated in Table 3.2.1 of ACI 306.1. Maximum temperature for concrete as mixed shall be 10ºF (5.6ºC) greater than the corresponding minimum temperature.

D. Place and maintain concrete so that its temperature is never less than the temperature indicated on line 1 of Table 5.1 of ACI 306R. Maintain the required temperature for the time duration indicated on Tables 5.1 and 7.1 of ACI 306R.

E. Monitor temperature of concrete in place at corners or edges of formwork as applicable.

F. Air Heaters:
   1. Do not expose concrete to carbon monoxide or carbon dioxide fumes from heaters or engines.
   2. Oil- or coke-burning salamanders will not be permitted.
   3. Heaters shall be ultramatic portable heaters made by the Union Chill Mat Company or Engineer approved equal.
   4. Personnel shall be present at all times to maintain safe, continuous operation of heating system.

G. Control temperature and humidity of protected concrete so that excessive drying of concrete surfaces does not occur.

H. Calcium chloride will not be permitted as a concrete accelerator or to thaw frozen subgrade prior to concrete placement.

I. The maximum allowable temperature drop during the first 24-hour period after protection is discontinued shall be as indicated on line 1 of Table 5.1 of ACI 306R.

J. Cure the concrete in accordance with Chapter 10 of ACI 306R.

3.07 LOW-STRENGTH CONCRETE:

A. Low-Strength Concrete:
   1. Defined as either:
      a. Concrete where the average, of any sets of three consecutive 28-day compressive strength tests, is below the required 28-day strength.
      b. Concrete where the individual 28-day strength test (average of two cylinders) is more than 500 psi (3450 kPa) below the required 28-day strength.
   2. Should concrete meet either definition of low-strength concrete as a minimum, the Contractor shall take the following steps:
      a. Increase the cement content. The increase shall be based on a statistical evaluation of the strength data, the design water-cement ratio, compressive-strength curve, and acceptable mix-design literature as follows:
         (1) If sufficient concrete has been furnished to accumulate 30 tests, these should be used to establish a new target average strength in accordance with ACI 318, Section 5.3.

(2) If less than 30 tests have been made, the new target average strength should be at least as great as the average strength used in the initial selection of the mix proportions. Increase the target average strength based on a statistical evaluation of the available strength data, the design water-cement ratio, compressive-strength curve, and acceptable mix-design literature. If the statistical average equals or exceeds the initial mix-design level, a further increase in the average level is required.

b. Remove and replace with acceptable concrete when the quality and location of the low-strength concrete is such that Engineer considers the strength or durability of the structure is impaired and so orders.

3. Low-strength concrete shall be considered defective Work as defined in General Conditions.

B. Potentially Low-Strength Concrete: Defined as concrete whose 7-day test (average of two cylinders) is less than 70% of the specified minimum 28-day compressive strength.

C. Construction delays caused by low-strength or potentially low-strength concrete shall not relieve Contractor from responsibility for late completion even though extensions of time may be granted.

3.08 TESTING:

A. Field Testing of Concrete Plant and Mixing Trucks:
1. The concrete plant shall be inspected and tested to ensure conformance with ACI 304R and the "Concrete Plant Standards of the Concrete Plant Manufacturers Bureau." The scales shall be calibrated at the initial setup and at 3-month intervals thereafter.
2. Mixing trucks shall be inspected and tested to ensure conformance with ACI 304R and "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau" of the National Ready-Mix Concrete Association. Tests shall be done at initial setup and every 3 months thereafter.
3. Submit test reports when requested.

B. Field Testing of Concrete and Making of Concrete Test Cylinders:
1. Contractor shall furnish test equipment, test cylinder molds, and certified personnel to perform all required field tests, make the required concrete test cylinders, and deliver test cylinders to the testing laboratory. The prescribed tests shall be made in the presence of or with the concurrence of the Owner.
2. Field testing personnel shall be on Site throughout placement of concrete.
3. Concrete sampling for tests and cylinder making shall be done conforming to ASTM C172. Samples shall be taken at random and at the point of truck discharge.
4. Perform the following tests:
a. Prepare test cylinders conforming to ASTM C31, with not less than one set of cylinders (four cylinders) from each day's placement for each 100 cubic yards (75 cubic meters) or fraction thereof.
b. Slump test conforming to ASTM C143. Perform tests on the first batch produced each day, for every 50 cubic yards (38 cubic meters) or fraction thereafter, and with every set of test cylinders. Additional tests shall be run when directed by Engineer.
c. Air content test conforming to ASTM C231. Perform for first batch of day and with each set of test cylinders.
d. The batch of concrete being tested for slump or air content shall not be placed until acceptable results are obtained.
e. Discard concrete used for slump and air tests.

f. Perform concrete and air temperature tests for first batch of day and with each set of test cylinders. Additional readings shall be taken when directed by Engineer.
g. Any batch of concrete with slump or air content not in conformance with Specifications shall be rejected.
h. Furnish slump, air content, and temperature test results to the testing laboratory for inclusion in the cylinder test reports.

C. Laboratory Testing of Aggregates and Concrete During Construction:
1. An independent testing laboratory shall be selected and paid by Contractor to perform the required laboratory tests and statistical evaluations of aggregates and concrete being used in the Work.
a. Laboratory shall cure and test concrete cylinders conforming to ASTM C192 and C39, testing two cylinders at 7 days of age and two at 28 days of age.
b. Engineer shall have the right to observe all phases of concrete cylinder curing and testing.
c. Should the test results indicate low strength concrete as defined in PART 3, Article 3.07- Low-Strength Concrete, this Section, Contractor shall take immediate corrective action.
d. Should the material tests taken during construction indicate nonconformance with the Specifications, Contractor shall take immediate corrective action.

3.09 REPAIR, REPLACEMENT, AND FIELD MODIFICATIONS:

A. Embedded items and concrete that are misplaced or damaged during construction shall not be repaired, replaced, or field-modified without approval of Engineer.

END OF SECTION 03 30 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section Includes:
   1. Concrete masonry units.
   2. Decorative concrete masonry units.
   3. Mortar and grout.
   4. Steel reinforcing bars.
   5. Masonry-joint reinforcement.
   6. Embedded flashing.
   7. Miscellaneous masonry accessories.

1.03 RELATED REQUIREMENTS:

A. Section 05 21 00 - Structural Joist Framing for installing anchor sections for connecting to structural joists.

B. Section 07 62 00 - Sheet Metal Flashing and Trim for sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.04 REFERENCED STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Concrete Institute (ACI):
   1. 315: Details and Detailing of Concrete Reinforcement.

C. ASTM International (ASTM):
   1. A36/A36M - Specification for Carbon Structural Steel.
   2. A82/A82M - Specification for Steel Wire, Plain, for Concrete Reinforcement.
   3. A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. A580/A580M - Specification for Stainless Steel Wire.
   5. A615/A615M - Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   6. A641/A641M - Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   7. A653/A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   8. A666 - Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
   9. A951/A951M - Specification for Steel Wire for Masonry Joint Reinforcement.
   10. A1008/A1008M - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   11. B370 - Specification for Copper Sheet and Strip for Building Construction.
   12. C90 - Specification for Loadbearing Concrete Masonry Units.
   13. C91/C91M - Specification for Masonry Cement.
   14. C109/C109M - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   15. C114 - Test Methods for Chemical Analysis of Hydraulic Cement.

16. C140 - Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
17. C143/C143M - Test Method for Slump of Hydraulic Cement Concrete.
18. C144 - Specification for Aggregate for Masonry Mortar.
19. C150/C150M - Specification for Portland Cement.
20. C207 - Specification for Hydrated Lime for Masonry Purposes.
21. C270 - Specification for Mortar for Unit Masonry.
22. C331/C331M - Specification for Lightweight Aggregates for Concrete Masonry Units.
23. C404 - Specification for Aggregates for Masonry Grout.
24. C476 - Specification for Grout for Masonry.
25. C494/C494M - Specification for Chemical Admixtures for Concrete.
26. C780 - Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
27. C920 - Specification for Elastomeric Joint Sealants.
28. C979/C979M - Specification for Pigments for Integrally Colored Concrete.
29. C1019 - Test Method for Sampling and Testing Grout.
30. C1093 - Practice for Accreditation of Testing Agencies for Unit Masonry.
31. C1314 - Test Method for Compressive Strength of Masonry Prisms.
32. C1329/C 1329M - Specification for Mortar Cement.
33. C1506 - Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters.
34. ASTM C1611/C1611M – Standard Test Method for Slump Flow of Self-Consolidating Concrete.
35. C1623 - Specification for Manufactured Concrete Masonry Lintels.
36. D1056 - Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
37. D2287 - Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
38. E119 - Test Methods for Fire Tests of Building Construction and Materials.
39. E514/ 514M - Test Method for Water Penetration and Leakage Through Masonry.

D. The Masonry Society (TMS), American Concrete Institute (ACI), and American Society of Civil Engineers (ASCE):
   1. TMS 402 – Building Code Requirements for Masonry Structures.
   2. TMS 602 – Specification for Masonry Structures.

E. National Concrete Masonry Association (NCMA):
   1. NCMA TEK 8-4A - Cleaning Concrete Masonry.

F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   1. Architectural Sheet Metal Manual.

1.05 DEFINITIONS:

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.06 PREINSTALLATION MEETINGS:

A. Preinstallation Conference: Conduct conference at Project Site.

1.07 SUBMITTALS:

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.
3. Weep holes/vents.

D. Qualification Data: For testing agency.

E. Material Certificates: For each type and size of the following:
1. Masonry units.
a. Include material test reports substantiating compliance with requirements.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Integral water repellant used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

F. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with Property Specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

G. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

H. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.08 QUALITY ASSURANCE:

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects.
1. Build sample panels for typical exterior wall in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness.
2. Build sample panels facing south.
3. Protect approved sample panels from the elements with weather-resistant membrane.
4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.

1.09 DELIVERY, STORAGE, AND HANDLING:

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS:

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40ºF (4ºC) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.02 PERFORMANCE REQUIREMENTS:

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602.

2.03 UNIT MASONRY, GENERAL:

A. Masonry Standard: Comply with TMS 602 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet (6 m) vertically and horizontally of a walking surface.

2.04 CONCRETE MASONRY UNITS:

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C90.
   1. Density Classification: Lightweight
   2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less-than-nominal dimensions.
   3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Decorative CMUs: ASTM C90.
   1. Density Classification: Lightweight.
   2. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
   3. Pattern and Texture as indicated on Drawings.
   4. Colors: As indicated on Drawings.

2.05 MASONRY LINTELS:

A. General: Provide one of the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from solid bottom lintel unit CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.06 MORTAR AND GROUT MATERIALS:

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content shall not be more than 0.1% when tested according to ASTM C114.
B. Hydrated Lime: ASTM C207, Type S.
C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
D. Masonry Cement: ASTM C91/C91M.
E. Mortar Cement: ASTM C1329/C1329M.
F. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4-inch (6 mm) thick, use aggregate graded with 100% passing the No. 16 (1.18-mm) sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
G. Aggregate for Grout: ASTM C404.
H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
I. Water: Potable.
J. Field addition of admixtures into self-consolidating grout is not permitted.

2.07 REINFORCEMENT:

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).
B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
   1. Interior Walls: Hot-dip galvanized carbon steel.
   2. Exterior Walls: Hot-dip galvanized carbon steel.
   3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
   4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
   5. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
   6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

2.08 TIES AND ANCHORS:

A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into masonry but with at least a 5/8-inch (16-mm) cover on outside face.
B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Mill-Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A641/A641M, Class 1 coating.
   2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
   3. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 (Z180) zinc coating.

4. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
5. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

2.09 EMBEDDED FLASHING MATERIALS:

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch (0.40 mm) thick.
2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. (4.9-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick or ASTM B370, Temper H01, high-yield copper sheet, 12 oz./sq. ft. (3.7-kg/sq. m) weight or 0.0162 inch (0.41 mm) thick.
3. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.
5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
6. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
7. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
8. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches (76 mm) into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
9. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
10. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches (76 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
11. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
12. Solder metal items at corners.

B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

2. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch (1.02 mm) thick.

C. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use flexible flashing.

D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.

E. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B32, Grade Sn96] with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B32, with maximum lead content of 0.2%.
3. Elastomeric Sealant: ASTM C920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES:

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35%; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.11 MASONRY CLEANERS:

A. Use ProSoCo, Inc. or approved equal masonry cleaners as recommended by manufacturer.

2.12 MORTAR AND GROUT MIXES:

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
2. Use Portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project Site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.

1. For reinforced masonry, use Type S.

D. Pigmented Mortar: Use colored cement product.
   1. Pigments shall not exceed 10% of Portland cement by weight.
   2. Mix to match Architect's sample.
   3. Application: Use pigmented mortar for exposed mortar joints with the following units:
      a. Decorative CMUs.

E. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2,000 psi (14 MPa).
   3. Provide grout with a slump of 10 to 11 inches (250 to 280 mm) as measured according to ASTM C143/C143M.
   4. Proportioning of self-consolidating grout at the project site is not permitted. Do not add water at the project site except in accordance with the self-consolidating grout manufacturer's recommendations.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL:

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

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

3.03 TOLERANCES:

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than +1/2 inch (12 mm) or -1/4 inch (6 mm).
   2. For location of elements in plan, do not vary from that indicated by more than ±1/2 inch (12 mm).
   3. For location of elements in elevation, do not vary from that indicated by more than ±1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm).

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than ±1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than +3/8 inch (9 mm) or -1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than ±1/8 inch (3 mm).

3.04 LAYING MASONRY WALLS:

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

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

3.05 MORTAR BEDDING AND JOINTING:

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

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

E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.06 MASONRY-JOINT REINFORCEMENT:

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at corners by using prefabricated L-shaped units.

3.07 CONTROL AND EXPANSION JOINTS:

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

3.08 LINTELS:

A. Provide masonry lintels where shown and where openings of more than 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

3.09 FLASHING:

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 - Joint Sealants for application indicated.

4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 - Joint Sealants for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

3.10 REINFORCED UNIT MASONRY INSTALLATION:

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 64 inches.

3.11 FIELD QUALITY CONTROL:

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

B. Inspections: Special inspections according to Level 2 in TMS 402.
1. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
2. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5,000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Prism Test: For each type of construction provided, according to ASTM C1314 at [7 days and at]28 days.

3.12 REPAIRING, POINTING, AND CLEANING:

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

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

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL:

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

END OF SECTION 04 22 00

SECTION 05 05 19 – POST-INSTALLED ANCHORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This section includes post installed adhesive anchors, mechanical anchors and epoxy anchorage of rebar in hardened concrete.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

1. Concrete Reinforcement: SECTION 03 20 00
2. Concrete: SECTION 03 30 00
3. Division 22 Hangers and Supports Section.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
   1. International Building Code (IBC).
   2. American Concrete Institute (ACI):
      a. 318 – Building Code Requirements for Reinforced Concrete.
      b. 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete.
      c. 355.4 – Qualification of Post-Installed Adhesive Anchors in Concrete
   3. International Code Council Evaluation Service (ICC-ES)
      a. AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
      b. AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
      c. AC60 - Acceptance Criteria for Anchors in Unreinforced Masonry Elements
      d. AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
      e. AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
   4. International Association of Plumbing and Mechanical Officials (IAPMO)

1.05 SUBMITALS:

A. Submit as specified in DIVISION 1.
B. Include but not limited to, the following:
   1. Product specification data with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.
   2. Quality Assurance Submittals:
      a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
      b. Certificates:
         (1) ICC ES Evaluation Reports.
   3. Manufacturer's installation instructions.
   4. Installer Qualifications & Procedures: Submit installer qualifications as stated in Section 1.06.B. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.
C. Closeout Submittals: Submit the following:

1. Record Documents: Project record documents for installed materials in accordance with Division 1 Closeout Submittals Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Drilled-in anchors shall be installed by a contractor with at least three years of experience performing similar installations.
   2. All personnel installing adhesive anchors shall be ACI adhesive anchor certified.

B. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the contractor on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
   1. hole drilling procedure
   2. hole preparation & cleaning technique
   3. adhesive injection technique & dispenser training / maintenance
   4. rebar dowel preparation and installation
   5. proof loading/torqueing

C. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications:
   1. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.
   2. IAPMO UES Evaluation Report indicating conformance with current applicable acceptance criteria.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to job site in manufacturer's clearly labeled unopened packaging, complete with installation instructions.

B. Protect and handle materials in accordance with manufactures recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS:

2.01 MATERIALS

A. Fasteners and Anchors:
   1. Bolts and Studs: ASTM A307; ASTM A449 where "high strength" is indicated on the Drawings.
   2. Carbon and Alloy Steel Nuts: ASTM A563.
   3. Carbon Steel Washers: ASTM F436.
   4. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
   5. Wedge Anchors: ASTM A510; or ASTM A108.
   6. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
   7. Stainless Steel Nuts: ASTM F594.
   8. Zinc Plating: ASTM B633.
   9. Hot-Dip Galvanizing: ASTM A153.
   10. Reinforcing Dowels: ASTM A615

2.02 MECHANICAL ANCHORS

A. Mechanical anchors shall meet the qualification criteria of ACI 355.2, ICC-ES AC01 (masonry) or AC193 (concrete).

B. Use of mechanical anchors in permanently submerged conditions shall not be permitted.
C. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
D. Exterior Use: Unless otherwise indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
E. The type of anchors shall be as follows:
    1. Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. –
        a. Life safety applications (Including but not limited to handrail and direct tension hangers)
            (1) Simpson Strong Tie – Strong Bolt 2
            (2) Hilti Kwik Bolt TZ
            (3) Powers – Power-Stud SD2
        b. Low risk to life safety (small pipe stands, Unistrut, etc)
            (1) Simpson Strong Tie – Wedge All
            (2) Hilti Kwik Bolt 3
            (3) Powers – Power-Stud SD1
    2. Screw Anchors: screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.
        a. Hilti Kwik-HUS-EZ
        b. Simpson Titen HD
    3. Heavy Duty Undercut Anchors: Bearing type. Installed anchor shall have a minimum tension bearing area in the concrete, measured as the horizontal projection of the bearing surface, not less than two times the net tensile area of the anchor bolt. The installed anchor shall exhibit a form fit between the bearing elements and the undercut in the concrete. Type and size as indicated on Drawings.
        a. Simpson Strong Tie – Torq-Cut
        b. Hilti HDA Undercut Anchor
        c. Powers – Atomic+ Undercut
        d. Use only where specifically called for on drawings

2.03 ADHESIVE ANCHORS

A. Adhesive anchors shall meet the qualification criteria of ACI 355.4, ICC-ES A58 (masonry) or A308 (concrete).
B. Adhesive anchors shall not be installed in concrete less than 21 days of age.
C. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel threaded rods conforming to ASTM A36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
D. Exterior Use: Unless otherwise indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall

conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

E. Reinforcing dowels shall be A615 Grade 60.

F. The type of anchors shall be as follows:
   1. Epoxy Anchors – Life safety applications.
      a. Simpson Strong Tie – SET XP
      b. Hilti HIT-RE500 V3
      c. Hilti HIT-HY200
      d. Powers PE1000
   2. Adhesive Anchors: (Used for non-vibrating equipment anchorage and other non-life safety attachments)
      a. Simpson Strong Tie - AT
      b. Hilti HIT-HY200
      c. Powers – AC100+ Gold
   3. Epoxy Rebar Dowels:
      a. Simpson Strong Tie – SET
      b. Hilti HIT-RE500 V3
   4. Anchorage to Masonry, ICC-ES AC58 & AC60:
      a. Hilti HIT-HY270
         (1) Provide Hilti HIT-SC mesh sleeve when anchoring to hollow masonry.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Drilled-In Anchors:
   1. Drill holes with rotary impact hammer drills using carbide-tipped bits or hollow drill bit system. 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.
      a. Cored Holes: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
      b. 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. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
         (1) Notify the Engineer prior to abandoning and relocating anchor holes if reinforcing steel or other embedded items are encountered during drilling and the specified embedment depth has not been met.
      c. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   2. Perform anchor installation in accordance with manufacturer instructions.
   3. Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer

complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

4. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. 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.
5. Capsule Anchors: Perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors shall be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
6. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.02 REPAIR OF DEFECTIVE WORK

A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

3.03 FIELD QUALITY CONTROL

A. Mechanical anchor installation shall have periodic special inspection per IBC.
B. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tensions loads shall have continuous special inspection per IBC.
   1. All other adhesive anchors not described above shall have periodic special inspection per IBC.
C. Minimum anchor embedments, proof loads and torques shall be as shown on the Drawings.

END OF SECTION 05 05 19

SECTION 05 21 00 – STEEL JOIST FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. K-series steel joists.
   2. Joist accessories.

B. Related Requirements:
   1. DIVISION 04, Section "Unit Masonry" for installing bearing plates in unit masonry.
   2. DIVISION 05, Section "Metal Fabrications" for bearing plates.
   3. DIVISION 09, Section “Protective Coatings” for prime and paint of joists.

1.03 REFERENCE STANDARDS:

A. Comply with the provisions of the following codes, specifications, and standards, except as otherwise indicated.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. American Welding Society:
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

D. ASTM International:
   1. ASTM A36/A36M - Specification for Carbon Structural Steel.
   2. ASTM A123/A123M - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   5. ASTM A325 - Specification for Structural Bolts Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   6. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
   7. ASTM A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   8. ASTM B695- Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   9. ASTM E94 - Guide for Radiographic Examination.
   10. ASTM E164 - Practice for Ultrasonic Contact Examination of Weldment.
   11. ASTM E165 - Test Method for Liquid Penetrant Examination.
   12. ASTM E709 - Guide for Magnetic Particle Testing.
   13. ASTM F436 - Specification for Hardened Steel Washers.

E. California Department of Health Services:
   1. Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.

F. Occupational Safety and Health Administration:
   1. OSHA regulations, including, but not limited to, 29 CFR 1926 Subpart R - Steel Erection.

G. Research Council on Structural Connections:
   1. RCSC Specification for Structural Joints Using High-Strength Bolts.

H. SSPC - The Society for Protective Coatings:
   1. SSPC-Paint 15 - Paint Specification No. 15 - Steel Joist Shop Primer/Metal Building Primer.
   2. SSPC-SP 2 - Surface Preparation Specification No. 2 - Hand Tool Cleaning.
   3. SSPC-SP 3 - Surface Preparation Specification No. 3 - Power Tool Cleaning.

I. Steel Joist Institute:
   1. Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders. (Available in PDF at www.steeljoist.org).

1.04 DEFINITIONS:

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.05 SUBMITTALS:

A. Product Data: For each type of joist, accessory, and product.

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

C. Qualification Data: For manufacturer and professional engineer.

D. Two certified copies of all mill reports or laboratory reports covering chemical and physical properties of steel used if requested by Engineer.

E. Welding certificates if requested by Engineer.

F. Manufacturer certificates.

G. Mill Certificates: For each type of bolt.

H. Comprehensive engineering analysis of special joists sealed and signed by the qualified professional engineer responsible for its preparation.

1.06 QUALITY ASSURANCE:

A. Manufacturer Qualifications: A member of SJI certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications".
   1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M.

C. Inspection and Tests:
   1. Materials to be furnished shall be subject to inspection in the mill, shop, and field.
   2. Joists shall be inspected by the manufacturer before shipment to ensure compliance of materials and workmanship with the specifications.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.08 SEQUENCING:

A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
   1. Use ASD; data are given at service-load level.
   2. Design special joists to withstand design loads with live-load deflections no greater than the following:
      a. Total Loads: Vertical deflection of 1/240 of the span.
      b. Live Loads: Vertical deflection of 1/240 of the span.

B. All joists shall be fabricated from new materials.

C. Comply with all applicable OSHA regulations, including, but not limited to, 29 CFR 1926 Subpart R - Steel Erection.

2.02 K-SERIES STEEL JOISTS:

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
   1. Joist Type: K-series steel joists.

B. Provide holes in chord members for connecting and securing other construction to joists. Holes shall not be made or enlarged by burning.

C. Do not camber joists.

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.03 PRIMERS:

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15. Coordinate with Section 09 90 00.

2.04 JOIST ACCESSORIES:

A. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional bridging as necessary where net uplift is indicated, and additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

C. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated.

D. Carbon-Steel Bolts and Threaded Fasteners: ASTM A307, Grade A (ASTM F568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
   1. Finish: Plain, uncoated.

E. Welding Electrodes: Comply with AWS standards.

F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.05 CLEANING AND SHOP PAINTING:

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section, before construction loads are applied.

1. Before installation, splice joists delivered to Project Site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Install and connect bridging concurrently with joist erection, before construction loads are applied.

1. Bridging shall support the top chords against lateral movement and shall hold the steel joists in the plane indicated.
2. Anchor bridging to steel joists by welding or bolting. Welds for attachment of bridging shall not damage the joist members.
3. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

E. During the construction period, exercise care to avoid excessive concentrated loads. Distribute temporary loads so as not to exceed carrying capacity of steel joists. Do not apply loads to bridging.

F. Comply with all applicable OSHA regulations, including, but not limited to, 29 CFR 1926 Subpart R - Steel Erection.

3.03 FIELD QUALITY CONTROL:

A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to inspect field welds and to perform field tests and inspections and prepare test and inspection reports.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Perform additional testing to determine compliance of corrected Work with specified requirements.

3.04 PROTECTION:

A. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
   2. Apply a compatible primer of same type as primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 05 31 00 – STEEL DECKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Roof deck.
B. Related Requirements:
   1. DIVISION 05, Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
   2. DIVISION 09 Painting Sections for repair painting of primed deck and finish painting of deck.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American Iron and Steel Institute:
   1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members, with Supplement 1, 2010.
C. American Welding Society:
   1. AWS D1.3 - Structural Welding Code - Sheet Steel.
D. ASTM International:
   1. ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   3. ASTM A1008/A1008M - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   4. ASTM C423 - Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   5. ASTM E119 - Test Methods for Fire Tests of Building Construction and Materials.
   6. ASTM E329 - Specification for Agencies Engaged in Construction Inspection and/or Testing.
E. Occupational Safety and Health Administration:
   1. OSHA regulations, including, but not limited to, 29 CFR 1926 Subpart R - Steel Erection.
F. Steel Deck Institute:
   1. SDI DDM03 - DDM03.
   2. SDI MOC2 - Manual of Construction with Steel Deck.
   3. SDI Publication No. 31 - Design Manual for Composite Decks, Form Decks, and Roof Decks.
G. Underwriters Laboratories Inc.:
   1. UL 209 - Cellular Metal Floor Raceways and Fittings (ANSI).
   2. UL 580 - Tests for Uplift Resistance of Roof Assemblies.
   3. Electrical Construction Equipment Directory.
   4. Fire Resistance Directory.

1.04 SUBMITTALS:

A. Product Data: For each type of deck, accessory, and product indicated.
   1. Include a signed and sealed statement by a licensed professional engineer of the lateral diaphragm capacity of each type of deck based on SDI DDM03 or certified laboratory tests of shear capacity for the deck and fastening system provided. The stated lateral diaphragm capacity shall not exceed the value indicated in SDI DDM03.
   2. Include documentation of each roof construction assembly's uplift capacity in accordance with UL 580.

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

C. Two certified copies of all mill reports or laboratory reports covering chemical and physical properties of steel used if requested by Engineer.

D. Welding certificates.

E. Product Certificates: For each type of steel deck.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

G. Evaluation Reports: For steel deck.

H. Field quality-control reports.

1.05 QUALITY ASSURANCE:

A. Manufacturer Qualifications: A member of SDI.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI S100.

B. Comply with all applicable OSHA regulations, including, but not limited to, 29 CFR 1926 Subpart R - Steel Erection.

2.02 MANUFACTURERS:

A. Subject to compliance with requirements, provide products by one of the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company.
   2. Canam United States; Canam Group Inc.
   3. Nucor Corp.; Vulcraft Group.
   4. Verco Manufacturing Co.
   5. Engineer approved equal.

2.03 ROOF DECK:

A. General: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck" in SDI Publication No. 31.
B. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
   1. Color: Gray top surface with white underside.
C. Deck Profile: As indicated.
D. Profile Depth: As indicated.
E. Design Uncoated-Steel Thickness; Deck Unit: As indicated.
F. Span Condition: As indicated.
G. Side Laps: Overlapped or interlocking seam at Contractor's option.
H. Shear Capacity: Roof deck and attachments shall provide a minimum allowable diaphragm shear capacity indicated on Drawings] under wind and earthquake loads in accordance with AISI S100 and SDI DDM03.
I. Uplift Capacity: Roof construction assembly shall be capable of resisting wind uplift pressures indicated on Drawings when tested in accordance with UL 580.

2.04 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
F. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
G. Galvanizing Repair Paint: ASTM A780.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL:

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, SDI MOC2, manufacturer's written instructions, and requirements in this Section.
B. Install temporary shoring before placing deck panels if required to meet strength or deflection limitations during construction.
C. Locate deck bundles to prevent overloading of supporting members.
D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck. Cutting of deck shall be performed by sawing or nipping. Sharp edges shall be trimmed and ground smooth.
G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
I. Unless noted otherwise, power-actuated fasteners may be used in lieu of welding to fasten deck to supports. Locate fasteners and install according to deck and fastener manufacturers' written instructions to provide equal or greater shear and uplift capacity where welding is indicated.
J. Comply with all applicable OSHA regulations, including, but not limited to, 29 CFR 1926 Subpart R - Steel Erection.

3.03 ROOF DECK INSTALLATION:

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that are not less than 1-1/2 inches (38 mm) long, and as follows:
   1. Weld Diameter: 5/8 inch (16 mm), nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 12 inches unless otherwise indicated, and as follows:
   1. At overlaps, mechanically fasten with self-drilling, No. 10 (4.8-mm) diameter or larger, carbon-steel screws.
C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
   1. End Joints: Lapped 2 inches (51 mm) minimum.

3.04 FIELD QUALITY CONTROL:

A. Testing Agency: Contractor shall engage a qualified testing agency to perform tests and inspections.
B. Field welds will be subject to inspection.
C. Testing agency will report inspection results promptly and in writing to Contractor and Engineer.
D. Remove and replace work that does not comply with specified requirements.
E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 PROTECTION:

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This 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. Ledger angles.
   4. Metal ladders.
   5. Miscellaneous steel trim including steel edgings.
   6. Metal bollards.
   7. Abrasive metal nosings.
   8. 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 or built into unit masonry.

1.03 RELATED REQUIREMENTS:

A. 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.

B. Section 04 20 00 - Unit Masonry for installing loose lintels, anchor bolts, and other items built into unit masonry.

C. Section 09 90 00 – Protective Coatings for prime and paint of miscellaneous steel items.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Architectural Manufacturers Association
   1. AAMA 611: Voluntary Standards for Anodized Architectural Aluminum

C. American Institute of Steel Construction
   1. AISC 360: Specifications for Structural Steel Buildings (available at www.aisc.org)

D. American National Standards Institute
   1. ANSI A14.3: American National Standard for Ladders-Fixed-Safety Requirements

E. American Welding Society
   1. AWS D1.1/D1.1M: Structural Welding Code - Steel
   2. AWS D1.2/D1.2M: Structural Welding Code - Aluminum

F. ASTM International
   1. ASTM A 27/A 27M: Specification for Steel Castings, Carbon, for General Application
   2. ASTM A 36/A 36M: Specification for Carbon Structural Steel
   3. ASTM A 123/A 123M: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   4. ASTM A 153/A 153M: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

5. ASTM A 307: Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
6. ASTM A 325: Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
7. ASTM A 500/A 500M: Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
8. ASTM A 563: Specification for Carbon and Alloy Steel Nuts
9. ASTM A 653/A 653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
10. ASTM A 780/A 780M: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
11. ASTM A 786/A 786M: Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
12. ASTM A 1008/A 1008M: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High- Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
13. ASTM B 26/B 26M: Specification for Aluminum-Alloy Sand Castings
14. ASTM B 209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate
15. ASTM B 221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
16. ASTM B 632/B 632M: Specification for Aluminum-Alloy Rolled Tread Plate
17. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel
18. ASTM C 1107/C 1107M: Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
19. ASTM D 1187/D 1187M: Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
20. ASTM E 119: Test Methods for Fire Tests of Building Construction and Materials
21. ASTM E 488/E 488M: Test Methods for Strength of Anchors in Concrete and Masonry Elements
22. ASTM F 1554: Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
23. ASTM F 1941: Specification for Electrodeposited Coatings on Threaded Fasteners
24. ASTM F 2329: Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

G. Master Painters Institute
   1. MPI#20: Epoxy Zinc-Rich Primer
   2. MPI#79: Alkyd Anti-Corrosive Metal Primer
   3. MPI#107: Water Based Rust-Inhibitive Primer

H. Metal Framing Manufacturers Association
   1. MFMA-4: Metal Framing Standards Publication

I. SSPC: The Society for Protective Coatings
   1. SSPC-PA 1: Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel
   2. SSPC-Paint 20: Paint Specification No. 20: Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")
   3. SSPC-SP 3: Surface Preparation Specification No. 3: Power Tool Cleaning
   4. SSPC-SP 6/NACE No. 3: Joint Surface Preparation Standard SSPC-SP 6/NACE No. 3: Commercial Blast Cleaning

1.05 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.

1.06 SUBMITTALS:

A. Product Data: For the following:
   1. Nonslip aggregates and nonslip-aggregate surface finishes.
   2. Metal nosings and treads.
   3. Paint products.
   4. 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. Ledger angles.
   4. Metal ladders.
   5. Miscellaneous steel trim including steel edgings.
   6. Metal bollards.
   7. Abrasive metal.

C. Delegated-Design Submittal: Stairways and ramps, including analysis data signed and sealed by professional Engineer licensed in the jurisdiction where the project is located and who is responsible for their preparation.

D. Qualification Data: For professional Engineer.

E. Welding certificates.

F. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.07 QUALITY ASSURANCE:

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

1.08 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

2.01 METALS:

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

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: As indicated.
   2. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B, with G90 (Z275) coating; 0.064-inch (1.6-mm) nominal thickness.
F. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
G. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.
H. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
I. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.02 FASTENERS:

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941 (ASTM F1941M), 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.
   3. Provide stainless-steel fasteners for fastening nickel silver.
B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F593 (ASTM F738M); with hex nuts, ASTM F594 (ASTM F836M); and, where indicated, flat washers; Alloy Group 1 (A1).
D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.
F. Post-Installed Anchors: See Section 05 05 19.

2.03 MISCELLANEOUS MATERIALS:

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.04 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.
   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.

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 or built into masonry, 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.

2.05 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. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Prime miscellaneous framing and supports with zinc-rich primer.

2.06 LEDGER ANGLES:

A. Fabricate ledger angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in ledger angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. Galvanize ledger angles located in exterior walls.

2.07 METAL LADDERS:

A. General:
   1. Comply with ANSI A14.3, except for elevator pit ladders.

B. Steel Ladders:
   1. Siderails: Continuous, 3/8-by 2-1/2-inch steel flat bars, with eased edges.
   2. Rungs: 3/4-inch diameter steel bars.
   3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
   5. Support each ladder at top and bottom with welded or bolted steel brackets.
   6. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.08 MISCELLANEOUS STEEL TRIM:

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other Work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

2.09 METAL BOLLARDS:

A. Fabricate metal bollards from Schedule 40 steel pipe1/4-inch (6.4-mm) wall-thickness rectangular steel tubing.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch (6.4-mm) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

C. Prime bollards with zinc-rich primer.

2.10 LOOSE BEARING AND LEVELING PLATES:

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.11 LOOSE STEEL LINTELS:

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for

each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

2.12 STEEL WELD PLATES AND ANGLES:

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 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.

2.14 STEEL AND IRON FINISHES:

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A23M 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 not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning.":

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 09 96 00 - High-Performance Coatings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool 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.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL:

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 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.

3.03 INSTALLING NOSINGS, TREADS, AND THRESHOLDS:

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 07 92 00 - Joint Sealants to provide a watertight installation.

3.04 INSTALLING BEARING AND LEVELING PLATES:

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 ADJUSTING AND CLEANING:

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 Protective Coatings. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking, cants, and nailers.
   3. Plywood backing panels.

1.03 RELATED REQUIREMENTS:

1.04 REFERENCED STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Forest & Paper Association:
   1. WCD 1: Details for Conventional Wood Frame Construction (available in PDF at www.awc.org).

C. American Wood Protection Association:
   1. AWPA M4: Care of Preservative-Treated Wood Products.
   2. AWPA U1: Use Category System: User Specification for Treated Wood (The first 15 pages, which describe the various Use categories, are available in PDF at www.awpa.com).

D. ASTM International:
   1. A 153/A 153M: Specification for Zinc-Coating (Hot-Dip) of Iron and Steel Hardware.
   2. A 653/A 653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. A 666: Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
   4. B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   5. C 1289: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   6. D 2559: Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions.
   7. D 2898: Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
   8. D 3201/D 3201M: Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products.
   9. D 3498: Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.
   10. D 5456: Specification for Evaluation of Structural Composite Lumber Products.
   11. D 5664: Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber.
   12. D 6841 Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber.
   13. E 84: Test Method for Surface-Burning Characteristics of Building Materials.

14. F 593: Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
15. F 594: Specification for Stainless Steel Nuts.
16. F 1667: Specification for Driven Fasteners: Nails, Spikes, and Staples.

E. ICC Evaluation Service, LLC:
1. ICC-ES AC01: Expansion Anchors in Masonry Elements.
2. ICC-ES AC58: Adhesive Anchors in Masonry Elements.
3. ICC-ES AC70: Fasteners Power Driven into Concrete, Steel, and Masonry Elements.
4. ICC-ES AC193: Mechanical Anchors in Concrete Elements.
5. ICC-ES AC308: Post-installed Adhesive Anchors in Concrete Elements.

F. U.S. Department of Commerce, National Institute of Standards and Technology:
1. DOC PS 1: U.S. Product Standard for Construction and Industrial Plywood.
2. DOC PS 20: American Softwood Lumber Standard.

1.05 DEFINITIONS:

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.

C. OSB: Oriented strand board.

1.06 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 D5664.
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.

B. Material Certificates: Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
1. Evaluation Reports: For the following, from ICC-ES:
a. Wood-preservative-treated wood.
b. Fire-retardant-treated wood.
c. Power-driven fasteners.
d. Post-installed anchors.
e. Metal framing anchors.

1.07 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.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL:

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Dress lumber, S4S, unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER:

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground.
   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%. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated.

2.03 FIRE-RETARDANT-TREATED MATERIALS:

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19%. Kiln-dry plywood after treatment to maximum moisture content of 15%.

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. Concealed blocking.
   2. Framing for non-load-bearing partitions.

3. Framing for non-load-bearing exterior walls.
4. Roof construction.
5. Plywood backing panels.

2.04 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. Rooftop equipment bases and support curbs.
   4. Cants.
   5. Furring.
   6. Grounds.

B. Dimension Lumber Items: Standard, Stud, or No. 3 grade lumber of any species.

C. 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.

D. 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.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.05 PLYWOOD BACKING PANELS:

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch (19 mm) nominal thickness.

2.06 FASTENERS:

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate and as indicated in Section 05 05 19.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL:

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

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. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. ICC-ES evaluation report for fastener.

3.02 PROTECTION:

A. Protect rough carpentry from weather. If, despite protection, 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 00

SECTION 06 40 23 – INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes the following:
   1. Plastic-laminate cabinets.
   2. Solid-surfacing-material countertops.
   3. Closet and utility shelving.

1.03 RELATED REQUIREMENTS:

A. Division 06, Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

1.04 REFERENCE STANDARDS:

A. American National Standards Institute:
   1. ANSI A208.1-2009 - Particleboard.

B. American Wood Protection Association:
   1. AWPA N1-2006 - All Millwork Products - Preservative Treatment by Nonpressure Process.
   2. AWPA U1-2007 - Use Category System - User Specification for Treated Wood.

C. ASTM International:
   1. ASTM C834-05 - Specification for Latex Sealants.
   2. ASTM D570-98 (Reapproved 2005) - Test Method for Water Absorption of Plastics.
   3. ASTM D648-07 - Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
   4. ASTM D2898-08 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
   5. ASTM D5572-95 (Reapproved 2005) - Specification for Adhesives Used for Finger Joints in Nonstructural Lumber Products.
   6. ASTM E84-09 - Test Method for Surface-Burning Characteristics of Building Materials.

D. Builders Hardware Manufacturers Association:
   1. BHMA A156.9-2003 - Cabinet Hardware.
   2. BHMA A156.16-2008 - Auxiliary Hardware.

E. Hardwood Plywood & Veneer Association:
   1. HPVA HP-1-2004 - American National Standard for Hardwood and Decorative Plywood (ANSI).

F. National Electrical Manufacturers Association:
   1. NEMA LD 3-2005 - High Pressure Decorative Laminates (available in PDF at www.nema.org).

G. U.S. Department of Commerce, National Institute of Standards and Technology:
   1. DOC PS 1-1995 - Construction and Industrial Plywood (available in PDF at www.apawood.org and www.nist.gov).
   2. DOC PS 20-2005 - American Softwood Lumber Standard (available in PDF at www.alsc.org and www.nist.gov).

1.05 DEFINITIONS:

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.06 SUBMITTALS:

A. Product Data: For high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, cabinet hardware and accessories and finishing materials and processes.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets and other items installed in architectural woodwork.

C. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
   2. Solid-surfacing materials, 6 inches square.
   3. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
      b. Miter joints for standing trim.
   4. Exposed cabinet hardware and accessories, one unit for each type.

D. Qualification Data: For Installer & fabricator.

1.07 QUALITY ASSURANCE:

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers [and wood doors with face veneers that are sequence matched with woodwork] [and transparent-finished wood doors that are required to be of same species as woodwork].

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.09 PROJECT CONDITIONS:

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate

measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 COORDINATION:

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:
   1. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
   2. Softwood Plywood: DOC PS 1, Medium Density Overlay.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
   1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
      a. Formica Corporation.
      b. Wilsonart International; Div. of Premark International, Inc.
      c. Haworth.
      d. Architect approved equal.

D. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Corian by DuPont.
      b. Wilsonart International; Div. of Premark International, Inc.
      c. Architect approved equal.
   2. Type: Standard type, unless Special Purpose type is indicated.
   3. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.02 CABINET HARDWARE AND ACCESSORIES:

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08, Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal.
F. Drawer Slides: BHMA A156.9, B05091.
   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
   2. Trash Bin Slides: Grade 1HD-100; for trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide.
G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
   2. Satin Stainless Steel: BHMA 630.
H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
I. Concealed Dish Drying Rack: Above sink provide cabinet concealed dish drying rack.
   1. Product: TheDripDry.com, Type A Large

2.03 MISCELLANEOUS MATERIALS:
A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15% moisture content.
B. Adhesives, General: Adhesives shall not contain urea formaldehyde.
C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.04 FABRICATION, GENERAL:
A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom grade interior woodwork complying with referenced quality standard.
B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).
      a. Eased edges are not required where closet shelving abuts a finished wall face.
E. Complete fabrication, including assembly, finishing,] and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.05 PLASTIC-LAMINATE CABINETS:
A. Grade: Custom.
B. WI Construction Style: Style A, Frameless.
C. WI Construction Type: Type II, single-length sections to fit access openings.
D. WI Door and Drawer Front Style: Flush.
E. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS.

4. Edges: Grade HGS.

F. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
      a. Edges of Plastic-Laminate Shelves: PVC edge banding,0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
      b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
   2. Drawer Sides and Backs: Solid-hardwood lumber.
   3. Drawer Bottoms: Hardwood plywood.

G. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As selected by Architect from laminate manufacturer's full range in the following categories:
      a. Solid colors, gloss & matte finish.
      b. Wood grains, gloss & matte finish.

I. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.06 SOLID-SURFACING-MATERIAL COUNTERTOPS:

A. Grade: Custom.

B. Solid-Surfacing-Material Thickness: 1 inch.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
   1. As selected by Architect from manufacturer's full range.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Fabricate tops with shop-applied edges of materials and configuration indicated.
   2. Fabricate tops with shop-applied backsplashes.

E. Install integral sink bowls in countertops in shop.

F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.07 CLOSET SHELVING:

A. Grade: Custom.

B. Shelf Material: 3/4-inch (19-mm) solid lumber.

C. Cleats: 3/4-inch (19-mm) solid lumber.

D. Wood Species: Match species indicated for door to closet where shelving is located.

2.08 SHOP FINISHING:

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. Transparent Finish:
   1. Grade: Custom.
   2. AWI Finish System: Catalyzed vinyl.
   3. Sheen: Flat, 15-30 gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION:

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Calk space between backsplash and wall with sealant specified in Division 07, Section "Joint Sealants."

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 ADJUSTING AND CLEANING:

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 23

SECTION 07 21 00 – THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Extruded polystyrene foam-plastic board.
   2. Molded polystyrene foam-plastic board.
   3. Polyisocyanurate foam-plastic board.
   4. Glass-fiber blanket.
   5. Glass-fiber board.
   6. Mineral-wool blanket.
   7. Mineral-wool board.
   8. Loose-fill insulation.
   9. Spray-applied cellulosic insulation.

1.03 RELATED REQUIREMENTS:

A. Section 07 21 19 - Foamed-in-Place Insulation for spray-applied polyurethane foam insulation.
B. Section 07 53 23 - Ethylene-Propylene-Diene-Monomer (EPDM) Roofing for insulation specified as part of roofing construction.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International:
   1. ASTM C553: Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   2. ASTM C578: Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   3. ASTM C764: Specification for Mineral Fiber Loose-Fill Thermal Insulation.
   4. ASTM C920: Specification for Elastomeric Joint Sealants.
   5. ASTM C1015: Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation.
   6. ASTM C1029: Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
   7. ASTM C1149: Specification for Self-Supported Spray Applied Cellulosic Thermal Insulation.
   8. ASTM C1158: Practice for Installation and Use of Radiant Barrier Systems (RBS) in Building Construction.
   9. ASTM C1289: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   10. ASTM C1313: Specification for Sheet Radiant Barriers for Building Construction Applications.
   11. ASTM C1320: Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

12. ASTM C1321: Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction.
13. ASTM C1371: Test Method for Determination of Emittance of Materials near Room Temperature Using Portable Emissometers.
14. ASTM D4397: Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
15. ASTM D5116: Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
16. ASTM E84: Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E136: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750ºC.

C. NFPA:
1. NFPA 285: Method of Test for the Evaluation of Fire Propagation Characteristics of Exterior, Nonload-Bearing Wall Assemblies Containing Combustible Components.

1.05 SUBMITTALS:
A. Product Data: For each type of product.
B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
C. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.06 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.

PART 2 - PRODUCTS

2.01 MOLDED POLYSTYRENE FOAM-PLASTIC BOARD:
A. Molded Polystyrene Board, Type II: ASTM C578, Type II, 15-psi (104-kPa) minimum compressive strength.
1. Use for insulation of foundation walls and below slabs on grade as indicated on Drawings.

2.02 MINERAL-WOOL BLANKETS:
A. Mineral-Wool Blanket, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.
1. Use for insulation of interior gyp board partition walls.

2.03 SPRAY-APPLIED CELLULOSIC INSULATION:
A. Use on interior side of exterior CMU walls. See Section 07 21 19.

2.04 INSULATION FASTENERS:

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
   1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
      a. Below grade insulation

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.05 ACCESSORIES:

A. 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

3.01 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.

3.02 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.

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.

3.03 INSTALLATION OF SLAB INSULATION:

A. On vertical slab edge and 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 36 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 30 inches in from exterior walls.

3.04 INSTALLATION OF FOUNDATION WALL INSULATION:

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.05 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION:

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3 inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings and seal each continuous area of insulation to ensure airtight installation.
      a. Interior Walls: Set units with facing placed toward areas of high humidity.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.06 INSTALLATION OF REFLECTIVE INSULATION:

A. Install sheet reflective insulation according to ASTM C727.

B. Install sheet radiant barriers according to ASTM C1744.

C. Install interior radiation control coating system according to ASTM C1321.

3.07 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 19 - FOAMED-IN-PLACE INSULATION & AIR BARRIER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Closed-cell spray polyurethane foam.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International:
   1. ASTM C1029: Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
   2. ASTM E84: Test Method for Surface Burning Characteristics of Building Materials.
C. NFPA:
   1. NFPA 285: Method of Test for the Evaluation of Fire Propagation Characteristics of Exterior, Nonload-Bearing Wall Assemblies Containing Combustible Components.

1.04 SUBMITTALS:

A. Product Data: For each type of product.
B. Qualification Data: For Installer.
C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
D. Evaluation Reports: For spray-applied polyurethane foam-plastic insulation, from ICC-ES.

1.05 QUALITY ASSURANCE:

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

A. System Performance: Substantiate that air barrier material used in a system assembly, will have an air permeance not to exceed 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested in accordance with ASTM E 2357.
B. Wall Assembly:
   1. Exterior wall assembly shall comply with NFPA 285.
   2. The wall must have a potential heat of 1961 BTU/ft^2 or less (per inch of thickness) when tested in accordance with NFPA 259.
   3. Fire Resistant Assemblies: If a fire- resistance rating is required for the wall assembly, then the wall must be tested in accordance with ASTM E 119 or UL 263 or have substantiation in the form of an Engineering Judgment based on results from tested assemblies.
C. Connections to adjacent materials and assemblies: Provide connections to prevent air leakage at the following locations:
   1. Foundation and walls, including penetrations, ties and anchors.
   2. Walls and building fenestration e.g. doors and windows.

3. Dissimilar wall assemblies and fixed openings within those assemblies.
4. Wall and roof connections.
5. Floors over unconditioned space.
6. Walls, floor and roof across construction, control and expansion joints.
7. Utility, pipe, and duct penetrations.
8. Leakage pathways in the building envelope.

2.02 CLOSED-CELL SPRAY POLYURETHANE FOAM:

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 2.0 lb./ft.^{3} and minimum aged R-value at 1 inch thickness of 6.7ºF by hr. by ft.^{2}/Btu at 75ºF.
   1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 350 or less.
   2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   3. Compressive Strength: 26psi minimum, ASTM D1621.
   4. Tensile Strength: 62.4psi minimum, ASTM D1623, Type C.
   5. Water Vapor Transmission: 1.39 perm-inch thick, ASTM E96.
   6. Fungi Resistance: “Pass” when tested in accordance with ASTM C1338.
   7. Air Permeance: Less than 0.04 cfm/ft^2 of surface area at 1.57lbf/ft^2 when tested in accordance with ASTM E2178.
B. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Walltite Eco® v.2 – BASF Corporation.
   2. Architect approved equal.

2.03 AUXILIARY MATERIALS

A. Sealant at Transitions in Substrate and Connections to Adjacent Elements: One-component, high-performance, very low-modulus, high-movement, non-sag, fast-curing, hybrid sealant, "MasterSeal ® NP 150™" (BASF Construction Systems); or approved substitution.
B. Transition Membrane: For use between spray polyurethane foam air barrier and roofing and other adjacent materials, and for use to flash around building fenestration, wall penetrations, and similar conditions, in accordance with local building codes.
   1. General: Comply with both general recommendations for air barriers and with air barrier material manufacturer’s recommendations.
   2. "MasterSeal AWB®660-I" fluid-applied air/water-resistive barrier membrane including:
      a. Sheathing Joint Fabric: Air barrier manufacturer's reinforced, nonwoven, polyester fabric and preformed corners.
         (1) Provide "Quick Corner™ 6", premanufactured corner reinforcement for use with sheathing joint fabric specified.
      b. Transition Membrane: "TF MEMBRANE" polyester-faced, 30-mil thick, self-sealing, rubberized asphalt membrane.
      c. Flashing Primer: "WS FLASHING PRIMER" water-based primer.
C. Counter flashing for Masonry Through-Wall Flashing: "MasterSeal®-TWF"; or approved substitution.
D. Foam Stop Angle: Metal or plastic angle used for foam stop.
   1. Plastic: Extruded thermoplastic angle, 60 mils thick, "Jam-Ex" (EXO-TEC Manufacturing, Inc.); or approved substitution.

E. Primers: Air barrier manufacturer's recommended primers to enhance foam adhesion to certain substrates, including penetrating water-based epoxy primer/sealer, "FE Coat 1601", or elastomeric acrylic primer, "Spraycoat 1800".
F. Portable SPF Application Units: “Kit” foam containers with closed cell SPF, Class 1, nominal 2 lb per cubic foot density, for incidental use; one of the following:
   1. "Touch n’ Seal" (Convenience Products).
   2. "Versi-Foam" (RHH Foam Systems, Inc.).
G. One-Component Foams (OCF): Air barrier manufacturer's suggested open cell, one component product for use around windows and doors; one of the following:
   1. "Touch n’ Seal" (Convenience Products).
   2. "Versi-Tite Window & Door Foam Sealant" (RHH Foam Systems, Inc.).

PART 3 - EXECUTION

3.01 PREPARATION:
A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.02 INSTALLATION:
A. Comply with insulation manufacturer's written instructions applicable to products and applications.
B. Spray insulation to envelop entire area to be insulated and fill voids.
C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.03 PROTECTION:
A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 21 19

SECTION 07 53 23 – ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
   2. Vapor retarder.
   3. Roof insulation.

1.03 RELATED REQUIREMENTS:

A. Section 06 10 00 - Rough Carpentry for wood nailers, curbs, and blocking.
B. Section 07 62 00 - Sheet Metal Flashing and Trim for metal roof flashings and counterflashings.
C. Section 07 92 00 - Joint Sealants for joint sealants, joint fillers, and joint preparation.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International:
   1. ASTM C140: Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   2. ASTM C578: Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   3. ASTM C1289: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   4. ASTM D41/D41M: Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
   5. ASTM D312: Specification for Asphalt Used in Roofing.
   6. ASTM D1079: Terminology Relating to Roofing and Waterproofing.
   7. ASTM D1970: Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   8. ASTM D2178: Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
   9. ASTM D3468: Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing.
   10. ASTM D3746: Test Method for Impact Resistance of Bituminous Roofing Systems.
   11. ASTM D4263: Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
   12. ASTM D4272: Test Method for Total Energy Impact of Plastic Films by Dart Drop.
   13. ASTM D4397: Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
   14. ASTM D4637: Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
   15. ASTM D5957: Guide for Flood Testing Horizontal Waterproofing Installations.
   16. ASTM D6083: Specification for Liquid Applied Acrylic Coating Used in Roofing.
   17. ASTM D6152: Specification for SEBS-Modified Mopping Asphalt Used in Roofing.
   18. ASTM E108: Test Methods for Fire Tests of Roof Coverings.
   19. ASTM E1980: Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

20. ASTM G152: Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.
21. ASTM G154: Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
22. ASTM G155: Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

C. Cool Roof Rating Council:
1. CRRC-1: Product Rating Program.

D. National Roofing Contractors Association:
1. The NRCA Roofing and Waterproofing Manual.

E. Single Ply Roofing Industry:
1. SPRI RP-4: Wind Design Standard for Ballasted Single-Ply Roofing Systems (ANSI).

F. Underwriters Laboratories Inc.:
1. UL 790: Test Methods for Fire Tests of Roof Coverings.

G. U.S. Department of Commerce, National Institute of Standards and Technology:
1. DOC PS 2: Performance Standard for Wood-Based Structural-Use Panels.

H. U.S. Department of Energy:
1. DOE ENERGY STAR Roof Products Qualified Product List.

1.05 DEFINITIONS:

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to Work of this Section.

1.06 PREINSTALLATION MEETINGS:

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project Site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.07 SUBMITTALS:

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing and fastening spacings and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:
1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

D. Qualification Data: For Installer and manufacturer.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
1. Submit evidence of complying with performance requirements.

F. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

G. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

H. Sample Warranties: For manufacturer's special warranties.

I. Maintenance Data: For roofing system to include in maintenance manuals.

1.08 QUALITY ASSURANCE:

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.09 DELIVERY, STORAGE, AND HANDLING:

A. Deliver roofing materials to Project Site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS:

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY:

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, cover boards, substrate board, roofing accessories and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.02 PERFORMANCE REQUIREMENTS:

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D3746 or ASTM D4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
   1. Corner Uplift Pressure: 77.0lbf./ft.^{2}.
   2. Perimeter Uplift Pressure: 58lbf./ft.^{2}.
   3. Field-of-Roof Uplift Pressure: 44lbf./ft.^{2}.

D. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.03 EPDM ROOFING:

A. EPDM: ASTM D4637, Type I, nonreinforced, uniform, flexible EPDM sheet.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Firestone Building Products.
      b. Johns Manville.
      c. Versico Incorporated.
      d. Architect approved equal.
   2. Thickness: 60 mils nominal.
   3. Exposed Face Color: White on black.

2.04 AUXILIARY ROOFING MATERIALS:

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil thick EPDM, partially cured or cured, according to application.

C. Bonding Adhesive: Manufacturer's standard.
D. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
E. Seaming Material: Single-component, butyl splicing adhesive and splice cleaner.
F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
H. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
I. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
    1. Provide white flashing accessories for white EPDM membrane roofing.

2.05 SUBSTRATE BOARDS:

A. Use as first layer of roofing system above metal roof deck.
B. Substrate Board: ASTM C728, perlite board, 3/4 inch thick, seal coated.
C. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate panel to roof deck.

2.06 VAPOR RETARDER:

A. Glass-Fiber Felts: ASTM D2178, Type IV, asphalt impregnated.

2.07 ROOF INSULATION:

A. General: Preformed roof insulation boards manufactured or approved by EPDM roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
B. Install in thickness required to meet R-value indicated on the Drawings.
C. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Carlisle SynTec Incorporated.
        b. Firestone Building Products.
        c. Insulfoam LLC; a Carlisle company.
        d. Johns Manville.
D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.
E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.08 INSULATION ACCESSORIES:

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Cover Board: DOC PS 2, Exposure 1, oriented strand board, 7/16 inch thick.

2.09 ASPHALT MATERIALS:

A. Roofing Asphalt: ASTM D312, Type III or Type IV.

B. Asphalt Primer: ASTM D41/D41M.

2.10 WALKWAYS:

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 - Steel Decking.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 ROOFING INSTALLATION, GENERAL:

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.04 SUBSTRATE BOARD INSTALLATION:

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.05 VAPOR-RETARDER INSTALLATION:

A. Built-Up Vapor Retarder: Install two glass-fiber felt plies lapping each felt 19 inches (483 mm) over preceding felt. Embed each felt in a solid mopping of hot roofing asphalt. Glaze coat completed surface with hot roofing asphalt. Apply hot roofing asphalt within ±25ºF (14ºC) of equiviscous temperature.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.06 INSULATION INSTALLATION:

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
   2. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together [and fasten to roof deck].
   1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.07 ADHERED MEMBRANE ROOFING INSTALLATION:

A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer and allow to partially dry before installing roofing. Do not apply to splice area of roofing.
E. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roofing.
F. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeters.
G. Apply roofing with side laps shingled with slope of roof deck where possible.
H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing terminations.
    1. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
I. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.
J. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

3.08 BASE FLASHING INSTALLATION:

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.09 WALKWAY INSTALLATION:

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL:

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
    1. Notify Engineer or Owner 48 hours in advance of date and time of inspection.
B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING:

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for

deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 53 23

SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Formed roof-drainage sheet metal fabrications.
   2. Formed low-slope roof sheet metal fabrications.
   3. Formed equipment support flashing.

1.03 RELATED REQUIREMENTS:

A. Section 04 22 00 – Concrete Unit Masonry for through-wall flashing and other integral masonry flashings specified as part of Masonry work.
B. Section 06 10 00 - Rough Carpentry for wood nailers, curbs, and blocking.
C. Section 07 53 23 – EPDM Roofing for materials and installation of sheet metal flashing and trim integral with roofing.
D. Section 07 72 36 - Roof Accessories for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
E. Section 07 95 00 - Expansion Control for manufactured sheet metal expansion-joint covers.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum
   2. AAMA 620 - Voluntary Specification High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates
   3. AAMA 621 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
C. ASTM International:
   1. ASTM A 153/A 153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. ASTM A 240/A 240M - Specification for Chromium and Chromium-Nickel Stainless-Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
   3. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   4. ASTM A 666 - Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar
   5. ASTM A 755/A 755M - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
   6. ASTM A 792/A 792M - Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
   7. ASTM B 32 - Specification for Solder Metal
   8. ASTM B 69 - Specification for Rolled Zinc.

9. ASTM B 101 - Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
10. ASTM B 209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate
11. ASTM B 370 - Specification for Copper Sheet and Strip for Building Construction
12. ASTM B 506 - Specification for Copper-Clad Stainless Steel Sheet and Strip for Building Construction
13. ASTM B 882 - Specification for Pre-Patinated Copper for Architectural Applications
14. ASTM C 920 - Specification for Elastomeric Joint Sealants
15. ASTM C 1311 - Specification for Solvent Release Sealants
16. ASTM D 226/D 226M - Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
17. ASTM D 1187 - Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal
18. ASTM D 1970 - Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
19. ASTM D 2244 - Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates
20. ASTM D 4214 - Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
21. ASTM D 4586 - Specification for Asphalt Roof Cement, Asbestos-Free
22. ASTM F 2329 - Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

D. Copper Development Association Inc.:
   1. Copper in Architecture Handbook.
E. Metal Construction Association:
   1. Guide Specification for Residential Metal Roofing.
F. National Association of Architectural Metal Manufacturers (NAAMM):
   1. Metal Finishes Manual for Architectural and Metal Products.
G. National Roofing Contractors Association:
   1. The NRCA Roofing Manual. Four volumes; various dates.
H. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   1. Architectural Sheet Metal Manual.
I. Single Ply Roofing Industry:
   1. SPRI ES-1: Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems (ANSI and FM4435)

1.05 COORDINATION:

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.06 SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
B. Shop Drawings: For sheet metal flashing and trim.
   1. Include plans, elevations, sections, and attachment details.

2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashing as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

C. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

D. Qualification Data: For fabricator.
E. Sample Warranty: For special warranty.
F. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.07 QUALITY ASSURANCE:
A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.08 DELIVERY, STORAGE, AND HANDLING:
A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.09 WARRANTY:
A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. 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 D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120ºF (67ºC), ambient; 180ºF (100ºC), material surfaces.

2.02 SHEET METALS:

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Color Anodic Finish Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   a. Color: Dark bronze.

C. Zinc Sheet: 99.995% electrolytic high-grade zinc with alloy additives of copper (0.08 to 0.20%), titanium (0.07 to 0.12%), and aluminum (0.015%); with manufacturer's standard factory-applied, flexible, protective back coating.

1. Finish: Preweathered black.

2.03 MISCELLANEOUS MATERIALS:

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
   b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

C. Sealant Tape: Pressure-sensitive, 100% solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch-wide and 1/8 inch thick.

D. Elastomeric Sealant: Sealant of type, grade, class, and use classifications recommended by sheet metal manufacturer to seal joints in sheet metal flashing and trim and remain watertight.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D1187.

G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.04 FABRICATION, GENERAL:

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
1. Fabricate as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

G. Do not use graphite pencils to mark metal surfaces.

2.05 ROOF-DRAINAGE SHEET METAL FABRICATIONS:

A. Downspouts: Fabricate rectangular open-face downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.
1. Fabricate from the following materials:

a. Aluminum: 0.024 inch thick.

B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

2.06 LOW-SLOPE ROOF SHEET METAL FABRICATIONS:

A. Copings: Fabricate in minimum 96-inch long, but not exceeding 12-foot long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners fasten and seal watertight. Shop fabricate interior and exterior corners.
1. Fabricate from the Following Materials:
a. Aluminum: 0.050 inch thick.

B. Roof-Penetration Flashing: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.07 MISCELLANEOUS SHEET METAL FABRICATIONS:

A. Equipment Support Flashing: Fabricate from the following materials:
1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 UNDERLAYMENT INSTALLATION:

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.03 INSTALLATION, GENERAL:

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
   2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
   5. Torch cutting of sheet metal flashing and trim is not permitted.
   6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
   2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70ºF (4 and 21ºC), set joint members for 50% movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40ºF (4ºC).
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 - Joint Sealants.

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.04 ROOF-DRAINAGE SYSTEM INSTALLATION:

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Downspouts: Join sections with 1-1/2-inch telescoping joints.
   1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
   2. Provide elbows at base of downspout to direct water away from building.

C. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
   2. Loosely lock front edge of scupper with conductor head.
   3. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.05 ROOF FLASHING INSTALLATION:

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
   1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant, interlocking folded seam or blind rivets and sealant or anchor and washer at 36-inch centers unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.06 MISCELLANEOUS FLASHING INSTALLATION:

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.07 ERECTION TOLERANCES:

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.08 CLEANING AND PROTECTION:

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 72 36 – ROOF SCUTTLES

PART 1 - GENERAL

1.01 SUMMARY:
A. This Section includes roof scuttle(s) , related accessories, and ladder safety post device.

1.02 RELATED REQUIREMENTS:
A. Section 06 10 00 - Rough Carpentry.
B. Section 07 62 00 - Flashing and Sheet Metal.
C. Section 07 53 23 – EPDM Roofing System.

1.03 REFERENCE STANDARDS:
A. Applicable Standards:
1. Factory Mutual (FM).
2. Underwriters Laboratories (UL).
3. American Society of Testing and Materials (ASTM).

1.04 SUBMITTALS:
A. Submit as specified in Division 01.
B. Include, but not limited to, the following:
1. Product data and Specifications, rough-in diagram, details, fabrication and erection details, and Drawings.
2. Coordination drawings for items interfacing with units. Indicate dimensions of items and locations of items provided under this Section, together with relationships and method of attachment to adjacent construction.
a. Operation and maintenance data.

1.05 DELIVERY, STORAGE, AND HANDLING:
A. Handle and store units to prevent racking, warping, or other damage.

1.06 GUARANTEE:
A. Roof scuttles shall be guaranteed by the manufacturer for proper operation and against defects in workmanship and materials for 5 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:
A. Babcock-Davis Hatchways, Inc.
B. The Bilco Company.
C. Milcor, Inc.
D. Nystrom Products Company.

2.02 ROOF SCUTTLE(S):
A. Prefabricated unit, single-leaf, complete with curbs, mounting flanges, insulation, weather seal, gaskets, hardware and accessories, and integral cap flashing. Weld corner joints for weathertightness. Units shall be designed for 40-psf external loading and 20-psf internal loading pressure. Fabricate for ladder access.
B. Metal: Aluminum mill-finish cover and curb. Metal gages for curb and cover shall be as required by size of unit.

C. Insulation: Not less than 3-inch thickness in curb and in hatch door; provide with cover liner.
D. Well Liner: Sheet metal same as metal for unit.
E. Hardware: Hinges, automatic self-lifting devices, hold-open device, latch, interior padlock hasp and vinyl-grip operating handle, and exterior operating handle. All hardware shall be zinc- or cadmium-plated.
F. Fasteners: Same metal as metal being fastened or other noncorrosive metal as recommended by scuttle manufacturer. Match finish of exposed fasteners with finish of material being fastened.
G. Size(s): As indicated with 12-inch curb. Where roof slope exceeds 1/4 inch per foot, fabricate curbs with height tapered to match slope and to result in level installation of top of unit.

2.03 SAFETY POST DEVICE:

A. Ladder extension device of high-strength steel with tubular section that locks automatically when fully extended.
B. Upward and downward movement controlled by spring-balancing mechanism.
C. Hot-dip galvanized finish.
D. Provide device with components and fasteners for securing to type of ladder rungs indicated.
E. Manufacturer: Bilco Co. - LadderUp Safety Post and BilGuard® 2.0 Safety Railing.

PART 3 - EXECUTION

3.01 INSTALLATION: ROOF SCUTTLES:

A. Coordinate installation with roof deck construction, roof insulation, and roofing system to ensure that each element of the Work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses, as well as inward and outward loading pressures.
B. Separate metal surfaces from dissimilar metals, wood, and cementitious substrates as required to prevent corrosive action. Separate with a thick coating of bituminous compound or other separation as recommended by the roof unit manufacturer.
C. Bed flanges in mastic or compound which is compatible with roofing and flashing to form a seal.

3.02 INSTALLATION: SAFETY POST DEVICE:

A. Install device on rungs at top of fixed ladder in scuttles and heat-smoke vents to provide for safe assistance in getting in and out of unit.
B. Install device securely to rungs with components and fasteners so that devices operate properly and without interference of proper scuttle or vent operation.

3.03 FIELD QUALITY CONTROL, ADJUSTMENT, AND CLEANING:

A. Test and adjust units as required for proper operation. Lubricate joints and hardware.
B. Clean surfaces as required to prevent deterioration and uneven weathering.
C. Touch up any damaged coatings with coating equivalent to that used in fabrication. Prepare surfaces as required prior to touch-up.

END OF SECTION 07 72 36

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Silicone joint sealants.
   2. Urethane joint sealants.

1.03 REFERENCED STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. ASTM International:
   1. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
   2. ASTM C 920 - Specification for Elastomeric Joint Sealants.
   3. ASTM C 1021 - Practice for Laboratories Engaged in Testing of Building Sealants.
   4. ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
   5. ASTM C 1193 - Guide for Use of Joint Sealants.
   6. ASTM C 1247 - Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
   7. ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.
   8. ASTM C 1311 - Specification for Solvent Release Sealants.
   9. ASTM C 1330 - Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
   10. ASTM C 1521 - Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.

1.04 SUBMITTALS:

A. Product Data: For each joint-sealant product.

B. 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.

C. Qualification Data: For qualified testing agency.

D. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

E. Sample Warranties: For special warranties.

1.05 QUALITY ASSURANCE:

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.06 FIELD CONDITIONS:

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40ºF (5ºC).
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.

1.07 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.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

C. 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

2.01 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.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 SILICONE JOINT SEALANTS:

A. Silicone, S, NS, 25, NT: Single-component, nonsag, +25% and -25% movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. Sika Corporation.

B. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, +25% and -25% movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. Pecora Corporation.
      c. Sika Corporation; Joint Sealants.

2.03 URETHANE JOINT SEALANTS:

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, +25% and -25% movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, products by one of the following:
      a. BASF Corporation-Construction Systems.
      b. Pecora Corporation.
      c. Sika Corporation; Joint Sealants.

2.04 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, +25% and -25% movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. Sika Corporation.
   2. Use in the following locations:
      a. Sinks and plumbing fixtures where conditions of high humidity and temperature exist.

2.05 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.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Corporation-Construction Systems.
      b. Construction Foam Products; a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

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.

2.06 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

3.01 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.

3.02 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.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
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. Glazed surfaces of ceramic tile.

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.

3.03 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 C1193 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.
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 C1193 unless otherwise indicated.
   4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C1193.
      a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 FIELD QUALITY CONTROL:

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 5 tests for the first 1,000 feet of joint length for each kind of sealant and joint substrate.
      b. Perform one test for each 1,000 feet of joint length thereafter or one test per each floor per elevation.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.

c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 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.

3.06 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.

3.07 JOINT-SEALANT SCHEDULE:

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Construction joints in cast-in-place concrete.
   b. Control and expansion joints in unit masonry.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors and windows.
   e. Control and expansion joints in ceilings and other overhead surfaces.
   f. Joints at roof flashing materials.
   g. 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.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:
   a. Control joints on interior surfaces of exterior walls.
   b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.

c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, S, NS, 25, NT.
   a. Use acid cure only on non-metallic surfaces.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.
   c. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Interior standard steel doors and frames.
   2. Exterior standard steel doors and frames.

1.03 RELATED REQUIREMENTS:

A. Section 08 70 00 – Finish Hardware for door hardware for hollow-metal doors.
B. Section 08 80 00 – Glazing for glass in hollow-metal doors.

1.04 REFERENCED STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International:
   1. ASTM A 153/A 153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A 879/A 879M - Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
   4. ASTM A 1008/A 1008M - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   5. ASTM A 1011/A 1011M - Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   6. ASTM C 143/C 143M - Test Method for Slump of Hydraulic-Cement Concrete.
   7. ASTM C 476 - Specification for Grout for Masonry.
   8. ASTM C 665 - Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   9. ASTM C 1363 - Test Method for the Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
   10. ASTM E 136 - Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degree C.
C. Builders Hardware Manufacturers Association (BHMA):
   1. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames (ANSI)
D. National Fire Protection Association (NFPA):
   1. NFPA 80 - Fire Doors and Other Opening Protectives (ANSI).
   2. NFPA 252 - Fire Tests of Door Assemblies (ANSI).
   3. NFPA 257 - Fire Test for Window and Glass Block Assemblies (ANSI).
E. Steel Door Institute (SDI):
   1. SDI 111C - Recommended Louver Details for Standard Steel Doors
   2. SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames (ANSI).

3. SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors (ANSI).
4. SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames (ANSI).
5. SDI A250.8 - Specifications for Standard Steel Doors and Frames (ANSI).
6. SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames (ANSI).
7. SDI A250.11 - Recommended Erection Instructions for Steel Frames (ANSI).

F. Underwriters Laboratories Inc. (UL):
1. UL 9 - Fire Tests of Window Assemblies.
2. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
3. UL 1784 - Air Leakage Tests of Door Assemblies and Other Opening Protectives.

1.05 DEFINITIONS:

A. Minimum Thickness: Minimum thickness of base metal without coatings according to SDI A250.8.

1.06 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 requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.07 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 electrical raceway and preparation for electrified hardware, access control systems, and security systems.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

D. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Deliver hollow-metal doors and frames 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 doors and frames 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

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ceco Door; ASSA ABLOY.
   b. Curries Company; ASSA ABLOY.
   c. Fleming Door Products Ltd.; Assa Abloy Group Company.
   d. Republic Doors and Frames.
   e. Steelcraft; an Allegion brand.
   f. Architect approved equal.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.02 PERFORMANCE 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. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.

2.03 INTERIOR STANDARD STEEL DOORS AND FRAMES:

A. Construct interior hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: SDI A250.8, Level 1; SDI A250.4, Level C.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Edge Construction: Model 1, Full Flush.
      d. Edge Bevel: Provide manufacturer's standard beveled or square edges.
      e. Core: Manufacturer's standard.
      f. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.
   2. Frames:
      a. Materials: Metallic-coated, steel sheet, minimum thickness of 0.042 inch.
      b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
      c. Construction: Full profile welded.
   3. Exposed Finish: Prime.

2.04 EXTERIOR STANDARD STEEL 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; SDI A250.4, Level B.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches (44.5 mm.)
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 (ZF120) coating.
      d. Edge Construction: Model 1, Full Flush.
      e. Edge Bevel: Provide manufacturer's standard beveled or square edges
      f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
      g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
      h. Core: Manufacturer's standard.
      i. Fire-Rated Core: Manufacturer's standard core for fire-rated doors.
   2. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 (ZF120) coating.
      b. Construction: Full profile welded.
   3. Exposed Finish: Prime.

2.05 BORROWED LITES:

A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.053 inch.
B. Construction: Full profile welded.
C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.06 HOLLOW-METAL PANELS:

A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.07 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. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
   4. Post-installed 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.

2.08 MATERIALS:

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

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 C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.

H. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 08 80 00 - Glazing.

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.09 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.

C. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

D. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same or greater thickness metal as frames.

1. Sidelite 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 welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      (1) Two anchors per jamb up to 60 inches high.
      (2) Three anchors per jamb from 60 to 90 inches high.
   b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      (1) Three anchors per jamb up to 60 inches high.
      (2) Four anchors per jamb from 60 to 90 inches high.
   c. Compression Type: Not less than two anchors in each frame.
   d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches 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.

E. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

F. 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.

G. 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.
1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
3. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
4. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. 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.
6. Provide stops for installation 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.

2.10 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.

2.11 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 (0.4 mm) thick.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION:

A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    a. Install frames with removable stops located on secure side of opening.
    b. Install door silencers in frames before grouting.
    c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
2. At fire-rated openings, install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.
    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.

8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: ±1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: ±1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: ±1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: ±1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 08 80 00 - Glazing and with hollow-metal manufacturer's written instructions.

3.04 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.

END OF SECTION 08 11 13

SECTION 08 14 16 – WOOD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.03 RELATED REQUIREMENTS:

A. Section 08 11 13 – Hollow Metal Doors and Frames for metal frames.
B. Section 08 70 00 – Door Hardware.
C. Section 08 80 00 - Glazing for glass view panels in flush wood doors.

1.04 REFERENCED STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American National Standards Institute (ANSI):
   1. ANSI A208.1 - Particleboard.
C. Architectural Woodwork Institute (AWI) /Architectural Woodwork Manufacturers Association of Canada (AWMA)/Woodwork Institute (WI):
   1. Architectural Woodwork Standards.
D. Builders Hardware Manufacturers Association (BHMA):
   1. BHMA-156.115-W-2006: Hardware Preparation in Wood Doors with Wood or Steel Frames.
E. Door and Hardware Institute (DHI):
   1. DHI-WDHS-3-1996: Recommended Hardware Locations for Wood Flush Doors.
F. Forest Stewardship Council:
   1. FSC STD-01-001 - FSC Principles and Criteria for Forest Stewardship (available in PDF at www.fsc.org).
G. Underwriters Laboratories Inc. (UL):
   1. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
   2. UL 1784 - Air Leakage Tests of Door Assemblies and Other Opening Protectives.
H. Window & Door Manufacturers Association (WDMA):
   1. WDMA I.S.1-A - Architectural Wood Flush Doors.
   2. WDMA I.S.10 - Testing Cellulosic Composite Materials.
   3. WDMA T.M.-6 - Adhesive Durability.
   4. WDMA T.M.-10 - Screw Holding Capacity.

1.05 SUBMITTALS:

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.

3. Dimensions and locations of cutouts.
4. Undercuts.
5. Doors to be factory finished and finish requirements.

C. Samples for Initial Selection: For factory-finished doors.
D. Sample Warranty: For special warranty.
E. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.06 QUALITY ASSURANCE:

A. Manufacturer Qualifications: A qualified manufacturer that is a licensee of WI's Certified Compliance Program.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.08 FIELD CONDITIONS:

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.09 WARRANTY:

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Warping (bow, cup, or twist) more than 1/4 inch in a 42- by 84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Algoma Hardwoods, Inc. - Novodoor
2. Eggers Industries. – Master Flush-Particle.
3. Graham Wood Doors; an Assa Abloy Group company – Edge Glued GPC.
4. Haley Brothers, Inc. – APC.
5. Mohawk Doors; a Masonite company – Architectural Grade Bonded Particle.
6. Oshkosh Door Company Edge Glued GPC.
7. Architect approved equal.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.02 FLUSH WOOD DOORS, GENERAL:

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards WDMA I.S.1-A, "Architectural Wood Flush Doors."

B. Regional Materials: Flush wood doors shall be manufactured within 500 miles (800 km) of Project Site.
C. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
D. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde.

2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH:
A. Interior Solid-Core Doors:
   1. Grade: Custom (Grade A faces).
   2. Species: Red oak.
   3. Cut: Plain sliced (flat sliced).
   4. Match between Veneer Leaves: Book match.
   5. Assembly of Veneer Leaves on Door Faces: Running match.
   6. Pair and Set Match: Provide for doors hung in same opening.
   7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
   8. Transom Match: Continuous match.
   9. Exposed Vertical Edges: Same species as faces - Edge Type A.
   10. Core: Particleboard.
   11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.04 LIGHT FRAMES AND LOUVERS:
A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Flush rectangular beads.

2.05 FABRICATION:
A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 - Glazing.

2.06 FACTORY FINISHING:
A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.
C. Transparent Finish:
   1. Grade: Custom.
   2. Staining: As selected by Architect from manufacturer's full range.
   3. Effect: Open-grain finish.
   4. Sheen: Semigloss.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Hardware: For installation, see Section 08 71 00 - Door Hardware.
B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project Site.

3.03 ADJUSTING:

A. Operation: Rehang or replace doors that do not swing or operate freely.
B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 33 23 – OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Insulated service doors.

1.03 RELATED REQUIREMENTS:

A. Section 05 50 00 - Metal Fabrications for miscellaneous steel supports.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Architectural Manufacturers Association:
   1. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

C. American Society of Civil Engineers/Structural Engineering Institute:
   1. ASCE/SEI 7: Minimum Design Loads for Buildings and Other Structures.

D. ASTM International:
   1. ASTM A653/A653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A666: Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
   3. ASTM B209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. ASTM B221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   5. ASTM E84: Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM E283: Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
   7. ASTM E330: Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   8. ASTM E1996: Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.

E. Door and Access Systems Manufacturers Association:
   1. DASMA 105: Test Method for Thermal Transmittance and Air Infiltration of Garage Doors (ANSI).
   2. DASMA 108: Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance under Uniform Static Air Pressure Difference (ANSI).
   3. DASMA 115: Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance under Missile Impact and Cyclic Wind Pressure (ANSI).

F. International Code Council:
   1. International Energy Conservation Code.

G. National Association of Architectural Metal Manufacturers/National Ornamental & Miscellaneous Metals Association:
   1. Metal Finishes Manual for Architectural and Metal Products (AMP 500).
H. National Electrical Manufacturers Association:
   1. NEMA ICS 1: Industrial Control and Systems General Requirements.
   2. NEMA ICS 6: Industrial Control and Systems Enclosures.
I. NFPA:
   1. NFPA 70: National Electrical Code.
J. Underwriters Laboratories Inc.:
   1. UL 325: Door, Drapery, Gate, Louver, and Window Operators and Systems.
   2. UL 1784: Air Leakage Tests of Door Assemblies.

1.05 SUBMITTALS:

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   5. Show locations of controls, locking devices, and other accessories.
C. Qualification Data: For Installer.
D. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.06 QUALITY ASSURANCE:

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS, GENERAL:

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS:

A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: As indicated on Drawings.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
   3. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20 lbf./ft.^{2} wind load, acting inward and outward.

2.03 DOOR ASSEMBLY:

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Company, Themacore® Sectional Steel Door or comparable product by one of the following:
      a. ACME Rolling Doors.
      b. Alpine Overhead Doors, Inc.
      c. Raynor.
      d. Engineer approved equal.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.08 cfm/ft.² (0.406 L/s per m²) at 15 and 25 mph tested according to ASTM E283.

D. Curtain R-Value: 15 minimum.

E. Door Curtain Material: Galvanized steel.

F. Door Curtain Slats: Flat profile slats of [1-7/8-inch (48-mm)] [2-5/8-inch (67-mm)] [3-1/4-inch (83-mm)] <Insert dimension> center-to-center height.
   1. Vision Panels: Approximately 44 by 15-inch openings equally spaced and beginning 12 inches from end guides; in two adjacent rows of slats, with the bottom row at 5’ above the bottom of the door. Installed with insulated vision-panel glazing.
   2. Insulated-Slat Interior Facing: Metal.

G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

H. Locking Devices: Equip door with slide bolt for padlock.

I. Manual Door Operator: Chain-hoist operator.

J. Curtain Accessories: Equip door with weatherseals.

K. Door Finish:
   1. Factory Prime Finish: Manufacturer's standard color.

2.04 DOOR CURTAIN MATERIALS AND CONSTRUCTION:

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A653/A653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.
   2. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection rated glass as required for type of door; set in glazing channel secured to curtain slats.
   3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
   4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to

retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.05 LOCKING DEVICES:

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Chain Lock Keeper: Suitable for padlock.

2.06 CURTAIN ACCESSORIES:

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch (3-mm) thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch (3-mm) thick seals of flexible vinyl, rubber, or neoprene.

2.07 COUNTERBALANCING MECHANISM:

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 inch/ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.08 MANUAL DOOR OPERATORS:

A. General: Equip door with manual door operator by door manufacturer.

B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 30-lbf. force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.09 GENERAL FINISH REQUIREMENTS:

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" 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.

2.10 STEEL AND GALVANIZED-STEEL FINISHES:

A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.03 STARTUP SERVICE:

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING:

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.05 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23

SECTION 08 51 13 – ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes aluminum windows for exterior locations.

1.03 RELATED REQUIREMENTS:

A. Section 08 80 00 - Glazing

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Architectural Manufacturers Association:

1. AAMA 502: Voluntary Specification for Field Testing of Newly Installed Fenestration Products.
2. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
3. AAMA 901: Voluntary Specification for Rotary & Linear Operators in Window Applications.
4. AAMA 902: Voluntary Specification for Sash Balances.
5. AAMA 907: Voluntary Specification for Corrosion Resistant Coatings on Carbon-Steel Components.
6. AAMA 1503: Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
7. AAMA 2603: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
8. AAMA 2604: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
9. AAMA 2605: Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American Architectural Manufacturers Association/Window & Door Manufacturers:

1. AAMA/WDMA/CSA 101/I.S.2/A440: NAFS - North American Fenestration Standard/Specification for Windows, Doors, and Skylights.

D. ASTM International:

1. ASTM C1036: Specification for Flat Glass.
2. ASTM C1172: Specification for Laminated Architectural Flat Glass.
3. ASTM D3656/D3656M: Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
4. ASTM E90: Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
5. ASTM E405: Test Methods for Wear Testing Rotary Operators for Windows.
6. ASTM E413: Classification for Rating Sound Insulation.
7. ASTM E1332: Classification for Rating Outdoor-Indoor Sound Attenuation.
8. ASTM E1886: Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

9. ASTM E1996: Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
10. ASTM E2112: Practice for Installation of Exterior Windows, Doors and Skylights.
11. ASTM E2190: Specification for Insulating Glass Unit Performance and Evaluation.

E. National Association of Architectural Metal Manufacturers:
1. Metal Finishes Manual.

F. National Fenestration Rating Council:
1. NFRC 100-: Procedure for Determining Fenestration Product U-Factors.
2. NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visual Transmittance at Normal Incidence.

G. Screen Manufacturers Association:
1. SMA 1004: Specifications for Aluminum Tubular Frame Screens for Windows (ANSI).
2. SMA 1201: Specifications for Insect Screens for Windows, Sliding Doors, and Swinging Doors.

1.05 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: 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 (50 by 100 mm) size.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

E. Qualification Data: For manufacturer and Installer.

F. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

G. Sample Warranties: For manufacturer's warranties.

1.06 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.

1.07 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:

a. Window: Five years from date of Substantial Completion.
b. Glazing Units: Five years from date of Substantial Completion.
c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. EFCO Corporation; a Pella company.
   2. Kawneer North America; an Alcoa company.
   3. Architect approved equal.
B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.02 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.
B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: CW.
   2. Minimum Performance Grade: 30.
C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of:
   1. Fixed Windows – 0.36 Btu/ft.² by h by ºF (1.71 W/m² by K)
   2. Operable Windows – 0.43 Btu/ft.² by h by ºF (1.83 W/m² by K)
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 CRF of 45.
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: 120ºF (67ºC), ambient; 180ºF (100ºC) material surfaces.
G. Outside-Inside Transmission Class (OITC): Rated for not less than 26OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

2.03 ALUMINUM WINDOWS:

A. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Horizontal sliding.
   2. Fixed.
B. 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.
C. Glass: Comply with Section 088000 – Glazing.

D. 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 indicated by manufacturer's designations.
E. Horizontal-Sliding Window Hardware:
   1. Sill Cap/Track: Extruded-aluminum track with natural anodized finish, of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
   2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
   3. Roller Assemblies: Low-friction design.
F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.04 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 sliding 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 (1.1- by 1.4-mm) or 18 by 16 (1.0- by 1.1-mm) 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 D3656.
   1. Mesh Color: Manufacturer's standard.

2.05 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. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.
F. 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.

2.06 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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 ALUMINUM FINISHES:

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

1. Color: Dark bronze.

PART 3 - EXECUTION

3.01 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.

3.02 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 E2112.

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.

3.03 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Water-Resistance Testing:
   a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
   b. Allowable Water Infiltration: No water penetration.
3. Testing Extent: Two windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
4. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.04 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

SECTION 08 70 00 - FINISH HARDWARE

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes hardware for the proper installation, operation, and control of doors.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 08 11 13 – Hollow Metal Doors and Frames
B. Section 08 14 00 – Wood Doors.
C. Section 281000 - Electronic Access Control and Intrusion Detection.

1.03 REFERENCES:

A. Applicable Standards:
    1. American National Standards Institute (ANSI):
        a. A115 Series - Door and Frame Preparation.
        b. A156 Series - Hardware.
    2. Builders Hardware Manufacturers Association (BHMA):
        a. 1301 - Materials and Finishes.
    3. Door and Hardware Institute (DHI):
        a. Keying - Procedures, Systems and Nomenclature.
        b. Architectural Hardware Scheduling Sequence and Schedule Format.
        c. Abbreviations and Symbols.
        d. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames.
        e. Recommended Procedure for Processing Hardware Schedules and Templates.
        f. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames.
    4. Underwriters Laboratories (UL):
        a. Building Materials Directory.
        b. 305 - Panic Hardware.

1.04 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Includes, but not limited to, the following:
    1. Product data includes manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
    2. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
        a. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:
            (1) Type, style, function, size, and finish of each hardware item.
            (2) Name and manufacturer of each item.
            (3) Fastenings and other pertinent information.
            (4) Location of each hardware set cross referenced to indications on drawings both on floor plans and in door and frame schedule.
            (5) Explanation of all abbreviations, symbols, and codes contained in schedule.
            (6) Mounting locations for hardware.
            (7) Door and frame sizes and materials.

(8) Keying information.

b. Keying Schedule: Submit separate detailed schedule indicating clearly how the Engineer's final instructions on keying of locks has been fulfilled.

c. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Iron and steel products must be produced in the United States and certifications of such production must be provided to the Owner prior to shipment.

1.05 QUALITY ASSURANCE:

A. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Engineer and Contractor for consultation at reasonable times during the course of the Work.

1. Require supplier to meet with Engineer to finalize keying requirements and to obtain final instructions in writing.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Tag each item or package separately with identification related to final hardware schedule and include basic installation instructions with each item or package.

B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (Project Site).

E. Provide secure lock-up for door hardware delivered to the project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the work will not be delayed by hardware losses both before and after installation.

1.07 COORDINATION:

A. Coordinate hardware with other Work.

B. Furnish templates and other detail matter as required to each fabricator of doors and frames, and to other Work to be prepared for the installation of hardware.

C. Where Modifications to this Specification are required due to unanticipated conditions, make recommendations of alternative procedures to the Engineer for his consideration and approval.

1.08 MAINTENANCE:

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PRODUCTS:

A. Items of hardware are specified in Door Schedule, with reference to the listing given in this PART - PRODUCT REQUIREMENTS:.

2.02 PRODUCT REQUIREMENTS:

A. Hardware shall meet the respective applicable standards specified in PART 1, this Section.
B. Provide hardware complete with all fasteners, anchors, instructions, layout templates, and any specialized tools as required for satisfactory installation and adjustment.
C. Provide manufacturer's standard products meeting the design intent of this Specification, free of imperfections affecting appearance or serviceability.
D. Hardware is specified in PART 2 - HARDWARE SETS, this Section, by type and function category, each of which has been selected as that best meeting the application. Acceptable products are given for each category as follows:

2.03 HARDWARE SCHEDULE:

A. Refer to the Door Schedule and the Drawings to ascertain hands, and sizes.

HARDWARE SET: 01

FOR USE ON DOOR #(S):

101 103

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	98-L-17	626	VON
1	EA	RIM CYLINDER	20-022	626	SCH
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
1	EA	WEATHER RING	8310-801 (AT EXTERIOR ACTUATOR)	PLA	LCN
2	EA	ACTUATOR, FLUSH MOUNT	8310-853T X 8310-867F	630	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS444	626	IVE
1	EA	RAIN DRIP	142A	AL	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	8197AA	AA	ZER
1	EA	THRESHOLD	655A-223	A	ZER

ADA INGRESS/EGRESS BY ACTUATOR EACH SIDE WHEN EXIT DEVICE IS DOGGED.

HARDWARE SET: 02

FOR USE ON DOOR #(S):

201

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	OFFICE/ENTRY LOCK	L9050P 17A 09-544	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS444	626	IVE
1	EA	RAIN DRIP	142A	AL	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	8197AA	AA	ZER
1	EA	THRESHOLD	655A-223	A	ZER

HARDWARE SET: 03

FOR USE ON DOOR #(S):

116

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CORRIDOR LOCK	L9456P6 17A L583-363 L283-722	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A	AL	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	8197AA	AA	ZER
1	EA	THRESHOLD	655A-223	A	ZER

HARDWARE SET: 04

FOR USE ON DOOR #(S):

109 110

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70PD SPA	626	SCH
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 05

FOR USE ON DOOR #(S):

108

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 06

FOR USE ON DOOR #(S):

107 111 112

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53PD SPA	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 07

FOR USE ON DOOR #(S):

202

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	ND40S SPA	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 08

FOR USE ON DOOR #(S):

102 104

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURF. AUTO OPERATOR	4642 WMS	689	LCN
2	EA	ACTUATOR, FLUSH MOUNT	8310-853T X 8310-867F	630	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	GASKETING	8144SBK PSA	BK	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER

ADA INGRESS/EGRESS BY ACTUATOR EITHER SIDE AT ALL TIMES.

HARDWARE SET: 09

FOR USE ON DOOR #(S):

105 106

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 10

FOR USE ON DOOR #(S):

113 114 115

PROVIDE EACH BP DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	BYPASS DOOR KIT	100SD X SIZE REQ'D	AL	JOH

Mfr. = MANUFACTURER
SCH = Schlage
SCE = Schlage Electronics
LCN = LCN
IVE = Ives
ZER = Zero International
VON = Von Duprin
JOH = Johnson Hardware
Or engineer approved equal

2.04 KEYING:

A. Keying requirements shall be determined by consultation with the Owner.
B. Tag and identify keys.
C. Provide three keys for each lock or cylinder.
D. Key to existing master key system.
E. Provide construction master keys for all exterior doors.

2.05 MATERIALS AND FABRICATION:

A. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location.
   1. Manufacturer's identification will be permitted on rim of lock cylinders only.
B. Base Metals: Product hardware units of basic metal using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods except as otherwise specified.
C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated or specified.
D. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed screws to match hardware finish.
E. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use hex screw fasteners.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Check all frames and doors for proper hardware cutouts and reinforcements.
B. Except as specified otherwise, install articles of hardware after finishes have been completed on the substrate. Note all requirements for coordination with protective coating applications.
C. Install hardware at such a time in the Project schedule so as to minimize the possibility of damage from the activity of other trades prior to acceptance.
D. Check the installation directions of PART 1, paragraph 1.02 - Related Work Specified Elsewhere, this Section, before proceeding.

3.02 INSTALLATION:

A. Mount articles of hardware at locations and in the manner prescribed in the respective DHI standards specified in PART 1, this Section, unless otherwise specified.
B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the DIVISION 09 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. All field preparations, such as drilling, cutting, tapping, and countersinking shall be accurately executed to assure precise fitting and adjustment.
E. Use fasteners of correct size and type with anchoring devices as required by construction conditions, suited to the nature of the attachment substrate, and the duty performance required.
F. In the course of installation, avoid damage to hardware mechanisms, finishes, and surrounding surfaces; smearing of paints, sealants, and lubricants onto surfaces not intended to receive them; and the admission of foreign matter into chassis and cases of units and their associated preparations.
G. Seal weather-protection components attached to the exterior sides of doors and frames in place with clear silicone caulk in such a manner as to ensure a continuously filled seam throughout the joinery.
H. Cut and fit weatherstripping accurately so as to affect the greatest possible continuity of the contact element. Where hardware-compatible extrusions are specified "do not cut," adjust templating of soffit-mounted hardware to suit the extrusion thickness and mount all such items on the extrusions.
I. Protection plates shall be installed on visual centers of closed doors. Bottom edges of all such plates shall be flush with bottoms of doors or shall meet top edges of surface-applied door sweeps where they are specified.
J. At exterior doors, obtain satisfactory operation of the installation, then apply a thin layer of clear silicone caulk under hinge leaves, both door and frame. Remove excess caulk after torquing fasteners.
K. Adjust door closers immediately upon installation. Adjust in exact conformance with manufacturer's printed instructions. Back-check shall be advanced to reduce shock at dead stop. Latching speed shall be set to assure unassisted positive latching. Readjustment of closers may be required prior to acceptance as directed by the Engineer. Adjust hold open device so door closes with normal use. Hold open device to be engaged only when extra push to the door is applied.
L. Degrees of swing of doors are given for closers where exact dimensioning, of the installation to achieve the indicated angles, is required.

3.03 ADJUSTMENT AND CLEANING:

A. Check and adjust each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
    1. Where door hardware is installed more than one month prior to acceptance or occupancy return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
    2. Checking and adjustment shall be performed by a certified Architectural Hardware Consultant to ensure proper operation and function of each unit.
B. Lubricate units only as recommended by their manufacturers.
C. Remove excess sealants, lubricants, and any other foreign substances, and protect all installations from subsequent damage.
D. Clean units just prior to final acceptance, with only materials and procedures recommended by their manufacturers.
E. Maintain the sheets of instruction, layout templates, and any supplementary literature regarding hardware in a readable condition. Transmit to the Engineer all such matter together with all spare parts, specialized tools, and other accessories supplied with the hardware. Also, transmit

to the Engineer a copy of the approved hardware schedule. Notify the Engineer in writing that such transmittal has occurred.

F. Instruct Owner's maintenance personnel in the proper adjustment and maintenance of door hardware and finishes. Instructions shall be performed by a certified Architectural Hardware Consultant or a qualified representative of the manufacturer.

END OF SECTION 08 70 00

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Glass for windows, doors and interior borrowed lites.
   2. Glazing sealants and accessories.

1.03 RELATED REQUIREMENTS:

A. Section 08 11 13 – Hollow Metal Doors and Frames.
B. Section 08 14 16 – Flush Wood Doors.
C. Section 08 51 13 – Aluminum Windows.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American Society of Civil Engineers/Structural Engineering Institute:
   1. ASCE/SEI 7: Minimum Design Loads for Buildings and Other Structures.
C. ASTM International:
   1. ASTM C920: Specification for Elastomeric Joint Sealants.
   2. ASTM C1021: Practice for Laboratories Engaged in the Testing of Building Sealants.
   3. ASTM C1036: Specification for Flat Glass.
   4. ASTM C1048: Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
   5. ASTM C1087: Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
   6. ASTM C1281: Specification for Preformed Tape Sealants for Glazing Applications.
   7. ASTM C1330: Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
   8. ASTM E1300: Practice for Determining Load Resistance of Glass in Buildings.
   9. ASTM E2190: Specification for Insulating Glass Unit Performance and Evaluation.
D. Code of Federal Regulations:
   1. 16 CFR 1201: Safety Standard for Architectural Glazing Materials.
E. Glass Association of North America:
   1. Engineering Standards Manual.
   2. Glazing Manual.
   3. Laminated Glazing Reference Manual.
F. Insulating Glass Manufacturers Alliance:
   1. IGMA TB-3001: Guidelines for Sloped Glazing.
   2. SIGMA TM-3000: North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
G. International Code Council:
   1. International Building Code.
H. National Fenestration Rating Council:
   1. NFRC 100: Procedure for Determining Fenestration Product Thermal Properties (Currently Limited to U-Factors).

2. NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
3. NFRC 300: Procedures for Determining Solar Optical Properties of Simple Fenestration Products.

I. National Fire Protection Association (NFPA):
1. 80 - Fire Doors and Windows.
2. 252 - Fire Tests of Door Assemblies.
3. 257 - Fire Test for Window and Glass Block Assemblies.

1.05 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 C1036.
C. IBC: International Building Code.
D. Interspace: Space between lites of an insulating-glass unit.

1.06 COORDINATION:

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.07 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 (300 mm) square.
C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
D. Qualification Data: For Installer and glass testing agency.
E. Product Certificates: For glass.
F. Product Test Reports: For insulating glass, fire rated glass and glazing sealants, for tests performed by a qualified testing agency.
1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
G. Preconstruction adhesion and compatibility test report.
H. Sample Warranties: For special warranties.

1.08 QUALITY ASSURANCE:

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.09 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.

1.10 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. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40ºF (4.4ºC).

1.11 WARRANTY:

A. General: Warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is 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

2.01 MANUFACTURERS:

A. 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.

B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.02 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 IBC and ASTM E1300.
   1. Design Wind Pressures: As indicated on Drawings.
   2. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

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 laminated-glass lites, properties are based on products of construction indicated.

3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/ft.^{2} by h by ºF (W/m^2 by K).
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to IECC Table C402.4.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.03 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. Thickness: Where glass thickness is indicated, it is a minimum.

2.04 GLASS PRODUCTS:

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
B. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.05 INSULATING GLASS:

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
   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.
   4. Performance Characteristics: Visible light transmittance of 15, exterior light reflectance of 10%, interior light reflectance of 38%, winter nighttime U-value of 0.36 (fixed windows). 0.43 (operable windows) and 0.77 (entrance doors), solar heat gain coefficient of according to IECC Table C402.4, and light-to-solar gain of 0.60.
   5. Basis of Design Product: Vitro Architectural Glass Solarcool Pacifica
   6. Use in the following Admin and Scale House locations:
      a. Exterior doors.
      b. Exterior windows.
      c. Scale building

2.06 HEAT-TREATED GLASS PRODUCTS:

A. Tempered Glass:
   1. Float glass, ASTM C1048 Condition A, uncoated surfaces, transparent glass, flat, clear, glazing select quality q3, find FT (fully tempered) conforming to ANSI Z97.1.
   2. 1/4 inch thickness.
   3. IGU with ¼ inch lite, ½ inch air space and ¼ inch glass used at Lab Storefront and Control Room Storefront.
   4. Vitro Architectural Glass − Herculite Tempered Glass − Clear. Or engineer approved equal.

5. Use in following locations:
    a. Non-Fire Rated interior doors.
    b. Non-Fire Rated interior windows and sidelites.

2.07 FIRE RATED GLASS:

A. Fire rated glass:
    1. 90 minute fired rated glass.
    2. Pilkington Pyrostop Fire-Rated, Impact Safety-Rated Transparent Wall Panels. 90 minute rated 2 1/8" thick IGU. Provide framing to accommodate IGU. Or engineer approved equal.
    3. Use in the following locations:
        a. Fire rated interior doors.

2.08 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
B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT.
    1. Sika Corporation – Sikasil SG-10, or architect approved equal.
    2. Applications: Use in locations with single-pane glass.

2.09 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, ±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).

2.10 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: 120ºF (67ºC), ambient; 180ºF (100ºC), material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

PART 3 - EXECUTION

3.01 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.

3.02 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.

3.03 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.

3.04 SEALANT GLAZING (WET):

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.05 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.

END OF SECTION 08 80 00

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the following:
   1. Nonload-bearing steel framing members for gypsum board assemblies.
   2. Gypsum board assemblies attached to steel framing.

1.02 REFERENCES:

A. American National Standards Institute (ANSI):
   1. A108.11 - Interior Installation of Cementitious Backer Units.
   2. A118.9 - Cementitious Backer Units.

B. American Society for Testing and Materials (ASTM):
   1. A568/A568MN - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements.
   2. A641/A641M - Zinc-Coated (Galvanized) Carbon Steel Wire.
   3. A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   4. B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   5. B221M - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
   6. C11 - Terminology Relating to Gypsum and Related Building Materials and Systems.
   7. C36/C36M - Gypsum Wallboard.
   8. C423 - Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   9. C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
   10. C514 - Nails for the Application of Gypsum Wallboard.
   11. C557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.
   12. C578 - Rigid, Cellular Polystyrene Thermal Insulation.
   13. C630/C630M - Water-Resistant Gypsum Backing Board.
   14. C645 - Nonload (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.
   15. C665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   16. C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
   17. C834 - Latex Sealants.
   18. C840 - Application and Finishing of Gypsum Board.
   19. C919 - Practices for Use of Sealants in Acoustical Applications.
   20. C931/C931M - Exterior Gypsum Soffit Board.
   21. C954 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
   22. C1002 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   23. C1047 - Accessories for Gypsum Wallboard and Gypsum Veneer Base.
   24. C1178/C1178M - Glass Mat Water-Resistant Gypsum Backing Board.
   25. D226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   26. D4397 - Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

27. E84 - Test Method for Surface Burning Characteristics of Building Materials.
28. E90 - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
29. E119 - Method for Fire Tests of Building Construction and Materials.
30. E413 - Classification for Rating Sound Insulation.
31. E488 - Test Method for Strength of Anchors in Concrete and Masonry Elements.
32. E1190 - Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members.

C. Gypsum Association (GA):
1. 214 - Recommended Specification: Levels of Gypsum Board Finish.
2. 216 - Application and Finishing of Gypsum Board.
3. 600 - Fire Resistance Design Manual.

D. Underwriters Laboratories (UL):
1. Fire Resistance Directory.

E. United States Gypsum Co.
1. Gypsum Construction Handbook.

1.03 DEFINITIONS:

A. Gypsum Board Construction Terminology: Refer to ASTM C11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 SUBMITTALS:

A. Product Data for each type of product specified.

B. Shop Drawings showing locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

C. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

1.05 QUALITY ASSURANCE:

A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

D. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Intertek Testing Services, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

1.07 PROJECT CONDITIONS:

A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40ºF (4ºC). For adhesive attachment and finishing of gypsum board, maintain not less than 50ºF (10ºC) for 48 hours before application and continuously after until dry. Do not exceed 95º (35ºC) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

1.08 WARRANTY

A. The Manufacturer shall warrant that all assemblies shall be free from defects caused by faulty material or workmanship for a minimum period of two (2) years from the date of Substantial Completion, unless otherwise specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Framing and Furring:
   a. ClarkDietrich Building Systems.
   b. Consolidated Systems, Inc.
   c. National Gypsum Co.; Gold Bond Building Products Division.
   d. Unimast, Inc.
   e. The Steel Network.
2. Grid Suspension Assemblies:
   a. Ref to Specification 09 51 23.
3. Gypsum Board and Related Products:
   a. American Gypsum Co.
   b. Georgia-Pacific Corp.
   c. National Gypsum Co.; Gold Bond Building Products Division.
   d. United States Gypsum Co.
   e. Certain Teed, a Saint Gobain Company

B. Products: Subject to compliance with requirements, provide one of the following products where proprietary gypsum wallboard is indicated:
   1. Gyprock Fireguard C Gypsum Board; Domtar Gypsum.
   2. Firestop Type C; Georgia-Pacific Corp.
   3. Fire-Shield G; National Gypsum Co.; Gold Bond Building Products Division.
   4. SHEETROCK Brand Gypsum Panels, FIRECODE C Core; United States Gypsum Co.
   5. SHEETROCK Brand Gypsum Panels, ULTRACODE Core; United States Gypsum Co.

2.02 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS:

A. General: Provide components complying with ASTM C754 for conditions indicated.
B. Wire Ties: ASTM A641 (ASTM A641M), Class 1 zinc coating, soft temper, 0.062 inch thick.
C. Wire Hangers: ASTM A641 (ASTM A641M), Class 1 zinc coating, soft temper, 0.162-inch diameter.
D. Hanger Rods: Mild steel and zinc coated or protected with rust-inhibitive paint.
E. Flat Hangers: Mild steel and zinc coated or protected with rust-inhibitive paint.
F. Angle-Type Hangers: Angles with legs not less than 7/8-inch wide, formed from 0.0635-inch thick galvanized steel sheet complying with ASTM A653, G90 (ASTM A653M, Z180) coating designation, with bolted connections and 5/16-inch diameter bolts.
G. Channels: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch wide flanges, and as follows:
   1. Carrying Channels: 2 inches deep, 590 lb/1000 feet, unless otherwise indicated.
   2. Finish: Rust-inhibitive paint, unless otherwise indicated.
   3. Finish: ASTM A653, G60 (ASTM A653M, Z180) hot-dip galvanized coating for framing for exterior soffits and where indicated.
H. Grid Suspension System for Interior Ceilings: ASTM C645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross-furring members that interlock to form a modular supporting network.

2.03 STEEL FRAMING FOR INTERIOR PARTITIONS:

A. General: Provide steel framing members complying with the following requirements:
   1. Protective Coating:
      a. ASTM A653, G40 (ASTM A653M, Z90) hot-dip galvanized coating.
      b. Manufacturer's standard corrosion-resistant coating.
      c. ASTM A653, G40 (ASTM A653M, Z90) hot-dip galvanized coating for framing members attached to and within 10 feet of exterior walls.
B. Steel Studs and Runners: ASTM C645, with flange edges of studs bent back 90° and doubled over to form 3/16 inch wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
   1. Thickness:
      a. 20 Gauge.
   2. Depth:
      a. 3-5/8 inches, unless otherwise indicated.
C. Deflection Track: Manufacturer's top runner complying with the requirements of ASTM C645 and with 3-inch deep flanges and 0.0456 inch (20 Gauge) minimum thickness.
D. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web and capable of resisting forces imposed by the wall system.

1. ClarkDetrich Fast Top Clip FTC3 with a slip allowance of 1-1/4".
2. Or approved equal.

E. Steel Rigid Furring Channels: ASTM C645, hat shaped, depth and minimum thickness of base (uncoated) metal as follows:
   1. Thickness:
      a. 0.0456 inch (20 Gauge).
   2. Depth:
      a. 1-1/2 inch.

F. Z-Furring Members: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, fabricated from steel sheet complying with ASTM A653 (ASTM A653M) or ASTM A568 (ASTM A568M); with a minimum base metal (uncoated) thickness of 0.0179 inch, face flange of 1-1/4 inch, wall-attachment flange of 7/8 inch, and of depth required to fit insulation thickness indicated.

G. Steel Channel Bridging: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch wide flanges, 1-1/2 inches deep, 475 lb/1000 feet, unless otherwise indicated.

H. Steel Flat Strap and Backing Plate: Steel sheet for blocking and bracing complying with ASTM A653 (ASTM A653M) or ASTM A568 (ASTM A568M), length and width as indicated, and with a minimum base metal (uncoated) thickness as follows:
   1. Thickness:
      a. 0.0179-inch, unless otherwise indicated.

I. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.
   1. All steel stud, runner, and track fastening shall be accomplished using a minimum #12 self-drilling screw, unless noted otherwise.

2.04 GYPSUM BOARD PRODUCTS:

A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
   1. Width:
      a. Provide gypsum board in widths of 48 inches.

B. Gypsum Wallboard: ASTM C36 and as follows:
   1. Type:
      a. Regular for vertical surfaces, unless otherwise indicated.
      b. Type X where required for fire-resistance-rated assemblies.
      c. Sag-resistant type for ceiling surfaces.
      d. Moisture resistant drywall as indicated on drawings.
   2. Edges:
      a. Tapered.
   3. Thickness:
      a. 5/8-inch unless indicated otherwise.

2.05 SUBSTRATE BOARD:

A. ASTM D3273, glass-mat, water-resistant gypsum substrate, 1/2 inch.
   1. Products: Subject to compliance with requirements, provide one of the following:

a. Georgia-Pacific Corporation; DensGlass.

2.06 CEMENTITIOUS BACKER UNITS:

A. Provide cementitious backer units under all wall tile and as indicated on drawings complying with ANSI A118.9, of thickness and width indicated below, and in maximum lengths available to minimize end-to-end butt joints.
   1. Thickness:
      a. 1/2-inch, unless otherwise indicated.
   2. Width:
      a. 32 inches.

B. Products: Subject to compliance with requirements, provide one of the following products:
   1. The Original Wonderboard; Custom Building Products.
   2. Wonderboard Multi+Board; Custom Building Products.
   3. Util-A-Crete Concrete Backer Board; FinPan, Inc.
   4. DUROCK Cement Board; United States Gypsum Co.
   5. Or approved equal.

2.07 INSULATING MATERIALS:

A. General: Provide insulating materials that comply with requirements and with referenced standards.
   1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:
   1. Glass-Fiber Blanket Insulation:
      a. CertainTeed Corporation.
      b. Guardian Fiberglass, Inc.
      c. Johns Manville.
      d. Knauf Fiber Glass.
      e. Owens Corning.

C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
   1. 3-1/2 inches thick with a thermal resistance of 11ºF by h by sq. ft./Btu at 75ºF.

2.08 INTERIOR WALL INSULATING MATERIALS:

A. Mineral-Wool Blanket, Unfaced: ASTM C665, Type 1 (blankets without membrane facing); consisting of fibers; with maximum flame spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.
   1. Sound Transmission Class: minimum 52.
   2. Noise Reduction Coefficient: minimum of 1.00.
   3. Thickness: 3 inches.
   4. Moisture repellent; does not promote fungi growth.

B. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:

1. Roxul AFB.
2. Engineer approved equal.

C. See Section 07 21 19 – Foamed-in-Place Insulation for insulation at interior side of exterior walls.

2.09 TRIM ACCESSORIES:

A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C1047 and requirements indicated below:
   1. Material: Formed metal or plastic, with metal complying with the following requirement:
      a. Steel sheet zinc coated by hot-dip process or rolled zinc.
   2. Shapes indicated below by reference to Fig. 1 designations in ASTM C1047:
      a. Cornerbead on outside corners, unless otherwise indicated.
      b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
      c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.

2.10 JOINT TREATMENT MATERIALS:

A. General: Provide joint treatment materials complying with ASTM C475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.
   1. Use pressure-sensitive or staple-attached, open-weave, glass-fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.

C. Joint Tape for Cementitious Backer Units: As recommended by cementitious backer unit manufacturer.

D. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
   1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
   2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
   3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
   4. For topping compound, use sandable formulation.

E. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mixed Formulation: Factory-mixed product.
      a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
      b. Topping compound formulated for fill (second) and finish (third) coats.
      c. All-purpose compound formulated for both taping and topping compounds.
   2. Job-Mixed Formulation: Powder product for mixing with water at Project Site.
      a. Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.

b. Topping compound formulated for fill (second) and finish (third) coats.
c. All-purpose compound formulated for both taping and topping compounds.

F. Joint Compound for Cementitious Backer Units: Material recommended by cementitious backer unit manufacturer.

2.11 MISCELLANEOUS MATERIALS:

A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.
C. Spot Grout: ASTM C475, setting-type joint compound recommended for spot-grouting hollow metal door frames.
D. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
E. Steel drill screws complying with ASTM C1002 for the following applications:
1. Fastening gypsum board to steel members less than 0.033 inch thick.
F. Foam Gaskets: Closed-cell vinyl foam adhesive-backed strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit metal stud size indicated.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

3.03 INSTALLING STEEL FRAMING, GENERAL:

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.
B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co. "Gypsum Construction Handbook."
C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
1. Where building structure abuts ceiling perimeter or penetrates ceiling.
2. Where partition framing and wall furring abut structure, except at floor.

a. Provide slip or cushioned-type joints as detailed to attain lateral support and avoid axial loading.
b. Install deflection track top runner and vertical deflection clips, as indicated, to attain lateral support and avoid axial loading.
c. Install deflection and vertical deflection clips, as indicated, and firestop track top runner at fire-resistance-rated assemblies where indicated.

D. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

3.04 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED GYPSUM CEILINGS:

A. Suspend ceiling hangers from building 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 structural or ceiling suspension system. 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 the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure flat, angle, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or otherwise fail.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Sway-brace suspended steel framing with hangers used for support.

C. Install suspended steel framing components in sizes and at spacings indicated, but not less than that required by the referenced steel framing installation standard.
1. Wire Hangers: 48 inches o.c.

D. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.05 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS:

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8-inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing above suspended ceilings and secure to structural supports as indicated on the Drawings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
   1. Cut studs 1-inch short of full height to provide perimeter relief. Install top track and vertical deflection clips. Fasten vertical deflection clips and top track to primary structure as required. Fasten vertical deflection clips to stud with manufacturer provided hardware in accordance with the manufacturer's instructions. Do not fasten stud to top track.
   2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
      a. Terminate partition framing at suspended ceilings where indicated.

D. Install steel studs and furring in sizes and at spacings indicated.
   1. Double-Layer Construction: Space studs at 16 inches o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

F. Frame door openings to comply with GA-600, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   1. Install 2 studs at each jamb, unless otherwise indicated.
   2. 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.

G. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

H. Install thermal insulation as follows:
   1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
   4. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch diameter tie wire and inserted through slot in web of member.

I. Install polyethylene vapor retarder where indicated to comply with the following requirements:
   1. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with mechanical fasteners or adhesives. Extend vapor retarder to cover

miscellaneous voids in insulated substrates, including those filled with loose mineral fiber insulation.

2. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16 inches o.c.
3. Seal joints in vapor retarders caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor retarder tape.
4. Repair any tears or punctures in vapor retarder immediately before concealing it with the installation of gypsum board or other construction.

3.06 INSTALLATION OF GENERAL BUILDING INSULATION:

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
C. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
D. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.07 APPLYING AND FINISHING GYPSUM BOARD, GENERAL:

A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C840 and GA-216.
B. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
C. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. 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 both edge or 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. Avoid joints other than control joints at corners of framed openings where possible.
E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
F. Attach gypsum panels to framing provided at openings and cutouts.
G. Spot grout hollow metal door frames. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.
H. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.
    1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
    2. Fit gypsum panels around ducts, pipes, and conduits.

J. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.
   1. Space screws a maximum of 12 inches o.c. for vertical applications.

L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.08 GYPSUM BOARD APPLICATION METHODS:

A. Single-Layer Application: Install gypsum wallboard panels as follows:
   1. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
   1. Install cementitious backer units to comply with ANSI A108.11 at locations indicated to receive wall tile.
   2. Install water-resistant gypsum backing board panels at showers, tubs, and where indicated. Install with 1/4-inch open space where panels abut other construction or penetrations.
   3. Install gypsum wallboard panels with tapered edges taped and finished to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:
   1. Fasten with screws.

D. Multilayer Fastening Methods: Apply base layers of gypsum panels and face layer to base layers as follows:
   1. Fasten both base layers and face layers separately to supports with screws.

E. Direct-Bonding 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 recommendations, and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.09 INSTALLING TRIM ACCESSORIES:

A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

B. Install metal cornerbead at external corners.

C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
   1. Install aluminum trim and other accessories where indicated.

D. Install control joints according to ASTM C840 and manufacturer's recommendations and in specific locations approved by Engineer/Architect for visual effect.

3.10 FINISHING GYPSUM BOARD ASSEMBLIES:

A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
C. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.
D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
    1. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
    2. Level 2 where panels form substrates for tile and where indicated.
    3. Level 4 for gypsum board surfaces, unless otherwise indicated.
E. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
F. Where Level 2 gypsum board finish is indicated, embed tape in joint compound and apply first coat of joint compound.
G. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.
H. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C840 and gypsum board manufacturer's directions for treatment of joints behind tile.
I. Finish glass-mat, water-resistant gypsum backing board to comply with gypsum board manufacturer's directions.
J. Finish cementitious backer units to comply with unit manufacturer's directions.

3.11 CLEANING AND PROTECTION:

A. Promptly remove any residual joint compound from adjacent surfaces.
B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 09 21 16

SECTION 09 30 13 – CERAMIC TILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Porcelain tile.
   2. Waterproof membrane for thinset applications.
   3. Crack isolation membrane.
   4. Metal edge strips.

1.03 RELATED REQUIREMENTS:

A. Section 07 92 00 - Joint Sealants for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
B. Section 09 29 00 - Gypsum Board for glass-mat, water-resistant backer board.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American National Standards Institute (ANSI) (The 12 standards below and the TCNA Handbook are available on a CD offered by TCNA.):
   1. ANSI A108 Series (A108.01, .02, .1A, .1B, .1C, .4, .5, .6, .8, .9, .10, .11, .12, .13, .14, .15, .16, and .17) - Specifications for Installation of Ceramic Tile.
   2. ANSI A118.1 - Specifications for Standard Dry-Set Mortar.
   3. ANSI A118.3 - Specifications for Chemical Resistant Water Cleanable Tile-Setting and Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.
   4. ANSI A118.4 - Specifications for Modified Dry-Set Mortar.
   5. ANSI A118.6 - Specifications for Standard Cement Grouts for Tile Installation.
   6. ANSI A118.7 - Specifications for High Performance Cement Grouts for Tile Installation.
   7. ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units.
   8. ANSI A118.10 - Specifications for Load Bearing, Bonded, Waterproof Membranes for ThinSet Ceramic Tile and Dimension Stone Installations.
   9. ANSI A118.12 - Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installations.
   10. ANSI A118.15 - Specifications for Improved Modified Dry-Set Mortar.
   11. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
   12. ANSI A137.1 - Specifications for Ceramic Tile.
C. Tile Council of North America, Inc.
   1. Handbook for Ceramic, Glass, and Stone Tile Installation. (Also available on a CD that includes ANSI standards for tile, tile installation material, and tile installation methods).

1.05 DEFINITIONS:

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15,

ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.
D. Face Size: Actual tile size, excluding spacer lugs.

1.06 SUBMITTALS:

A. Product Data: For each type of product.
B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
C. Samples for Verification:
   1. Full-size units of each type and composition of tile and grout and for each color and finish required.
   2. Full-size units of each type of trim and accessory.
D. Qualification Data: For Installer.
E. Product Certificates: For each type of product.
F. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 2% of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 2% of amount installed for each type, composition, and color indicated.

1.07 QUALITY ASSURANCE:

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of floor tile installation.
   2. Build mockup of wall tile installation.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
D. Store liquid materials in unopened containers and protected from freezing.

1.09 FIELD CONDITIONS:

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

A. Source Limitations for Tile: Obtain tile from single source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
   1. Waterproof membrane.
   2. Crack isolation membrane.
   3. Metal edge strips.

2.02 PRODUCTS, GENERAL:

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.03 TILE PRODUCTS:

A. Ceramic Tile Type Porcelain tile.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Dal-Tile Ironcraft or comparable product by one of the following:
      a. Architect approved equal.
   2. Certification: Tile certified by the Porcelain Tile Certification Agency.
   3. Tile Color, Glaze, and Pattern: Casper Grey IC12.
   4. Grout Color: As selected by Architect from manufacturer's full range.
   5. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
      a. External Corners: Surface bullnose, module size.
      b. Internal Corners: Field-butted square corners.

2.04 THRESHOLDS/TRANSITIONS:

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
   1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
   2. Products: Subject to compliance with requirements, provide one of the following]:
      a. Schluter Systems L.P.
      b. Engineer approved equal.

2.05 WATERPROOF MEMBRANE:

A. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
   1. Products: Subject to compliance with requirements, provide one of the following]:
      a. Schluter Systems L.P.; KERDI.
      b. Engineer approved equal.

2.06 CRACK ISOLATION MEMBRANE:

A. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Schluter Systems L.P.; DITRA.
      b. Engineer approved equal.

2.07 SETTING MATERIALS:

A. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide TEC 3N1 Performance Mortar or comparable product by one of the following:
      a. Architect approved equal.
   2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project Site.
   3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.08 GROUT MATERIALS:

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
   1. Color: As selected by Architect from manufacturer’s standard colors.

2.09 MISCELLANEOUS MATERIALS:

A. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A666, 300 Series exposed-edge material.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Schluter Systems L.P.
      b. Engineer approved equal.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.10 MIXING MORTARS AND GROUT:

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project Site before installing.

3.03 CERAMIC TILE INSTALLATION:

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95% mortar coverage:
      a. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
E. Jointing Pattern: Lay tile in running bond pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Porcelain Tile: 3/16 inch.
G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
H. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.04 WATERPROOFING INSTALLATION:

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.05 CRACK ISOLATION MEMBRANE INSTALLATION:

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.06 ADJUSTING AND CLEANING:

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.07 PROTECTION:

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 13

SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Acoustical tiles for ceilings.
   2. Concealed suspension systems.

1.03 RELATED REQUIREMENTS:

A. Grilles and Diffusers: Division 23
B. Interior Lighting Fixtures: Division 26

1.04 REFERENCE STANDARDS

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
C. American Society of Civil Engineers/Structural Engineering Institute (ASCE):
   1. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.
D. ASTM International:
   1. ASTM A 641/A 641M - Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   2. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM B 633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   4. ASTM C 635/C 635M - Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   5. ASTM C 636/C 636M - Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
   6. ASTM D 3273 - Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   7. ASTM D 3274 - Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation.
   8. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
   9. ASTM E 119 - Test Methods for Fire Tests of Building Construction and Materials.
   10. ASTM E 488/E 488M - Test Methods for Strength of Anchors in Concrete Elements.
   11. ASTM E 1190 - Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members.
   12. ASTM E 1264 - Classification for Acoustical Ceiling Products.
   13. ASTM E 1512 - Test Methods for Testing Bond Performance of Bonded Anchors.
   14. ASTM F 593 - Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   15. ASTM F 594 - Specification for Stainless Steel Nuts.
   16. ASTM G 21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.05 SUBMITTALS:

A. Product Data: For each type of product.

B. Samples: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
   2. Concealed Suspension-System Members: 6-inch long Sample of each type.
   3. Exposed Moldings and Trim: Set of 6-inch long Samples of each type and color.
C. 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. Ceiling suspension-system members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).
D. Field quality-control reports.
E. Maintenance Data: For finishes to include in maintenance manuals.
F. 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 Units: Full-size tiles equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver acoustical tiles, 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 tiles, permit them to reach room temperature and a stabilized moisture content.
C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.07 FIELD CONDITIONS:

A. Environmental Limitations: Do not install acoustical tile 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

2.01 PERFORMANCE REQUIREMENTS:

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Seismic requirements are indicated on the structural drawings.
B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.

2.02 ACOUSTICAL TILES, GENERAL:

A. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance unless otherwise indicated.
C. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

2.03 ACOUSTICAL TILES:

A. Subject to compliance with requirements, similar products of the manufacturers listed below are acceptable:
   1. Armstrong World Industries, Inc.
   2. CertainTeed, a Saint-Gobain company
   3. USG Interiors, Inc.
   4. Architect approved equal.

A. Classification: Provide tiles complying with ASTM E1264 for type, form, and pattern as follows:
   1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
   2. Pattern: Equivalent to Performa Symphony M as manufactured by CertainTeed .
B. Color: White.
C. NRC: Not less than 0.70.
D. CAC: Not less than 30.
E. AC: Not less than 170.
F. Edge/Joint Detail: Square, kerfed and rabbeted; tongue and grooved; or butt.
G. Thickness: 3/4 inch.
H. Modular Size: 24 by 24 inches.
I. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles 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 D3273 and evaluated according to ASTM D3274 or ASTM G21.

2.04 METAL SUSPENSION SYSTEMS, GENERAL:

A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635/C635M.
B. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, 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 A641/A641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 12-gauge wire.

2.05 METAL SUSPENSION SYSTEM:

A. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A653/A653M, G30 (Z90) coating designation.
   1. Structural Classification: Intermediate-duty system.

2. Access: Upward, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
   a. Initial Access Opening: In each module, 24 by 24 inches.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS:

A. General: Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

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. 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.
   6. Do not attach hangers to steel deck tabs.
   7. Attach hangers to structural members where possible. Hangers may be attached to steel roof deck only with written approval from the Engineer.
   8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) 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.

C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
   1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
   2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.

3.04 CLEANING:

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

SECTION 09 65 13 – RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Resilient base.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International:
   1. ASTM E 648 - Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
   2. ASTM F 710 - Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   3. ASTM F 1861 - Specification for Resilient Wall Base.
   4. ASTM F 1869 - Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   5. ASTM F 2170 - Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
C. National Fire Protection Association (NFPA):
   1. NFPA 253 - Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.04 SUBMITTALS:

A. Product Data: For each type of product.
B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.
C. Product Schedule: For resilient base and accessory products.
D. 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.

1.05 QUALITY ASSURANCE:

A. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1.06 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 50ºF (10ºC) or more than 90ºF (32ºC).

1.07 FIELD CONDITIONS:

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70ºF (21ºC) or more than 95ºF (35ºC), in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55ºF (13ºC) or more than 95ºF (35ºC).

C. Install resilient products after other finishing operations, including painting, have been completed.

D. Maintain the ambient relative humidity between 40% and 60% during installation.

PART 2 - PRODUCTS

2.01 THERMOSET-RUBBER BASE:

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Basis of Design: Flexco – Wallflowers.

B. Product Standard: ASTM F1861, Type TS vulcanized thermoset, Group I solid, homogeneous.
   1. Style and Location:
      a. Style A, Straight: Provide in areas with carpet.
      b. Style B, Cove: Provide in areas with resilient flooring.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: 014 Medium Gray.

2.02 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.

PART 3 - EXECUTION

3.01 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.

3.02 PREPARATION:

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
C. Do not install resilient products until 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.

3.03 RESILIENT BASE INSTALLATION:

A. Comply with manufacturer's written instructions for installing resilient base.
B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
E. Do not stretch resilient base during installation.
F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
G. Preformed Corners: Install preformed corners before installing straight pieces.
H. Job-Formed Corners:
    1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
        a. Form without producing discoloration (whitening) at bends.
    2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
        a. Miter corners to minimize open joints.

3.04 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 65 19 – RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. Section Includes:
   1. Rubber floor tile.

1.03 REFERENCED STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. ASTM International:
   1. ASTM C 109/C 109M - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   2. ASTM D 2240 - Test Method for Rubber Property – Durometer Hardness.
   3. ASTM E 648 - Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
   4. ASTM F 510/F 510M - Test Method for Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method.
   5. ASTM F 710 - Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   6. ASTM F 970 - Test Method for Static Load Limit.
   7. ASTM F 1344 - Specification for Rubber Floor Tile.
   8. ASTM F 1516 - Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method (when Recommended).
   9. ASTM F 1869 - Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   10. ASTM F 2170 - Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

C. NFPA:
   1. NFPA 253 - Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.04 SUBMITTALS:

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile.
   1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Product Schedule: For floor tile.

E. Qualification Data: For Installer.

F. Maintenance Data: For each type of floor tile to include in maintenance manuals.

G. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.05 QUALITY ASSURANCE:

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Store floor tile 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 (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.07 FIELD CONDITIONS:

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
C. Close spaces to traffic during floor tile installation.
D. Close spaces to traffic for 48 hours after floor tile installation.
E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 RUBBER FLOOR TILE:

A. Products: Subject to compliance with requirements, provide the following or architect approved equal:
   1. Flexco; Evolving Styles Tile.
B. Tile Standard: ASTM F 1344.
C. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer according to ASTM D 2240.
D. Wearing Surface: Smooth.
E. Thickness: 0.125 inch.
F. Size: 18 by 18 inches.
G. Colors and Patterns: French Grey w/ Black CE-103.

2.02 INSTALLATION MATERIALS:

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.01 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 floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
   4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles 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 floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.03 FLOOR TILE INSTALLATION:

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.04 CLEANING AND PROTECTION:

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 68 13 – TILE CARPETING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes modular carpet tile.

1.03 RELATED REQUIREMENTS:

A. Section 09 65 13 - Resilient Base and Accessories for resilient wall base and accessories installed with carpet tile.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Association of Textile Chemists and Colorists:
   1. AATCC 16: Colorfastness to Light.
   2. AATCC 134: Electrostatic Propensity of Carpets.
   3. AATCC 174: Antimicrobial Activity Assessment of Carpets.
   4. AATCC 165: Colorfastness to Crocking: Textile Floor Coverings - Crockmeter Method.

C. American National Standards Institute/NSF International:
   1. ANSI/NSF 140: Sustainability Assessment for Carpet.

D. ASTM International:
   1. ASTM C423: Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM D1335: Test Method for Tuft Bind of Pile Yarn Floor Coverings.
   3. ASTM D2646: Test Methods for Backing Fabric Characteristics of Pile Yarn Floor Coverings.
   4. ASTM D3936: Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering.
   5. ASTM D6859: Test Method for Pile Thickness of Finished Level Pile Yarn Floor Coverings.
   6. ASTM D7330: Test Method for Assessment of Surface Appearance Change in Pile Floor Coverings Using Standard Reference Scales.
   7. ASTM F710: Practice for Preparing Concrete Floors to Receive Resilient Flooring.

E. The Carpet and Rug Institute:
   1. CRI Carpet Installation Standard.

F. International Organization for Standardization:
   1. ISO 2551 (Aachen Test): Machine-Made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions.

G. NFPA:
   1. NFPA 253: Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.05 SUBMITTALS:

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch long Samples.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

E. Qualification Data: For Installer.

F. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

G. Sample Warranty: For special warranty.

H. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

I. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5% of amount installed for each type indicated, but not less than 10 $yd.^2$.

1.06 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Comply with CRI's "CRI Carpet Installation Standard."

1.08 FIELD CONDITIONS:

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.09 WARRANTY:

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, the following:
      a. More than 10% edge raveling, snags, and runs.
      b. Dimensional instability.
      c. Excess static discharge.
      d. Loss of tuft-bind strength.
      e. Loss of face fiber.
      f. Delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CARPET TILE:

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following or approval equal:
   1. Tandus Centive – Tarkett Powerbond Hybrid Resilient – Maelstrom 04849 Mercury Retrograde 33205.
B. Fiber Type: Dynex SD Nylon.
C. Pile Characteristic: Stratatec Patterned Loop pile.
D. Pile Thickness: 0.085" according to ASTM D6859.
E. Primary Backing/Backcoating: Synthetic Non-Woven.
F. Secondary Backing: Manufacturer's standard material.
G. Backing System: Powerbond® Cushion.
H. Size: 24 by 24 inches.
I. Applied Treatments:
   1. Soil-Resistance Treatment: Manufacturer's standard treatment.
   2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
      a. Antimicrobial Activity: Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
J. Performance Characteristics:
   1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
   2. Critical Radiant Flux Classification: Not less than 0.45 W/cm^2 according to NFPA 253.
   3. Dry Breaking Strength: Not less than 100 lbf. (445 N) according to ASTM D2646.
   4. Tuft Bind: Not less than 8 lbf. (36 N) according to ASTM D1335.
   5. Delamination: Not less than 4 lbf./inch (0.7 N/mm) according to ASTM D3936.
   6. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
   7. Dimensional Stability: 0.2% or less according to ISO 2551 (Aachen Test).
   8. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.

9. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
10. Electrostatic Propensity: Less than 2 kV according to AATCC 134.

2.02 INSTALLATION ACCESSORIES:

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Schluter Systems LP.
      b. Engineer approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 - Cast-in-Place Concrete and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
   1. Moisture Testing: Perform tests so that each test area does not exceed 1,000 $ft.^2$, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
      a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb. of water/1,000 $ft.^2$ in 24 hours.
      b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 % relative humidity level measurement.
      c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.03 INSTALLATION:

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
B. Installation Method: As recommended in writing by carpet tile manufacturer.
C. Maintain dye-lot integrity. Do not mix dye lots in same area.
D. Maintain pile-direction patterns indicated on Drawings.
E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
H. Install pattern parallel to walls and borders.

3.04 CLEANING AND PROTECTION:

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.
B. Protect installed carpet tile to comply with CRI's "CRI Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 90 00 – PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes coating of exterior and interior surfaces throughout the Project and which are listed in Part 2, with systems specified on "coating system" sheets at the end of this Section.

B. Coating systems include surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied, may be specified elsewhere or referenced to this Section so that a complete system is specified and coordinated.

1. Where surface preparation and first (prime) coat are specified in other Sections to be shop-applied, such as for structural steel, hollow metal doors or equipment, only the touch up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
2. If materials are provided without shop primer such as miscellaneous steel or sheet metal, then surface preparation, first, second, and third coats are a part of field painting.
3. Concealed surfaces subject to corrosion or attack if unprotected shall be prime-coated and touched up prior to concealment under insulation or other protective layer.
4. Where Equipment and Materials are provided with shop-applied finished coating system, only touch up and finish coats are a part of field painting.
5. Refer to applicable Sections to determine whether surface preparation and first coat, or complete coating system, is to be shop-applied.

1.03 RELATED REQUIREMENTS:

A. Shop Painting and Coatings: All applicable Divisions.

B. Factory Prefinished Items: All applicable Divisions.

C. Colors:

1. Color of finish coatings shall match accepted color Samples.
2. When second and finish coats of a system are of same type, tint or use an alternate color on second coat to enable visual coverage inspection of the third coat. When first and second coats only are specified and are of same or different types, tint or use an alternate color on first coat to enable visual coverage inspection of the second coat.
3. Contract Price shall include the following approximate number of finish coat colors to form a basis for bidding:
   a. Alkyd: 3 colors.
   b. Latex: 3 colors.
   c. Acrylic: 7 colors.
   d. Epoxy: 3 colors.
   e. Polyurethane: 3 colors.
   f. Stains: 3 colors.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:

1. American National Standards Institute (ANSI):
   a. ANSI A13.1 - Scheme for the Identification of Piping Systems.

b. ANSI Z53.1 - Safety Color Code for Marking Physical Hazards.

2. ASTM International (ASTM):
   a. ASTM D6386 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
   b. ASTM D4258 - Surface Cleaning Concrete for Coating.
   c. ASTM D4259 - Abrading Concrete.
   d. ASTM D4260 - Acid Etching Concrete.
   e. ASTM D4261 - Surface Cleaning Concrete Unit Masonry for Coating.
3. Society for Protective Coatings (SSPC) Surface Preparation Specifications:
   a. SP1 - Solvent Cleaning: Removes oil, grease, soil, drawing and cutting compounds, and other soluble contaminants.
   b. SP2 - Hand Tool Cleaning: Remove loose material. Not intended to remove adherent mill scale, rust, and paint.
   c. SP3 - Power Tool Cleaning: Removes loose material. Not intended to remove all scale or rust.
   d. SP5 - White Metal Blast Cleaning: Removes all scale, rust, foreign matter. Leaves surface gray-white uniform metallic color.
   e. SP6 - Commercial Blast Cleaning: Two-thirds of every 9 inches² free of all visible residues; remainder only light discoloration.
   f. SP7 - Brush-Off Blast Cleaning: Removes only loose material, remaining surface tight and abraded to give anchor pattern.
   g. SP10 - Near-White Blast Cleaning: At least 95% of every 9 inches² shall be free of all visible residues.
   h. SP11 - Power Tool Cleaning to Bare Metal.
   i. SP12 - Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating.
   j. SP13 - Surface Preparation of Concrete.

1.05 SUBMITTALS:

A. Submit as specified in Division 01.

B. Includes, but not limited to, the following:
   1. Schedule of products and paint systems to be used. Schedule shall include the following information:
      a. Surfaces for system to be applied.
      b. Surface preparation method and degree of cleanliness.
      c. Product manufacturer, name, and number.
      d. Method of application.
      e. Dry film mil thickness per coat of coating to be applied.
   2. Color charts for selection and acceptance.
   3. Technical and material safety data sheets.
   4. Certification(s) by coating manufacturer(s) that all coatings are suitable for service intended as stated on each coating system sheet. If manufacturer has an equivalent product as that specified, and it is suitable for the intended purpose, Contractor shall submit the recommended product for approval at no increase in cost, and state reasons for substitution.

5. Contractor shall certify in writing to the Engineer/Architect that applicators have previously applied all the systems in this Specification and have the ability and equipment to prepare the surfaces and apply the coatings correctly.

C. Submittals for industrial maintenance coatings shall be prepared by, or have assistance in preparation of, a corrosion engineer or industrial coatings technical representative of the coating manufacturer.

1.06 QUALITY ASSURANCE:

A. Include on label of container:
1. Manufacturer's name, product name, and number.
2. Type of paint and generic name.
3. Color name and number.
4. Storage and temperature limits.
5. Mixing and application instructions, including requirements for precautions which must be taken.
6. Drying, recoat, or curing time.

B. A coating report shall be completed daily by Contractor at each phase of the coating system starting with surface preparation. These shall be submitted on the form attached at end of this Section.

C. In the event a problem occurs with coating system, surface preparation, or application, Contractor shall require coating applicator and coating manufacturer's technical representative to promptly investigate the problem and submit results to Engineer/Architect.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Delivery of Materials:
1. Deliver in sealed containers with labels and information legible and intact. Containers shall also have correct labels with required information.
2. Allow sufficient time for testing if required.

B. Storage of Materials:
1. Store only acceptable materials on Project Site.
2. Provide separate area and suitable containers for storage of coatings and related coating equipment.
3. Dispose of used or leftover containers, thinners, rags, brushes, and rollers in accordance with applicable regulations.

1.08 REGULATORY REQUIREMENTS:

A. In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the U.S. EPA and the local and regional jurisdictions. Notify Engineer/Architect of any coating specified herein that fails to conform to the requirements for the location of the Project or location of application.

B. Lead Content: Use only coatings that are totally lead free.

C. Chromate Content: Do not use coatings containing zinc-chromate or strontium chromate.

D. Asbestos Content: Materials shall not contain asbestos.

E. Mercury Content: Materials shall not contain mercury or mercury compounds.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Proprietary names and product numbers are specified in most systems for material identification from these manufacturers:
   1. Ameron Protective Coatings Systems Group, Ameron Corp.
   2. Carboline Company, Inc.
   3. Devoe Coating Company, Division of ICI.
   4. ITW Devcon Futura Coatings, Inc.
   5. International Protective Coatings.
   6. Keeler & Long, Inc., Division of PPG Industries, Inc.
   7. Pittsburgh Paints, PPG Industries Inc.
   8. Sherwin-Williams.
   9. Tnemec Company, Inc.
   10. Equivalent coatings (on approval by Engineer/Architect) are acceptable from the following alternate companies:
      a. E.I. DuPont de Nemours & Co., Inc.
      b. Benjamin Moore Company.
      c. Coronado Paint Company.
      d. Rust-Oleum.
      e. Sigma Coatings USA B.V.
      f. U.S. Coatings, Inc.
      g. Kwal-Howells, Inc.

2.02 GENERAL:

A. Materials furnished for each coating system must be compatible to the substrate.
B. When unprimed surfaces are to be coated, entire coating system shall be by the same coating manufacturer to assure compatibility of coatings.
C. When shop-painted surfaces are to be coated, ascertain whether finish materials will be compatible with shop coating. Inform Engineer/Architect of any unsuitable substrate or coating conditions.

2.03 COATING SYSTEMS:

A. Specified on the "Protective Coating System" sheets at the end of this Section.

2.04 SURFACES TO BE COATED:

A. System A-5:
   1. Steel Bollards and exterior exposed carbon steel
      a. Reference: Section 05 50 00, Civil, Structural and Architectural drawings.
      b. Location: As indicated.
B. System A-11:
   1. Bar Joists and Metal Roof Deck.
      a. Reference: Section 05 21 00, 05 31 00, Structural and Architectural drawings.
      b. Location: Electrical and Mechanical rooms (Rooms 110 and 111).
C. System B-4:
   1. Galvanized steel, galvanized steel doors and frames.
      a. Reference: Section 05 50 00, Section 08 11 13, Structural and Architectural drawings.

b. Location: All door frames, hollow metal doors and as indicated.

D. System F-2:
1. Interior CMU walls.
a. Reference: Architectural drawings.
b. Location: As indicated.

E. System J-2:
1. Interior Gypsum Board.
a. Reference: Architectural drawings.
b. Location: As indicated.

F. System K-2:
1. Wood.
a. Reference: Architectural drawings.
b. Location: Wood closet shelving.

G. System K-5:
1. Plywood.
a. Reference: Architectural drawings.
b. Location: Plywood walls in Eectrical room (Room 111).

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Prepare surfaces for each coating system conforming to SSPC or ASTM surface preparation specifications listed.
1. If grease or oils are present, SSPC SP1 shall precede any other method specified for metal substrates.
2. Remove surface irregularities such as weld spatter, burrs, or sharp edges prior to specified surface preparation.

B. Depth of profile will be as specified or as recommended by the manufacturer for each system, but in no instance shall it exceed one-third of the total dry film thickness of complete system.

C. Prepare only those areas which will receive the first coat of the system on the same day.
1. On steel substrates, apply coating before rust bloom forms.

D. Concrete and masonry surfaces shall be adequately cured prior to coating application.
1. Use surface cleaning methods, followed by mechanical or chemical surface preparation as specified in SSPC SP13.

E. For new galvanized steel to be coated, if absence of hexavalent stain inhibitors is not documented, test as described in ASTM D2092, Appendix X2, and remove by one of the methods described therein.

3.02 APPLICATION:

A. Apply coatings in accordance with coating manufacturer's recommendations.

B. Use properly designed brushes, rollers, and spray equipment for all applications.

C. On unprimed surfaces apply first coat of the system the same day as surface preparation.

D. Dry film thickness of each system shall meet the minimum specified. Maximum dry film thickness shall not exceed the minimum more than 20% or coating manufacturer's requirements if less. Where a dry film thickness range is specified, the range shall not be less than or exceeded.

E. Shop and field painting shall remain 3 inches (75 mm) away from unprepared surface of any substrate such as areas to be welded or bolted.

F. Environmental Conditions:
   1. Atmospheric temperature must be 50ºF (10ºC) or higher during application, unless otherwise approved by coating manufacturer. Do not apply coatings when inclement weather or freezing temperature may occur within coating recoat cure times.
   2. Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating manufacturer's limits.
   3. Relative humidity must be less than 85%. The ambient temperature and the temperature of the surface to be painted must be at least 5ºF (2.8ºC) above the dew point.
   4. Provide adequate ventilation in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the manufacturer's Material Safety Data Sheets for the specific coatings being applied.

G. Recoat Time: In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the applied coating in accordance with manufacturer's recommendations.

H. Protection:
   1. Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
   2. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.
   3. Provide cover or shields to prevent surface preparation media and coatings from entering orifices in electrical or mechanical Equipment. Where ventilation systems must be kept in operation at time of surface preparation, take precautions to shield intakes and exhausts to prevent the materials from entering system or being dispersed.
   4. Provide signs to indicate fresh paint areas.
   5. Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers which cannot be reused in accordance with applicable regulations.
   6. Do not remove or paint over Equipment data plates, code stamps on piping, or UL fire-rating labels.

3.03 INSPECTION:

A. Contractor shall provide and use a wet film gauges to check each application approximately every 15 min. in order to immediately correct film thickness under or over that specified.

B. Contractor shall provide and use a dry film gauge to check each coat mil (mm) thickness when dry, and the total system mil (mm) thickness when completed.

C. Use holiday or pinhole detector on systems over metal substrates to detect and correct voids when indicated on system sheet.

D. Check air temperature and temperature of the substrate at regular intervals to be certain surface is 5ºF (2.8ºC) or more above the dew point.

3.04 CLEANING AND REPAIRS:

A. Remove spilled, dripped, or splattered paint from surfaces.

B. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.

END OF SECTION 09 90 00

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: A-5

SERVICE:	Steel - Moderate to Severe Exposure (Nonimmersion)
Surface Preparation:	Shop: SSPC-SP6 and profile depth 1.5 to 2.5 mils (38 to 63 microns). Field: SSPC-SP2/3. Clean and dry.
First Coat:	High solids polyamine or polyamide epoxy with minimum 67% solids by volume. Apply at 5.0 to 7.0 mils (125 to 175 microns) dry film thickness.
Second Coat:	High solids aliphatic acrylic polyurethane gloss enamel with minimum 52% solids by volume. Apply at 3.0 to 5.0 mils (75 to 125 microns) film thickness.
System Total:	Minimum 8.0 mils (200 microns) dry film thickness.
Volatile Organic Content:	Maximum 2.8 lb/gal (340 g/L)

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COATING MANUFACTURER	PRODUCT DESIGNATION		
	FIRST COAT	**TOUCH UP**	**SECOND COAT**
PPG	Amerlock 2 or 400	Same as first coat	Amercoat 450 H
Carboline	Carboguard 890	Same as first coat	Carbothane 134 HG
Tnemec	Hi-Build Epoxoline II, Series N69	Same as first coat	Endura-Shield II, Series 1074
Sherwin-Williams	Macropoxy 646 B58-600/B58V600	Same as first coat	HS Polyurethane B65-300 Series

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: A-11 VOC

SERVICE: Steel: Bar Joists, Metal Roof Deck: Interior

Surface Preparation: Clean and dry, free of oil, grease, loose mill scale and paint, and other contaminates. Clean bare and rusted areas per SSPC-SP11.

First Coat: Spot prime bare and rusted area with primer as recommended by manufacturer of finish coats. Pretreat galvanized metal as required by manufacturer of finish coats.

Touch Up Touch-up same as first coat.

Second Coat: Acrylic Emulsion, dry-fall type, matte finish, minimum of 30% solids by volume. Apply at 2.0 to 3.0 mils (50 to 75 microns) dry film thickness.

Third Coat: Same as second coat.

System Total: Minimum 4.0 mils (100 microns) dry film thickness in addition to prime coat.

VOC (per coat): Maximum 50 g/L (each coat).

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	**TOUCH UP**	**SECOND COAT**	**THIRD COAT**
PPG	Amercoat 148	Same as First Coat	Amercoat 222	Amercoat 222
Carboline	Carbocrylic 3359	Same as First Coat	Carbocrylic 3359	Carbocrylic 3359
Devoe	Spraymaster Uni-Grip-WB	Same as First Coat	Spraymaster Uni-Grip-WB	Spraymaster Uni-Grip-WB
International	Intercryl 520	Same as First Coat	Intercryl 530	Intercryl 530
Sherwin-Williams	Waterborne Acrylic Dry Fall	Same as First Coat	Waterborne Acrylic Dry Fall	Waterborne Acrylic Dry Fall
Tnemec	Uni-Bond DF 115	Same as First Coat	Uni-Bond DF 115	Uni-Bond DF 115

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: B-4

SERVICE: Nonferrous & Galvanized Metal — Moderate to Severe Exposure Exterior or Interior (Including Galvanized Handrail)

Surface Preparation: Shop or field first coat: Remove oil or soap film with neutral detergent or emulsion cleaner.

First Coat: Pretreat and/or allow to weather as recommended by coating manufacturer.

Second Coat: High build polyamide or polyamidoamine epoxy with minimum 65% solids by volume. Apply at 4.0 - 6.0 mils (100 -150 microns) dry film thickness.

Third Coat: High solids aliphatic acrylic polyurethane gloss enamel with minimum 60% solids by volume. Apply at 2.0 – 3.0 mils (50 – 75 microns) dry film thickness.

System Total: Minimum 6.0 mils (150 microns) dry film thickness in addition to galvanizing.

Volatile Organic Content: Maximum 2.8 lb/gal (340 g/L).

Surface Preparation: Shop or field first coat: Remove oil or soap film with neutral detergent or emulsion cleaner.

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	**TOUCH UP**	**SECOND COAT**	**THIRD COAT**
PPG	See above		Amercoat 385	Amercoat 450 H
Carboline	See above		Carboguard 893 SG	Carbothane 134 HG
Sherwin-Williams	See above		Macropoxy 646 B58-600 Series	HS Polyurethane B65-300 Series
Tnemec	See above		F.C. Typoxy Series 27	Endura-Shield II 1074

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: F-2

SERVICE: Concrete Masonry Units (CMU) Normal Exposure Interior (Nonimmersion) Exterior or Interior

Surface Preparation: Concrete: ASTM D4258, clean and dry. Fill pits in concrete with patching compound as recommended by coating manufacturer. CMU: ASTM D4261, clean and dry.

First Coat: Acrylic Latex block filler with minimum 44% solids by volume. Apply at approximately 800 square feet per gallon (20 square meters per liter) on concrete and as required to fill pores on CMU.

Second Coat: Water reducible acrylic coating with minimum 34% solids by volume, gloss finish. Apply at 2.0 to 2.5 (50 to 63 microns) dry film thickness.

Third Coat: Same as second coat.

System Total: Minimum 4.0 mils (100 microns) dry film thickness in addition to filler.

Volatile Organic Content: Maximum 2.8 lb/gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION		
	FIRST COAT	**TOUCH UP**	**SECOND COAT**
Ameron	Amerlock 400BF	Amercoat 220	Same as second coat
Carboline	Sanitile 100	Carbocrylic 3359 DTM	Same as second coat
Devoe - AkzoNobel	Bloxfil 4000	Devflex 4208	Same as second coat
International	Intercryl 320	Intercryl 530	Same as second coat
Keeler & Long	Kolor-Tex HS Block Filler KLC6442	Aqua-Kolor Enamel KLWC1 Series	Same as second coat
Pittsburgh Paints	Pitt-Glaze 16-90	Pitt-Tech 90-374 Series	Same as second coat
Sherwin-Williams	PrepRite Block Filler B25W25	DTM Acrylic B66W 100 Series	Same as second coat
Tnemec	Series 54-1205 Masonry Filler	Series 1028 Enduratone	Same as second coat

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: J-2

SERVICE: Gypsum Board & Plaster – Normal Exposure Interior Walls

Surface Preparation: Clean and dry.

First Coat: Acrylic Sealer. Apply at 1.5 to 2.0 mils (38 to 50 microns) dry film thickness.

Second Coat: Water reducible acrylic coating with minimum 34% solids by volume, semi-gloss finish. Apply at 1.5 to 2.0 mils (38 to 50 microns) dry film thickness.

Third Coat: Same as second coat.

System Total: Minimum 4.5 mils (114 microns) dry film thickness.

Volatile Organic Content: Maximum 2.8 lb/gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	TOUCH UP	SECOND COAT	THIRD COAT
Carboline	Carbocrylic 120		Carbocrylic 3359	Same as second coat
Glidden Professional	High Hide Acrylic Primer 1000		Ultra Hide 250 1406	Same as second coat
International	Intercryl 530		Intercryl 530	Same as second coat
PPG	Speedhide Latex Primer 6-2		Speedhide Zero S.G. 6-4510	Same as second coat
Sherwin-Williams	ProMar 200 Primer B28W8200		ProMar 200 Latex B31W200 Series	Same as second coat
Tnemec	PVA Sealer 512 Series 51-1204		Series 1029 Enduratone	Same as second coat

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: K-2

SERVICE: Wood, Clear Finish Interior

Surface Preparation: Sand smooth, clean and dry. Sand between coats.

First Coat: Clear, urethane varnish with minimum 40% solids by volume. Satin finish. Thin first coat with mineral spirits as recommended by varnish manufacturer for type of wood to be sealed.

Second Coat: Same as first coat, except do not thin. Apply full coat.

Third Coat: Same as second coat.

System Total: Per manufacturer's recommendations.

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	TOUCH UP	SECOND COAT	THIRD COAT
PPG	Olympic WB Sanding Sealer 41061		Olympic Int. Polyurethane 42786	Same as second coat
Sherwin-Williams	Polyurethane Varnish A67 Series		Same as first coat, but do not thin	Same as second coat
	Note: Product numbers shown are for satin finish. Revise if desiring a gloss finish.			

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: K-5

SERVICE: Wood and Plywood – Exterior or Interior, Normal Exposure

Surface Preparation: Sand smooth, clean and dry.

First Coat: Alkyd exterior wood primer with minimum 42% solids by volume. Apply at 1.5 to 2.5 mils (38 to 63 microns) dry film thickness.

Second Coat: Alkyd gloss enamel with minimum 40% solids by volume. Apply at 1.5 to 2.0 mils (38 to 50 microns) dry film thickness.

Third Coat: Same as second coat.

System Total: Minimum 4.5 mils (114 microns) dry film thickness.

Volatile Organic Content: Maximum 3.5 lb/gal.

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	TOUCH UP	SECOND COAT	THIRD COAT
Ameron	Amercoat 5105		Amercoat 5450	Same as second coat
Carboline	Carbocoat 150 HG		Carbocoat 45	Same as second coat
Glidden Professional	Ultra-Hide Durus 2110		Devguard 4348	Same as second coat
International	Interlac 393		Interlac 665	Same as second coat
Keeler & Long	Tri-Polar Primer No. KL6040		Fumeproof Enamel KLBC1 Series	Same as second coat
PPG	Speedhide Exterior Latex		Speedhide WB Alkyd 6-1610	Same as second coat
Sherwin-Williams	A-100 Exterior Wood Primer		Industrial Enamel B54Z Series	Same as second coat
Tnemec	Primer Series 10-99W		Hi-Build Tneme-Gloss 2 H	Same as second coat

SECTION 10 14 00 – SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes the following:
   1. Interior melamine plastic-laminate Plaques.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International:
   1. ASTM D256 - Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
   2. ASTM D638 - Test Method for Tensile Properties of Plastics.
   3. ASTM D648 - Test Method for Deflection Temperature of Plastics Under Flexural Load in Edgewise Position.
   4. ASTM D790 - Test Method for Flexural Properties for Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   5. ASTM D1044 - Test Method for Resistance of Transparent Plastics to Surface Abrasion.
   6. ASTM D4802 - Specification for Poly(Methyl Methacrylate) Acrylic Plastic Sheet
C. International Code Council/American National Standards Institute:
   1. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
D. NFPA:
   1. NFPA 70 - National Electrical Code.
E. U.S. Architectural & Transportation Barriers Compliance Board:
   1. Americans with Disabilities Act (ADA) Accessibility Guidelines for Build.

1.04 DEFINITIONS:

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.05 SUBMITTALS:

A. Product Data: For each type of product indicated.
B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
C. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Plaque: 6 inches (150 mm) square.
   2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter, number, and graphic element).
D. Sign Schedule.

1.06 QUALITY ASSURANCE:

A. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

B. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.07 PROJECT CONDITIONS:

A. Weather Limitations: Proceed with installation only when weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.08 WARRANTY:

A. Special Warranty: Manufacturer's standard form in which 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 polymer finishes beyond normal weathering.
    b. Deterioration of embedded graphic image colors and sign lamination.

B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Aluminum Castings: ASTM B26/B26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

B. Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.02 DIMENSIONAL CHARACTERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ACE Sign Systems, Inc.
2. Advance Corporation; Braille-Tac Division.
3. A. R. K. Ramos.
4. ASI-Modulex, Inc.
5. Bunting Graphics, Inc.
6. Charleston Industries, Inc.
7. Gemini Incorporated.
8. Grimco, Inc.
9. Innerface Sign Systems, Inc.
10. Metal Arts; Div. of L&H Mfg. Co.
11. Mills Manufacturing Company.
12. Mohawk Sign Systems.
13. Nelson-Harkins Industries.
14. Signature Signs, Incorporated.
15. Southwell Company (The).

B. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.
   1. Character Material: Aluminum.
   2. Thickness: 5/8 inches.
   3. Color(s): As indicated on Drawings.
   4. Mounting: Concealed studs for substrates encountered.

C. Aluminum Extrusions: Comply with the following requirements:
   1. Finish: Anodized.
   2. Thickness: 5/8 inches.
   3. Color(s): As indicated on drawings.
   4. Mounting: Concealed studs for substrates encountered on 1 ½" standoffs.

D. Dimensional Character Sign Schedule:
   1. Sign Type, Exterior Facility Sign:
      a. Sign Size: As Indicated.
      b. Character Size: As indicated.
      c. Text/Message: As indicated.
      d. Location: North Entrance.

2.03 PANEL SIGNS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. ACE Sign Systems, Inc.
   2. Advance Corporation; Braille-Tac Division.
   3. Allen Industries Architectural Signage
   4. Allenite Signs; Allen Marking Products, Inc.
   5. APCO Graphics, Inc.
   6. ASI-Modulex, Inc.
   7. Best Sign Systems Inc.
   8. Bunting Graphics, Inc.
   9. Fossil Industries, Inc.
   10. Gemini Incorporated.
   11. Grimco, Inc.
   12. Innerface Sign Systems, Inc.
   13. InPro Corporation
   14. Matthews International Corporation; Bronze Division.
   15. Mills Manufacturing Company.
   16. Mohawk Sign Systems.
   17. Nelson-Harkins Industries.
   18. Seton Identification Products.
   19. Signature Signs, Incorporated.
   20. Supersine Company (The).

B. Laminated Interior & Exterior Signs: Solid phenolic panel core with graphic image covered with thermosetting resin face layer.
   1. Surface Finish: Mat or UV resistant, outdoor.
   2. Edge Condition: Beveled.

3. Corner Condition: Square.
4. Thickness: 1/8 inch.

C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

D. Panel Sign Schedule:
1. Sign Size: 8 inch by 8 inch.
2. Message Panel Finish/Color: White.
3. Background Finish/Color: Black.
4. Character Size: 5/8" high.
5. Character Finish/Color: White.
6. Sign Type; Picture Signs:
   a. Room: Women's Locker Room.
      (1) Location: On Door 106.
      (2) Image: Woman picture and handicap symbol.
      (3) Text/Message: Restroom.
   b. Room: Men's Locker Room.
      (1) Location: On Door 105.
      (2) Image: Man picture and handicap symbol.
      (3) Text/Message: Restroom.
   c. Room: Public Restroom.
      (1) Location: On Door 116.
      (2) Image: Unisex picture and handicap symbol.
      (3) Text/Message: Restroom.
7. Sign Type; Word Signs:
   a. Room: Utility Room.
      (1) Location: Outside Door 110.
      (2) Text/Message: Utility.
   b. Room: Electrical Room.
      (1) Location: Outside Door 110.
      (2) Text/Message: Electrical/IT.

2.04 ACCESSORIES:

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.05 FABRICATION:

A. General: Provide manufacturer's standard signs of configurations indicated.
1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.

3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.06 FINISHES, GENERAL:

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 ALUMINUM FINISHES:

A. Color Anodic Finish: Manufacturer's standard Class 1 integrally colored or electrolytically deposited color anodic coating, 0.018 mm or thicker, in dark bronze applied over a satin directionally textured mechanical finish, complying with AAMA 611.

2.08 ACRYLIC SHEET FINISHES:

A. Colored Coatings for Acrylic Sheet: For copy colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
B. Verify that items are sized and located to accommodate signs.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
   2. Shim Plate Mounting: Provide 1/8-inch (3-mm) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and

condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Projected Mounting: Mount characters at projection distance from wall surface indicated.

3.03 CLEANING AND PROTECTION:

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 21 13.13 - METAL TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes painted steel toilet compartments, urinal screens and related accessories.

1.03 RELATED REQUIREMENTS:

A. Section 05 50 00 - Metal Fabrications for supports that attach ceiling-hung compartments to overhead structural system.

B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories for toilet tissue dispensers, grab bars, and similar accessories mounted on toilet compartments.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. ASTM International:

1. ASTM A653/A653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A666: Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM A743/A743M: Specification for Castings, Iron-Chromium, IronChromium-Nickel, Corrosion Resistant, for General Application.
4. ASTM A879/A879M: Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
5. ASTM B26/B26M: Specification for Aluminum-Alloy Sand Castings.
6. ASTM B86: Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.
7. ASTM B221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
8. ASTM B455: Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes.
9. ASTM B584: Specification for Copper Alloy Sand Castings for General Applications.
10. ASTM F446: Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

C. International Code Council:

1. ICC A117.1: Accessible and Usable Buildings and Facilities (ANSI).

D. U.S. Architectural & Transportation Barriers Compliance Board:

1. Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities. (Available in PDF at http://www.access-board.gov/ada-aba/final.pdf).

1.05 SUBMITTALS:

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, and attachment details.
2. Show locations of reinforcements for compartment-mounted grab bars and locations of blocking for surface-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch (152-mm) square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

D. Product Certificates: For each type of toilet compartment.

E. Maintenance Data: For toilet compartments to include in maintenance manuals.

F. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Door Hinges: Two hinges with associated fasteners.
2. Latch and Keeper: One latch and keeper with associated fasteners.
3. Door Bumper: Two door bumpers with associated fasteners.
4. Door Pull: One door pull with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.06 PROJECT CONDITIONS:

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.02 PAINTED STEEL TOILET COMPARTMENTS:

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Sanitary Partition Corporation.
2. Bradley Corporation; Mills Partitions.
3. Global Steel Products Corp.
4. Scranton Products.
5. Special-Lite.
6. Architect approved equal.

B. Toilet-Enclosure Style: Floor anchored.

C. Urinal-Screen Style: Wall hung, flat panel.

D. Door, Panel, and Pilaster Construction: Seamless, metal facing sheets pressure laminated to core material; with continuous, interlocking molding strip or lapped-and-formed edge closures; corners secured by welding or clips and exposed welds ground smooth. Exposed surfaces shall be free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.

1. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated Kraft paper in thickness required to provide finished thickness of 1 inch (25 mm) for doors and panels and 1-1/4 inches (32 mm) for pilasters.
2. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.

E. Urinal-Screen Construction:
1. Flat-Panel Urinal Screen: Matching panel construction.

F. Facing Sheets and Closures: Electrolytically coated steel sheet with nominal base-metal (uncoated) thicknesses as follows:
1. Pilasters, Braced at Both Ends: Manufacturer's standard thickness, but not less than 0.036 inch.
2. Pilasters, Unbraced at One End: Manufacturer's standard thickness, but not less than 0.048 inch.
3. Panels: Manufacturer's standard thickness, but not less than 0.030 inch.
4. Doors: Manufacturer's standard thickness, but not less than 0.030 inch.
5. Flat-Panel Urinal Screens: Thickness matching the panels.

G. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

H. Brackets (Fittings):
1. Stirrup Type: Ear or U-brackets; stainless steel.

I. Steel Sheet Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish, including thermosetting, electrostatically applied, and powder coatings. Comply with coating manufacturer's written instructions for applying and baking.
1. Color: As selected by Architect from manufacturer's full range.

2.03 HARDWARE AND ACCESSORIES:

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
1. Material: Stainless steel.
2. Hinges: Manufacturer's standard continuous, spring-loaded type, allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.04 MATERIALS:

A. Steel Sheet: Commercial steel sheet for exposed applications; mill phosphatized and selected for smoothness.

1. Electrolytically Zinc-Coated: ASTM A879/A879M, 01Z (03G).
2. Hot-Dip Galvanized: ASTM A653/A653M, either hot-dip galvanized or galvannealed.

B. Stainless-Steel Sheet: ASTM A666, Type 304, stretcher-leveled standard of flatness.
C. Stainless-Steel Castings: ASTM A743/A743M.

2.05 FABRICATION:

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories, and solid blocking within panel where required for attachment of toilet accessories.
B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
C. Door Size and Swings: Unless otherwise indicated, provide 24-inch (610-mm) wide, doors for standard toilet compartments and 36-inch (914-mm) wide, doors with a minimum 32-inch (813-mm) wide, clear opening for compartments designated as accessible. Provide swing direction as indicated on the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
   1. Confirm location and adequacy of blocking and supports required for installation.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. Coordinate layout and installation of supports, inserts, and anchors built into other units of work for toilet compartment anchorage.

3.02 INSTALLATION:

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position indicated with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch (13 mm).
      b. Panels and Walls: 1 inch (25 mm).
   2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.
      a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.
B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.03 ADJUSTING:

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open

approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.13

SECTION 10 28 00 – TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Public-use washroom accessories.
   2. Under lavatory guards.
   3. Custodial accessories.

1.03 RELATED REQUIREMENTS:

A. Section 09 30 13 - Ceramic Tiling for ceramic toilet and bath accessories.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. ASTM International:
   1. A153/A153M: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. A653/A653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. A666: Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
   4. A1008/A1008M: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   5. B16/B16M: Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
   6. B19: Specification for Cartridge Brass Sheet, Strip, Plate, Bar, and Disks.
   7. B30: Specification for Copper Alloys in Ingot Form.
   8. B456: Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
   9. C1503: Specification for Silvered Flat Glass Mirror.
   10. F446: Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area.

C. NFPA:
   1. 70: National Electrical Code.

1.05 SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Samples: Full size, for each exposed product.
   1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

D. Sample Warranty: For manufacturer's special warranty.

E. Maintenance Data: For accessories to include in maintenance manuals.

1.06 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.

1.07 WARRANTY:

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PUBLIC-USE WASHROOM ACCESSORIES:

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Seat-Cover Dispenser <Mark B2>.

C. Combination Towel (Folded) Dispenser/Waste Receptacle <Mark B3>:
1. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
2. Mounting: Surface mounted.

D. Toilet Tissue (Roll) Dispenser <Mark B4>

E. Grab Bar <Mark B5>:
1. Mounting: Flanges with concealed fasteners.

F. Mirror Unit <Mark B6>:
1. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts, or;
b. Wall bracket of galvanized steel equipped with concealed locking devices requiring a special tool to remove.
2. Size: As indicated on Drawings.

G. Sanitary-Napkin Disposal Unit <Mark B7>:
1. Receptacle: Removable.

H. Automatic Liquid-Soap Dispenser <Mark B8>:
1. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing antibacterial soap in liquid or lotion form.

I. Coat Hook (Installed on the back of toilet partition doors):
1. Description: Double-prong unit.
2. Material and Finish: Stainless steel, No. 4 finish (satin).

2.02 UNDER LAVATORY GUARDS:

A. Under lavatory Guard
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded plastic, white.

2.03 CUSTODIAL ACCESSORIES:

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
B. Combination Utility Shelf with Mop and Broom Holder<Mark B11>:
   1. Description: Unit with shelf, hooks and holders.
   2. Length: 34 inches (914 mm).
   3. Hooks: Four.
   4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
   5. Material and Finish: Stainless steel, No. 4 finish (satin).

2.04 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

3.01 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. (1112 N), when tested according to ASTM F446.

3.02 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 instructions.

END OF SECTION 10 28 00

SECTION 10 44 16 – FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. NFPA:

1. NFPA 10: Portable Fire Extinguishers.

1.04 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. Warranty: Sample of special warranty.

C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.05 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: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS:

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet 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. Amerex Corporation.
   b. Ansul Incorporated.
   c. Badger Fire Protection.
   d. Buckeye Fire Equipment Company.

e. Fire End & Croker Corporation.
f. Guardian Fire Equipment, Inc.
g. JL Industries, Inc.; a division of the Activar Construction Products Group.
h. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
i. Larsens Manufacturing Company.
j. Moon American.
k. Nystrom Building Products.
l. Pem All Fire Extinguisher Corp.
m. Potter Roemer LLC.
n. Pyro-Chem; Tyco Safety Products.
o. Strike First Corporation of America.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL rated 2-A:10-B:C, 5-lb. nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

C. Clean-Agent Type in Steel Container: UL rated 5-B:C, 5-lb. nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.

2.03 MOUNTING BRACKETS:

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
1. Manufacturers: Same as extinguisher provided.

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.

C.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION:

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
1. Mounting Brackets: 5 ft. 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

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Welded athletic lockers.
   2. Locker benches.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. ASTM International:
   1. ASTM A500/A500M: Specification for Cold-Formed Welded and Seamless Carbon-Steel Structural Tubing in Rounds and Shapes.
   2. ASTM A653/A653M: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A666-03: Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
   4. ASTM A1008/A1008M: Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   5. ASTM B221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   6. ASTM D6007: Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small-Scale Chamber.
   7. ASTM E1333: Test Method for Determining Formaldehyde Concentration in Air and Emission Rates from Wood Products Using a Large Chamber.
   8. ASTM F1267: Specification for Metal, Expanded, Steel.

C. California Air Resources Board (1001 "I" Street, Sacramento, CA 95814: www.arb.ca.gov; 800242-4450):
   1. Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products.

D. California Department of Public Health:
   1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers.

E. International Code Council:
   1. ICC A117.1: Accessible and Usable Buildings and Facilities (ANSI).

F. National Electrical Manufacturers Association:
   1. NEMA LD 3: High-Pressure Decorative Laminates.

G. U.S. Architectural & Transportation Barriers Compliance Board:
   1. Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities.

1.04 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 [and bench].

B. Shop Drawings: For metal lockers.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Show locker trim and accessories.

C. Samples: For each color specified, in manufacturer's standard size.

D. Product Schedule: For lockers.

E. Qualification Data: For Installer.

F. Sample Warranty: For special warranty.

G. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

H. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Full-size units of the following metal locker hardware items equal to 10% of amount installed for each type and finish installed, but no fewer than 2 units:
      a. Identification plates.
      b. Hooks.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.06 FIELD CONDITIONS:

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.07 COORDINATION:

A. 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.

1.08 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 Welded Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single locker manufacturer.
   1. Obtain locks from single lock manufacturer.

2.02 PERFORMANCE REQUIREMENTS:

A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1.

2.03 WELDED ATHLETIC LOCKERS:

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Penco Products, Inc.
   2. DeBourgh Mfg. Co. (Basis of Design)
   3. Olympus Lockers & Storage Products, Inc.
   4. Engineer approved equal.

B. Expanded-Metal Doors: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angle frame; with 0.090-inch (2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness, steel sheet retainer welded to door frame.

C. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
   1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
   2. Backs: 0.048-inch (1.21-mm) nominal thickness.
   3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

D. Unperforated Sides: Fabricated from 0.060-inch (1.52-mm)nominal-thickness steel sheet.

E. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.097-inch (2.45-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded 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. Hinges: Manufacturer's standard, steel, continuous or knuckle type.

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. Single-Point Latching: Nonmoving latch hook with steel padlock loop that projects through recessed cup and is finished to match metal locker body.
      a. Latch Hook: Equip each door with one latch hook, fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

H. Locks: Provided by owner.

I. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

J. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

K. Coat Rods: Manufacturer's standard.

L. Continuous Zee Base: 4 inches (102 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.

M. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

N. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

2. Expanded Metal: ASTM F1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70% open area.

O. Finish: Baked enamel or powder coat.
1. Color: As selected by Architect from manufacturer's full range .

2.04 LOCKER BENCHES:

A. Provide bench units with overall assembly height of 17-1/2 inches (445 mm).
B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.
1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick (241 mm wide by 32 mm thick).
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.
C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
1. Tubular Steel: 1-1/2-inch (38-mm) diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; powder-coat finish; anchored with exposed fasteners.
D. Materials:
1. Stainless Steel: ASTM A666, Type 304.
2. Plastic Laminate: NEMA LD 3, Grade HGP.
3. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
4. Steel Tube: ASTM A500/A500 M, cold rolled.
5. Particleboard: ANSI A208.1, Grade M-2.

2.05 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 and two single-prong wall hooks.
2. Coat Rods: In lieu of ceiling hook.
D. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for preassembly at plant prior to shipping.
E. Accessible Lockers: Fabricate as follows:
1. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
F. Continuous Base: Formed into channel or zee profile for stiffness and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; 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.

2.06 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 for corrosion resistance.

PART 3 - EXECUTION

3.01 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.

3.02 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 (910 mm) 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.
   b. Attach plates to upper shelf of each open-front metal locker, centered, with a 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.

E. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.03 ADJUSTING:

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.04 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 12 24 13 – ROLLER WINDOW SHADES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. Section Includes:
   1. Manually operated roller shades with single rollers at every window.

1.03 REFERENCED STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. NFPA:
   1. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
C. Window Covering Manufacturers Association:
   1. WCMA A 100.1 - Safety of Corded Window Covering Products (ANSI).

1.04 SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.
D. Product Schedule: For roller shades.
E. Qualification Data: For Installer.
F. Product Certificates: For each type of shade and material.
G. Operation and Maintenance Data: For roller shades to include in maintenance manuals.
H. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.05 QUALITY ASSURANCE:

A. Installer Qualifications: Fabricator of products.
B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.07 FIELD CONDITIONS:

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.02 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS:

A. Basis-of-Design Product: Subject to compliance with requirements, provide Mecho/5 System or comparable product by one of the following:
   1. Hunter Douglas Contract.
   2. Lutron Electronics Co., Inc.
   3. MechoShade Systems, Inc.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Nickel-plated metal.
      a. Loop Length: Full length of roller shade.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Clip, jamb mount.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Roller Drive-End Location: Accessible, opposite end of furniture shown in plan. Indicate on shop drawings.
   2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
   3. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:
   1. Shadeband Material: Light-filtering fabric.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.

F. Installation Accessories:
   1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
      a. Shape: L-shaped.
      b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).

2. Endcap Covers: To cover exposed endcaps. Match fascia color.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.03 SHADEBAND MATERIALS:

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
   1. Source: Roller shade manufacturer.
   2. Type: PVC-coated polyester.
   3. Weave: Reversible Satin.
   4. Thickness: 0.03 inches .
   5. Roll Width: To match window.
   6. Openness Factor: 2 percent.
   7. Color: As selected by Architect from manufacturer's full range.

2.04 ROLLER SHADE FABRICATION:

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER SHADE INSTALLATION:

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
   1. Opaque Shadebands: Located so shadeband is not closer than 3 inches to interior face of glass. Allow clearances for window operation hardware.
B. Roller Shade Locations:
   1. Administration building: At all exterior windows.
   2. Scale House: At all widows except the transaction windows.

3.03 ADJUSTING:

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION:

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades.

END OF SECTION 12 24 13

SECTION 12 48 13 – ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Resilient entrance mats.
   2. Recessed frames.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American Architectural Manufacturers Association (AAMA):
   1. 611 - Voluntary Specifications for Anodized Architectural Aluminum
C. ASTM International:
   1. B221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. B455 - Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes.
D. International Code Council (ICC):
   1. A117.1 - Accessible and Usable Buildings and Facilities (ANSI).
E. National Association of Architectural Metal Manufacturers (NAAMM):
   1. Metal Finishes Manual for Architectural and Metal Products.
F. U.S. Architectural & Transportation Barriers Compliance Board:
   1. Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities. Adopted in 2004.

1.04 COORDINATION:

A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.05 SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
B. Shop Drawings:
   1. Items penetrating floor mats and frames, including door control devices.
   2. Divisions between mat sections.
   3. Perimeter floor moldings.
C. Samples: For the following products, in manufacturer's standard sizes:
   1. Floor Mat: Assembled sections of floor mat.
   2. Tread Rail: Sample of each type and color.
   3. Frame Members: Sample of each type and color.
D. Maintenance Data: For floor mats and frames to include in maintenance manuals.
E. Extra Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Resilient-Tile Entrance Mats: Full-size tile units equal to 2% of amount installed, but no fewer than 5 units.

PART 2 - PRODUCTS

2.01 ENTRANCE FLOOR MATS AND FRAMES, GENERAL:

A. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.

2.02 RESILIENT ENTRANCE MATS:

A. Basis-of-Design Product: Subject to compliance with requirements, provide Helix® HZ1 & HZ2 or a comparable product by one of the following:
   1. American Floor Products Company, Inc.
   2. C/S Group (Basis of Design).
   3. Musson Rubber Company.
   4. Architect approved equal.

2.03 FRAMES:

A. Recessed Frames: Manufacturer's standard extrusion.
   1. Extruded Aluminum: ASTM B221 (ASTM B221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
      a. Color: Clear.

2.04 CONCRETE FILL AND GROUT MATERIALS:

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.05 FABRICATION:

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
   1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.06 ALUMINUM FINISHES:

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.

1. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.03 PROTECTION:

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12 48 13

SECTION 13 34 20 – PRE-ENGINEERED METAL CANOPY FOR PHOTOVOLTAIC SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Pre-engineered Metal Canopy.

1.03 RELATED REQUIREMENTS:

A. Section 03 20 00 – Concrete Reinforcement.
B. Section 03 30 00 - Cast-In-Place Concrete.
C. Section 26 56 15 - Roadway and Parking Area Lighting.
D. Section 48 14 13 - Solar Energy Collectors.
E. Section 48 19 16 - Grid-Tie Utility Interactive Inverters.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American Institute of Steel Construction (AISC):
   1. 303 - Code of Standard Practice for Steel Buildings and Bridges.
   2. 325 - Steel Construction Manual-13th Edition.
   3. 360 - Specification for Structural Steel Buildings.
C. American Iron and Steel Institute (AISI):
   1. North American Specification for the Design of Cold-Formed Steel Structural Members.
D. American Society for Testing and Materials (ASTM):
   1. A36 - Carbon Structural Steel.
   2. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   6. A325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   7. A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   8. A529 - High-Strength Carbon-Manganese Steel of Structural Quality.
   9. A563 - Specification for Carbons and Alloy Steel Nuts.
   10. A572 High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   11. A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   12. A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   13. A792 - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   14. A992 - Specification for Structural Steel Shapes.
   15. A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   16. A1011 - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   17. B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

18. C1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
19. E329 - Specification for Agencies Engaged in Construction Inspection, Special Inspection, or Testing Materials Used in Construction.
20. F436 - Specification for Hardened Steel Washers (Metric).
21. F568M - Carbon and Alloy Steel Externally Threaded Metric Fasteners.
22. F844 - Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
23. F1554 - Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
24. F1852 - Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.

E. American Society of Civil Engineers (ASCE):
1. 7 - Minimum Design Loads for Buildings and Other Structures.

F. American Welding Society (AWS):
1. D1.1/D1.1M - Structural Welding Code - Steel.

G. Research council on Structural Connections (RCSC):
1. Specification for Structural Joints Using ASTM A325 (ASTM A325M) or A490 Bolts.

1.05 DEFINITIONS:

A. Canopy Length: Dimension of the canopy measured perpendicular to main framing, edge of canopy to edge of canopy.

B. Canopy Width: Dimension of the structure measured parallel to main framing, from edge of canopy to edge of canopy.

C. Clear Height under Structure: Vertical dimension from paving to lowest point of any part of primary or secondary structure.

1.06 SUBMITTALS:

A. Submit as specified in DIVISION 01.

B. Product Data: For each type of pre-engineered metal canopy component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
1. Pre-engineered metal canopy.
2. Canopy foundations.

C. Shop Drawings: For the following pre-engineered metal canopy components. Include plans, elevations, sections, details, and attachments to other work.
1. Foundation Plans: Submit foundation locations, sizes and design calculations
2. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach canopy frame to foundation.
3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
   a. Show provisions for attaching photovoltaic (PV) modules to structure.
4. Photovoltaic Module Panel Layout Drawings: Show layouts of PV panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
5. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:8).
   a. Flashing and trim.

b. Lighting.

D. Delegated-Design Submittal: For structural and electrical systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Calculations: Include structural calculations for framing and component design including calculations for foundations, anchorage and drift. Calculations shall be performed and sealed by a professional engineer responsible for their preparation.

F. Welding certificates.

G. Erector certificates.

H. Metal Canopy Certificates: For each type of canopy, 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. Canopy 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.
      i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

I. Material Test Reports: For each of the following products:
   1. Structural steel including chemical and physical properties.
   2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   3. Tension-control, high-strength, bolt-nut-washer assemblies.
   4. Shop primers.
   5. Nonshrink grout.

J. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

K. Source quality-control reports.

L. Field quality-control reports.

M. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

1.07 QUALITY ASSURANCE:

A. Manufacturer Qualifications: A qualified manufacturer.
   1. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer licensed to work in the state of Wyoming.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

1. Source Limitations: Obtain pre-engineered metal canopy including photovoltaic modules, inverter and all other additional components from single source who will manufacture and install the canopy and provide both post-installation inspection and installation inspection report.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

E. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

F. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Handle and store all steel and appurtenances as specified in DIVISION 01 and DIVISION 05.

1.09 PROJECT SITE CONDITIONS:

A. Weather Limitations: Proceed with installation only when weather conditions permit canopy to be installed according to manufacturers' written instructions and warranty requirements.

B. Coordination:
   1. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in DIVISION 03, Section "Concrete."
   2. Coordinate installation of photovoltaic modules, which are specified in Section 48 14 13 - Solar Energy Collectors, and inverters, which are specified in Section 48 19 16 - Grid-Tie Utility Interactive Inverters.
   3. Coordinate installation of all lighting, lighting attachments and accessories.
      a. Ensure all products and designs are compatible with photovoltaic modules.

1.10 WARRANTY:

A. Manufacturer shall provide a one-year warranty on products to be free of defects in materials, leaks, and workmanship for one year from date of substantial completion. In addition, provide the manufacturer's warranty on all accessory items.

PART 2 - PRODUCTS

2.01 PRE-ENGINEERED METAL CANOPY FOR PHOTOVOLTAIC SYSTEM:

A. Description: Provide a complete, integrated set of mutually dependent components and assemblies that form a photovoltaic system and metal canopy frame capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure.
   1. Provide pre-engineered metal canopy consisting of a structural frame supporting a series of connected photovoltaic modules.

B. Primary-Frame Type:

1. Single Column, Cantilever Design: Solid-member, structural-framing system with center post supporting photovoltaic modules. Posts shall be located between parking spaces. See civil drawings for parking layout.

C. Secondary-Frame Type: Manufacturer's standard galvanized purlins.

D. Clearance: A minimum of clearance of 10’ shall be maintained at the lowest point of the canopy.

E. Photovoltaic Modules: The total coverage of the PV panels shall be as indicated by the Drawings.

2.02 PRE-ENGINEERED METAL CANOPY PERFORMANCE:

A. Delegated Design: Provide a pre-engineered metal canopy, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Pre-engineered metal canopy shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in ASCE's "7 - Minimum Design Loads for Buildings and Other Structures."

1. Design Loads:
   a. Dead Loads: Weight of canopy and photovoltaic system.
   b. Live Loads: The design shall include the following uniform load or concentrated load, whichever produces the maximum load effects:
      (1) 20 psf.
      (2) 300-pound concentrated load located so as to produce the maximum load effect to the canopy.
   c. Collateral Loads: 5 psf (Live Load).
   d. Snow Loads:
      (1) Ground Snow Load (P_g): 30 psf
      (2) Importance factor: 1.0
      (3) Flat Roof Snow Load (P_f): 18.9psf
   e. Wind Loads: Determine loads based on the following minimum design criteria:
      (1) Design Code: ASCE7-16
      (2) Basic Wind Speed: 115mph.
      (3) Importance Factor: 1.0.
      (4) Exposure Category: C.
   f. Seismic Performance: Provide pre-engineered metal canopy capable of withstanding the effects of earthquake motions determined in accordance with the following design criteria:
      (1) Design Code: ASCE7-16.
      (2) Sds = 0.207.
      (3) Sd1 = 0.089.
      (4) Importance Factor: 1.0.
      (5) Site Class: D.
      (6) Seismic Design Category: B.
   g. Geotechnical Information:
      (1) Frost Depth: 36-inches.
      (2) Active Pressure: 45 psf/ft.
      (3) Passive Pressure: 150psf/ft.
      (4) Bearing Pressure: 3,000psf.

(5) Coefficient of Friction: 0.25.

2. Deflection Limits: Design canopy to withstand design loads with deflections no greater than the following:
   a. Primary Framing: Vertical deflection of l/120 of the span.
   b. Purlins and Rafters: Vertical deflection of 1/180 of the span.
   c. Girts: Horizontal deflection of 1/180 of the span.
   d. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
   e. Deflections shall meet or exceed allowable deflections required by photovoltaic panels.
3. Drift Limits: Engineer canopy to withstand design loads with drift limits no greater than the following:
   a. Lateral Drift: Maximum of 1/200 of the canopy height for wind loading, maximum of 1/100 of the canopy height for seismic loading.
   b. Drift shall meet or exceed allowable drift required by photovoltaic panels.
4. Structural System: Load path shall be from the post through the base plate and anchor bolts into the foundation.

C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120ºF (67ºC), ambient; 180ºF (100ºC), material surfaces.

D. Wind-Uplift Resistance: Provide Photovoltaic assemblies that resist wind-uplift loads per ASCE 7.

E. Design Analysis: The design analysis shall be the design of a licensed professional engineer experienced in design of this work. Submittal shall include complete calculations for the canopy and its components and shall be sealed by a professional engineer licensed in the state of Wyoming.

F. Foundations: Foundations shall be designed by a licensed professional engineer. Submittal shall include complete calculations for the foundations, including all soil parameters used and shall be sealed by a professional engineer licensed in the state of Wyoming.

2.03 STRUCTURAL-STEEL FRAMING:

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements.
   1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
      a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Contracting Officer.
   2. Single column, Cantilever Design: Solid-member, structural-framing system with center post supporting photovoltaic modules. Steel sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. All steel shall be galvanized.
   3. Frame Configuration: Monoslope cantilever.

B. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, base members, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, galvanized, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch (64-mm) wide flanges.
   a. Depth: As needed to comply with system performance requirements.
2. Purlin Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
3. 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.

C. Bolts: Provide hot-dip galvanized bolts for structural-framing components that are galvanized.

D. Materials:
1. W-Shapes: ASTM A992; ASTM A572, Grade 50 or 55 (345); or ASTM A529, Grade 50 or 55 (345).
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36; ASTM A572, Grade 50 or 55 (345 or 380); or ASTM A529, Grade 50 or 55 (345 or 380).
3. Plate and Bar: ASTM A36; ASTM A572, Grade 50 or 55 (345 or 380); or ASTM A529, Grade 50 or 55 (345 or 380).
4. Steel Tubing or Pipe: ASTM A500, Grade B; ASTM 501; or ASTM A53/Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A570, Structural Steel (SS), Grade 50 or Grade 55; hot-rolled, ASTM A568; or cold-rolled, ASTM A611, structural-quality, matte (dull) finish.
7. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, structural quality, Grade 50, with G60 (Z180) coating designation: Mill phosphatized.
8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755.
   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, Structural Steel (SS), Grades 33 through 80 (230 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.
9. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A (ASTM F568M, Property Class 4.6), carbon-steel, hex-head bolts; ASTM A563 (ASTM A563M) carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
   a. Finish: Mechanically deposited zinc coating, ASTM B695, Class 50.
10. High-Strength Bolts, Nuts, and Washers: ASTM F3125 Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563 (ASTM A563M) heavy-hex carbon-steel nuts; and ASTM F436 (ASTM F436M) hardened carbon-steel washers.
   a. Finish: Mechanically deposited zinc coating, ASTM B695, Class 50.
11. Anchor Rods: ASTM F1554.
12. Recycled Content of Steel Products: Provide steel products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25%.

E. Protective Coating Materials for Structural and Miscellaneous Framing:
1. General Requirements: All steel members to be hot-dipped galvanized.

2.04 FOUNDATIONS

A. Foundations shall be located such that the centerline of foundation

B. Base of foundations shall extend below frost depth. Top of foundations terminate flush with the top of asphalt.

C. Foundations shall be either drilled caisson type or pedestal on spread footings.
D. Materials:
   1. Concrete is specified in Section 03 30 00.
   2. Reinforcing steel is specified in Section 03 20 00.

2.05 ACCESSORIES:

A. General: Provide accessories as standard with canopy manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes.
B. 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 Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
      b. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
      c. Installation screws shall be furnished with electrode deposited cadmium coating unless approved otherwise by the Engineer.
   2. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.06 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 requirements given by AISC Manual of Steel, AISI Specifications for the Design of Cold Formed Steel Members, ASTM Standard Specifications for General Requirements for rolled steel plates, shapes, sheets and bars for structural use.
C. 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. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
D. 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.

2.07 MISCELLANEOUS MATERIALS:

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and with a 30-minute working time.

PART 3 - EXECUTION

3.01 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.
   1. For the record, prepare written report, endorsed by Erector, listing conditions detrimental to performance of work.

B. Before erection proceeds, survey elevations and locations of concrete bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and canopy tolerances.
   1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Clean substrates of substances, including oil, grease, rolling compounds, incompatible primers, and loose mill scale, that impair bond of erection materials.

B. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

C. 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.

3.03 FOUNDATION INSTALLATION

A. Concrete installation shall conform to the requirements of Section 03 30 00.

3.04 ERECTION OF STRUCTURAL FRAMING:

A. Erect canopy according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from canopy manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- 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.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing: 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 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 A325" for bolt type and joint type specified.
      a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
   1. Provide rake or gable purlins with tight-fitting closure channels and fascia.
   2. Locate canopy framing as indicated.

H. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.05 REPAIRS:

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

END OF SECTION 13 34 20

SECTION 13 34 23.16 - FABRICATED SCALE HOUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. Section includes fabricated steel scale houses.

1.03 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for scale houses.
B. Shop Drawings: For scale houses. Include plans, elevations, sections, details, accessories, and fastening and anchorage details, including mechanical fasteners.
   1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates. Include location, diameter, and projection of anchor bolts required to attach scale houses to foundation. Indicate post reactions at each location.
C. Samples for Initial Selection: For each type of exposed finish.
D. Samples for Verification: For each type of exposed finish in manufacturer's standard sizes.
   1. Include Samples of wall panels and accessories to verify finish selection.

1.04 QUALITY ASSURANCE:

A. The building manufacturer shall have been engaged in the manufacture of similar equipment buildings for at least five years.
B. The Contractor and Engineer shall be provided the opportunity to verify all materials and workmanship are in accordance with these Specification and the Contract Drawings prior to delivery of the building to the job site.

1.05 INFORMATIONAL SUBMITTALS:

A. Sample Warranty: For special warranty.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver enclosure, pre-assembled to the extent possible, complete with factory installation of all equipment specified, f.o.b. jobsite unless noted otherwise, freight prepaid and allowed.
B. Enclosures and all components mounted thereon shall be designed for and anchored sufficiently for transportation to the jobsite. Protect all components from damage during shipment, unloading and installation.
C. Delivery truck shall be positioned adjacent to the foundation on the Project Site to facilitate lifting and setting on the foundation by others.
D. Enclosure shall be designed to rest on concrete foundations by others. Attachment locations and mounting details shall be provided as Submittals by the manufacturer.
E. Oversee, instruct and guide on-site contractor in proper off-loading and installation procedures of Equipment.

1.07 CLOSEOUT SUBMITTALS:

A. Maintenance Data: For scale houses to include in maintenance manuals.

1.08 COORDINATION:

A. Cast-in Anchorage: Coordinate installation of anchorages for scale houses. Furnish sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete bases. Include setting drawings, templates, and directions for installing anchorages. Deliver such items to Project site in time for installation.

1.09 WARRANTY:

A. Special Warranty: Manufacturer agrees to repair finish or replace scale houses that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

A. Structural Performance: Scale houses shall withstand the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
   1. Loads: As indicated on Drawings.
B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
D. Safety Glazing Products: Category II materials complying with testing requirements in 16 CFR 1201.
E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.02 FABRICATED STEEL SCALE HOUSE:

A. General: Fabricate scale houses from an integrated set of mutually dependent components to form a completed assembly, ready for installation on Project site.
B. Building Style: Standard square corners.
C. Structural Framework: Fabricated from 2-by-2-by-0.075-inch (50-by-50-by-1.90-mm) steel structural or mechanical tubing. Connect framework by welding.
D. Doors: As indicated on Drawings.
E. Windows: As indicated on Drawings, Glazed with clear insulating glass per section 2.02K.11
   1. Operable Windows: Equip windows with cam locks, weather stripping, and stainless steel ball-bearing rollers.
   2. Screens: Insect screens for each window.
   3. Corner Shape: Square.
F. Wall Panel Assembly: Assembly consisting of exterior face panel fabricated from 0.079-inch (2.01-mm) nominal-thickness, galvanized-steel sheet; and interior face panel fabricated from 0.064-inch (1.63-mm) nominal-thickness, galvanized-steel sheet; with insulation in cavity between exterior and interior face panels to meet R-Value indicated on Drawings.
G. Base/Floor Assembly: 4-inch- (102-mm-) high assembly consisting of perimeter frame welded to structural framework of booth. Fabricate frame from 2-by-4-inch (51-by-102-mm) galvanized-steel structural tubing; 0.108-inch (2.74-mm) nominal-thickness, C-shaped, galvanized-steel sheet channels; or galvanized structural-steel angles. Include anchor clips

fabricated from 1/4-inch- (6-mm-) thick galvanized-steel plate, predrilled and welded to exterior of integral floor frame.

1. Subfloor and Finished Floor: Assembly consisting of one layer of 3/4-inch- (19-mm-) thick plywood or oriented strand board.
    a. At restroom provide moisture resistant subfloor.
2. Floor Finishes – See performance criteria on drawings.
3. Base shall be insulated to meet the R-Value indicated on the Drawings.

H. Flat Roof/Ceiling Assembly: Assembly consisting of exterior roof panels, interior ceiling panels, and insulation between exterior and interior panels; sloped to drain at booth perimeter.

1. Insulated Exterior/Interior Panel: Fabricated from 0.028-inch (0.71-mm) nominal-thickness, galvanized-steel sheet faces and expanded-foam insulation core.
2. Provide ceiling assembly as indicated on Drawings.
3. Canopy Fascia: Fabricated from 0.079-inch (2.01-mm) nominal-thickness, galvanized-steel sheet, of manufacturer's standard design:
    a. Height: 6 inches (152 mm).
    b. Overhang: 4 inches (76 mm) beyond face of walls below.
4. Downspouts: Integral, extending 3 inches (76 mm) beyond booth walls, location as indicated on Drawings.

I. Accessories: Provide the following for each scale house:

1. Pre-plumbed restroom, with fixtures as shown on Drawings.
2. Ventilation fan.

J. Anchorage: Cast-in-place anchor bolts fabricated from non-ferrous or corrosion-resistant materials, with allowable load or strength design greater than or equal to the design load as determined by testing conducted by a qualified testing agency.

1. Anchor locations shall be concealed below the floor on the interior of the base frame.

K. Materials:

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, commercial quality, G90 (Z275) coating designation; mill phosphatized.
2. Steel Structural Tubing: ASTM A500/A500M, Grade B.
3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
4. Steel Mechanical Tubing: ASTM A513, welded-steel mechanical tubing.
5. Zinc-Coated (Galvanized) Steel: Hot-dip galvanized according to ASTM A123/A123M.
6. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
    a. Sheet: ASTM B209 (ASTM B209M).
    b. Extruded Shapes: ASTM B221 (ASTM B221M).
    c. Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T4 or Alloy 6061-T6.
7. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
8. Plastic Laminate: NEMA LD 3, HGS or HGL grade.
9. Plywood: DOC PS 1, Exterior grade.
10. Particleboard: ANSI A208.1, Grade M-2.
11. Clear Insulating Glass: ASTM E2190. Factory-assembled units consisting of two lites of 2.5-mm-thick clear float glass, ASTM C1036, Type I, Class 1, Quality q3, and dehydrated air space 3/4 inch (19 mm)and with manufacturer's standard dual seal.

L. Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.03 FABRICATION:

A. Factory fabricate scale houses completely.
B. Factory preglaze windows and doors.
C. Factory prewire scale houses, ready for connection to service at Project site.
D. Fabricate scale houses with lifting lugs on the roof.
E. Accessible Scale houses: Where indicated to be accessible, fabricate scale houses as follows:
   1. Provide service windows located no higher than 34 inches (865 mm) above exterior grade.
   2. Provide door opening with minimum 32-inch (813-mm) clear width.
   3. Provide minimum 60-inch (1525-mm) clear turning spacing within the booth.
   4. Provide minimum 27-inch (685-mm) clearance beneath interior work surfaces. Locate work surfaces 28 inches (710 mm) minimum and 34 inches (865 mm) maximum above the floor.
   5. Locate controls and operable parts no lower than 15 inches (381 mm) and no higher than 48 inches (1219 mm) above the floor where reach is unobstructed. Where side reach is obstructed, locate controls and operable parts no lower than 15 inches (381 mm) and no higher than 46 inches (1219 mm) above the floor.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including concrete bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.
B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before scale house installation.
C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install scale houses according to manufacturer's written instructions.
B. Accessible Scale houses: Install with interior floor surface at same elevation as adjacent paved surfaces.
C. Set scale houses plumb and aligned. Level baseplates true to plane with full bearing on concrete bases.
D. Fasten scale houses securely to concrete base with anchorage indicated by manufacturer.
E. Connect to electrical power service and data systems.
F. Perform startup checks of heating and cooling units according to manufacturer's written instructions.

3.03 ADJUSTING:

A. Adjust doors, operable windows, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.
B. Lubricate hardware and other moving parts.
C. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION 13 34 23.16

SECTION 22 05 17 – SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

1.02 SUMMARY:

A. This Section includes:
   1. Sleeves.
   2. Sleeve-seal systems.
   3. Grout.

1.03 SUBMITTALS:

A. Product data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES:

A. Galvanized-Steel-Pipe Sleeves: ASTM A53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.02 SLEEVE-SEAL SYSTEMS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metraflex Company (The).
   2. Link-Seal.
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.

2.03 GROUT:

A. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
B. Characteristics: Nonshrink; recommended for interior and exterior applications.
C. Design Mix: 5,000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION:

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1 inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.
C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches 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. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION:

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE:

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:
   a. Galvanized-steel-pipe sleeves.
2. Concrete Slabs-on-Grade:
   a. Galvanized-steel-pipe sleeves with sleeve-seal system.
      Select sleeve size to allow for 1 inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Interior Partitions:
   a. Galvanized-steel-pipe sleeves.

END OF SECTION 22 05 17

SECTION 22 05 18 – ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY:
- A. This Section includes:
  1. Escutcheons.

1.02 SUBMITTALS:
- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS:
- A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION:
- A. Install escutcheons for piping penetrations of walls and ceilings.
- 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 or split-casting 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, stamped-steel type.
     e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
     f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
     g. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

3.02 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

1.01 SUMMARY:

A. Section Includes:
   1. Light-activated thermometers.
   2. Thermowells.
   3. Dial-type pressure gages.
   4. Gage attachments.
   5. Test plugs.

1.02 SUBMITTALS:

A. Product Data: For each type of product indicated.
B. Product Certificates: For each type of meter and gage, from manufacturer.
C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 LIGHT-ACTIVATED THERMOMETERS:

A. Direct-Mounted, Light-Activated Thermometers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Flo Fab, Inc.
      b. REOTEMP Instrument Corporation.
      c. Trerice, H. O. Co.
      d. Weiss Instruments, Inc.
      e. WIKA Instrument Corporation - USA.
      f. Winters Instruments - U.S.
   2. Case: Plastic; 7-inch nominal size, unless otherwise indicated.
   3. Scale: ºF.
   4. Case Form: Adjustable angle.
   5. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
   6. Stem: Aluminum and of length to suit installation.
      a. Design for Thermowell Installation: Bare stem.
   7. Display: Digital.
   8. Accuracy: ±2ºF.

2.02 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. Type: Stepped shank, unless straight or tapered shank is indicated.
   5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
   6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
   7. Bore: Diameter required to match thermometer bulb or stem.
   8. Insertion Length: Length required to match thermometer bulb or stem.
   9. Lagging Extension: Include on thermowells for insulated piping and tubing.

10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.03 PRESSURE GAGES:

A. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements,
   a. Ashcroft, Inc.
   b. Flo Fab, Inc.
   c. Tel-Tru Manufacturing Company.
   d. Trerice, H. O. Co.
   e. Weiss Instruments, Inc.
   f. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, 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.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Accuracy: Grade A, ±1% of middle half of scale range.

2.04 GAGE ATTACHMENTS:

A. Snubbers: ASME B40.100, brass; with NPS 1/4, 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, ASME B1.20.1 pipe threads.

2.05 TEST PLUGS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. Flow Design, Inc.
2. Trerice, H. O. Co.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. 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, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200ºF.

F. Core Inserts: Chlorosulfonated polyethylene synthetic self-sealing rubber.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.
E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
G. Install valve and snubber in piping for each pressure gage for fluids.
H. Install test plugs in piping tees.
I. Install thermometers in the following locations:
    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.

3.02 CONNECTIONS:
A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING:
A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCALE-RANGE SCHEDULE:
A. Scale Range for Domestic Cold-Water Piping: 0 to 100ºF.
B. Scale Range for Domestic Hot-Water Piping: 0 to 250ºF.

3.05 PRESSURE-GAGE SCALE-RANGE SCHEDULE:
A. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION 22 05 19

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Bronze ball valves.
   2. Bronze swing check valves.

B. Related Sections:
   1. DIVISION 22 Plumbing Piping Sections for specialty valves applicable to those sections only.
   2. SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT for valve tags and schedules.

1.02 DEFINITIONS:

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Nonrising stem.
E. OS&Y: Outside screw and yoke.
F. RS: Rising stem.
G. SWP: Steam working pressure.

1.03 SUBMITTALS:

A. Product Data: For each type of valve indicated.

1.04 QUALITY ASSURANCE:

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   2. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

1.05 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 angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

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.

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

2.01 GENERAL REQUIREMENTS FOR VALVES:

A. Refer to valve schedule articles for applications of valves.
B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
C. Valve Sizes: Same as upstream piping, unless otherwise indicated.
D. Valve Actuator Types:
   1. Handwheel: For valves other than quarter-turn types.
   2. Hand lever: For quarter-turn valves NPS 6 and smaller.
E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
F. Valve-End Connections:
   1. Solder Joint: With sockets according to ASME B16.18.
   2. Threaded: With threads according to ASME B1.20.1.
G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 SILICON BRONZE BALL VALVES:

A. Two-Piece, Regular-Port, Silicon Bronze Ball Valves with Stainless-Steel Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.; Apollo Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. NIBCO INC.
      d. Milwaukee Valve Company.
   2. Description:
      a. Standard: MSS SP-110.
      b. Maximum Pressure/Temperature Rating: 100 psig at 300ºF.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded or Solder.
      g. Seats: PTFE or TFE.
      h. Stem: Stainless steel.
      i. Ball: Stainless steel.
      j. Port: Regular.

2.03 SILICON BRONZE SWING CHECK VALVES:

A. Class 125, Silicon Bronze Swing Check Valves with Nonmetallic Disc:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Co.; Crane Valve Group; Crane Valves.
      b. Crane Co.; Crane Valve Group; Jenkins Valves.
      c. Crane Co.; Crane Valve Group; Stockham Division.
      d. Milwaukee Valve Company.
      e. NIBCO INC.
      f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-80, Type 4.

b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B584, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

PART 3 - EXECUTION

3.01 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 close. 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.

3.02 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.

3.03 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.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS:

A. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball valves.
2. Throttling Service: Ball valves.
B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
C. Select valves, except wafer types, with the following end connections:
1. For Copper Tubing, NPS 2 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: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Grooved-End Copper Tubing Piping: Valve ends may be grooved.

3.05 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE:

A. All Piping:
1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two-piece, regular port, bronze with stainless-steel trim.
3. Bronze Swing Check Valves: Class 125, nonmetallic disc.

END OF SECTION 020523

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.

1.02 SUBMITTALS:

A. Product Data: For each type of product indicated.
B. Welding Procedure Specification (WPS) and Welder Performance Qualification Record (WPQR)

1.03 QUALITY ASSURANCE:

A. Structural Steel Welding Qualifications: Qualify welding procedures, welders, and welding operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Pipe Welding Qualifications: Weld piping in accordance with qualified procedures using performance qualified welders and welding operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS:

A. Copper Pipe Hangers:
   1. Description: MSS SP-58, Types 1 through 58 (except as noted in PART 3 - EXECUTION), copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.02 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.

2.03 METAL FRAMING SYSTEMS:

A. MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cooper B-Line, Inc.
      b. Flex-Strut Inc.
      c. Powerstrut Corp.
      d. Unistrut Corporation; Tyco International, Ltd.
   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 carbon steel or stainless steel.
7. Metallic Coating: Electroplated zinc, Hot-dipped galvanized or Mill galvanized.
8. Paint Coating: Epoxy.

2.04 THERMAL-HANGER SHIELD INSERTS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carpenter & Paterson, Inc.
   2. PHS Industries, Inc.
   3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C533, Type I calcium silicate with 100-psig; ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig 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 beyond sheet metal shield for piping operating below ambient air temperature.

2.05 EQUIPMENT SUPPORTS:

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.06 MISCELLANEOUS MATERIALS:

A. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
B. Grout: ASTM C1107, 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: 5,000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 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 A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See DIVISION 22 Plumbing Fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
G. Install lateral bracing with pipe hangers and supports to prevent swaying.
H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
K. Insulated Piping:
    1. Attach clamps and spacers to piping.
        a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
        b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
        c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
    2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
        a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 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.
    4. Shield Dimensions for Pipe: Not less than the following:
        a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 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 qualified 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.

3.03 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.

3.04 PAINTING:
A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.05 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 copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
F. Use thermal-hanger shield inserts for insulated piping and tubing.
G. 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.
    2. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
H. 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.
    2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
I. 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. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
J. Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
    1. Exception: The following figure types given in Figure 1 of MSS SP-69 will not be acceptable: 19, 20, 23, 25, 27, 28, 29, 30, and 34.
    2. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
    3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
    4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
    5. 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 pounds.
        b. Medium (MSS Type 32): 1,500 pounds.
        c. Heavy (MSS Type 33): 3,000 pounds.

6. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
7. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

K. 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.

L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Valve tags.
   5. Warning tags.

1.02 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.

1.03 COORDINATION:

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.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS:

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   3. Background Color: White.
   4. Maximum Temperature: Able to withstand temperatures up to 160ºF.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 by 11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section

number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS:

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160ºF.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel rivets or self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS:

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
    1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
    2. Lettering Size: At least 1-1/2 inches high.

2.04 VALVE TAGS:

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
    1. Tag Material: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
    2. Fasteners: Brass wire-link or beaded chain; or S-hook.
B. 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.

2.05 WARNING TAGS:

A. Warning Tags: 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.
    2. Fasteners: Brass grommet and wire.
    3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.01 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.

3.02 EQUIPMENT LABEL INSTALLATION:

A. Install or permanently fasten labels on each major item of mechanical equipment.
B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION:

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 ft. along each run. Reduce intervals to 25 ft. in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
B. Pipe Label Color Schedule:
   1. Domestic Water Piping:
      a. Background Color: White.
      b. Letter Color: Black.
   2. Sanitary Waste Piping:
      a. Background Color: White.
      b. Letter Color: Black.

3.04 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, round.
      b. Hot Water: 1-1/2 inches, round.
   2. Valve-Tag Color:
      a. Cold Water: Natural.
      b. Hot Water: Natural.
   3. Letter Color:
      a. Cold Water: Black.
      b. Hot Water: Black.

3.05 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 19 – PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes requirements for insulating plumbing piping and devices.
   1. Indoor Domestic Hot and Cold Water Piping.
   2. Indoor Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities.

1.02 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 pipe expansion joints for each type of insulation.
   3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   4. Detail removable insulation at piping specialties, equipment connections, and access panels.
   5. Detail application of field-applied jackets.
   6. Detail application at linkages of control devices.

1.03 QUALITY ASSURANCE:

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.05 COORDINATION:

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 - 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.

1.06 SCHEDULING:

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS:

A. Comply with requirements in "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. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA, Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide products by one of 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.

2.02 INSULATING CEMENTS:

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. Ramco Insulation, Inc.; Super-Stik.

2.03 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. Products: Subject to compliance with requirements, provide products by one of 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.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
      b. Eagle Bridges - Marathon Industries; 225.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
      d. Mon-Eco Industries, Inc.; 22-25.

D. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation; 739, Dow Silicone.
      b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
      c. P.I.C. Plastics, Inc.; Welding Adhesive.
      d. Speedline Corporation; Polyco VP Adhesive.

2.04 MASTICS:

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
   1. Products: Subject to compliance with requirements, provide products by one of 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 E96, Procedure B, 0.013 perm at 43-mil dry film thickness.
   3. Service Temperature Range: -20 to +180ºF.
   4. Solids Content: ASTM D1644, 58% by volume and 70% by weight.
   5. Color: White.

2.05 SEALANTS:

A. Joint Sealants:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
      b. Eagle Bridges - Marathon Industries; 405.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Pittsburgh Corning Corporation; Pittseal 444.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Permanently flexible, elastomeric sealant.
   4. Service Temperature Range: +100 to +300ºF.
   5. Color: White or gray.

2.06 FACTORY-APPLIED JACKETS:

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, Kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C1136, Type II.

2.07 FIELD-APPLIED JACKETS:

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, 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, provide products by one of 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: White.
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.

2.08 TAPES:

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500%.
6. Tensile Strength: 18 lbf./inch in width.

2.09 SECUREMENTS:

A. Bands:

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H 14, 0.020 inch thick, 1/2 inch wide.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, galvanized steel.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire.

2.10 PROTECTIVE SHIELDING GUARDS:

A. Protective Shielding Pipe Covers:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Engineered Brass Company.
      b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
      c. McGuire Manufacturing.
      d. Plumberex.
      e. Truebro; a brand of IPS Corporation.
      f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
   2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION REQUIREMENTS:

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during application and finishing.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
M. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.
N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Cleanouts.

3.03 PENETRATIONS:

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
B. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in DIVISION 07.

3.04 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 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.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION:

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

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 manufacturers 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.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION:

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION:

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers 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.

3.08 FINISHES:

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Do not field paint aluminum or stainless-steel jackets.

3.09 PLUMBING PIPING INSULATION SCHEDULE, GENERAL:

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 PLUMBING PIPING INSULATION SCHEDULE:

A. Indoor Domestic Hot, Cold, and Recirculated Water:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE:

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Indoor or Outdoor Piping, Concealed:
   1. None.

C. Indoor or Outdoor Piping, Exposed, below 10 feet, and vertical piping at walls:
   1. PVC: 20 mils thick.

END OF SECTION 22 07 19

SECTION 22 11 16 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
   2. Encasement for piping.

1.02 SUBMITTALS:

A. Product Data: For piping, transition fittings, and dielectric fittings. Submit schedule of pipe materials used for each application.
B. System purging and disinfecting activities report.
C. Field quality-control reports.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS:

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Plastic piping components shall be marked with "NSF-pw."
C. Potable-water piping and components shall comply with 40 CFR 141, Subpart E including all amendments in place at the time of bids.

2.02 COPPER TUBE AND FITTINGS:

A. Hard Copper Tube: ASTM B88, Type K and ASTM B88, Type L water tube, drawn temper.
B. Soft Copper Tube: ASTM B88, Type K water tube, annealed temper.
C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
D. 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.

2.03 PIPING JOINING MATERIALS:

A. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
B. Solder Filler Metals: ASTM B32, lead-free alloys.
C. Flux: ASTM B813, water flushable.
D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.04 ENCASEMENT FOR PIPING:

A. Standard: ASTM A674 or AWWA C105/A21.5.
B. Form: Sheet or tube.
C. Color: Manufacturer’s standard.

2.05 TRANSITION FITTINGS:

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.3.
1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
   a. Dresser, Inc.; Piping Specialties Products.
   b. JCM Industries.
   c. Smith, Jay R. Mfg. Co.
   d. Smith-Blair, Inc.; a Sensus company.
   e. Viking Johnson.

2.06 DIELECTRIC FITTINGS:

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
   a. Hart Industries International, Inc.
   b. McDonald, A. Y. Mfg. Co.
   c. Watts; a division of Watts Water Technologies, Inc.
   d. Wilkins; a Zurn company.
   e. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig, 150 psig, or 250 psig at a minimum temperature of 180ºF. Pressure rating shall be minimum 20 psi above system design pressure.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Watts; a division of Watts Water Technologies, Inc.
   c. Wilkins; a Zurn company.
   d. Zurn Industries, LLC.
2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig (860 kPa) (82ºC), 150 psig (1035 kPa), 175 psig (1200 kPa) or 300 psig (2070 kPa) minimum at 180ºF. Pressure rating shall be minimum 20 psi above system design pressure.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.01 EARTHWORK:

A. Comply with requirements in DIVISION 31 for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION:

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated, unless deviations to layout are approved on coordination drawings.
B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
C. Install underground copper tube in PE encasement according to ASTM A674 or AWWA C105/A21.5.
D. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gauges in Section 22 05 19 - Meters and Gages for Plumbing Piping and with requirements for drain valves and strainers in Section 22 11 19 - Domestic Water Piping Specialties.
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 Section 22 11 19 - Domestic Water Piping Specialties.
G. Install domestic water piping level with 0.25% slope downward toward drain, unless otherwise indicated, and plumb.
H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
I. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless specifically indicated otherwise.
K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
L. Install piping to permit valve servicing.
M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below, unless otherwise indicated.
N. Install piping free of sags and bends.
O. Install fittings for changes in direction and branch connections.
P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
Q. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 - Meters and Gages for Plumbing Piping.
R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.
S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.
T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 - Escutcheons for Plumbing Piping.

3.03 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," "Brazed Joints" chapter.
E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
F. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION:
A. Install transition couplings at joints of dissimilar piping.
B. Transition Fittings in Underground Domestic Water Piping:
   1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
   2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

3.05 DIELECTRIC FITTING INSTALLATION:
A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.06 HANGER AND SUPPORT INSTALLATION:
A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   4. Base of Vertical Piping: MSS Type 52, spring hangers.
B. 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 and Smaller: 60 inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
   3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   4. NPS 2-1/2: 108 inches with 1/2-inch rod.
   5. NPS 3 to NPS 4: 10 feet with 1/2-inch rod.
E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.07 IDENTIFICATION:

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Label pressure piping with system operating pressure.

3.08 FIELD QUALITY CONTROL:

A. Perform the following tests and inspections:

1. Piping Inspections:
   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      (1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      (2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
   c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
   f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.09 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. 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.

4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING:

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         (1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         (2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Repeat procedures if biological examination shows contamination.
      e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as Work progresses.

3.11 PIPING SCHEDULE:

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints, unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping shall be one of the following:
   1. Soft copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
   1. Hard copper tube, ASTM B88, Type L; cast- or wrought-copper, solder-joint fittings; and brazed or soldered joints.

3.12 VALVE SCHEDULE:

A. All valves serving potable water systems shall meet the requirements of NSF 61.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller.
   2. Throttling Duty: Use ball valves for piping NPS 2 and smaller.
   3. Drain Duty: Hose-end drain valves.

C. 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

1.01 SUMMARY:

A. This Section includes:
   1. Vacuum breakers.
   2. Water pressure-reducing valves.
   3. Balancing valves.
   4. Strainers.
   5. Hose bibbs.
   6. Wall hydrants.
   7. Drain valves.
   8. Water-hammer arresters.
   9. Air vents.
   10. Trap-seal primer systems.
   11. Flexible connectors.

1.02 RELATED REQUIREMENTS:

A. Section 22 05 19 - Meters and Gauges for Plumbing Piping for thermometers, pressure gauges, and flow meters in domestic water piping.

1.03 SUBMITTALS:

A. Product Data: For each type of product.
B. Field quality-control reports.
C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES:

A. Potable-water piping and components shall comply with NSF 61 and 372.

2.02 PERFORMANCE REQUIREMENTS:

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

2.03 VACUUM BREAKERS:

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
      b. Conbraco Industries, Inc.
      c. FEBCO; a division of Watts Water Technologies, 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 1001.
   3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
   4. Body: Bronze.
   5. Inlet and Outlet Connections: Threaded.
   6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.
      b. MIFAB, Inc.
      c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
      d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
      e. Zurn Industries, LLC; Plumbing Products Group.
   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.

2.04 WATER PRESSURE-REDUCING VALVES:

A. Water Regulators:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cash Acme; a division of Reliance Worldwide Corporation.
      b. Conbraco Industries, Inc.
      c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
      d. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.
   2. Standard: ASSE 1003.
   3. Pressure Rating: Initial working pressure of 150 psig.
   4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
   5. End Connections: Threaded for NPS 2 and smaller, flanged for NPS 2-1/2 and NPS 3.
   6. Capacities and Characteristics: See Drawings.

2.05 BALANCING VALVES:

A. Copper-Alloy Calibrated Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong International, Inc.
      b. ITT Corporation; Bell & Gossett Div.
      c. NIBCO, Inc.
      d. TACO, Incorporated.
      e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
   3. Body: Brass or bronze.
   4. Size: Same as connected piping, but not larger than NPS 2.
   5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.06 STRAINERS FOR DOMESTIC WATER PIPING:

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
   2. Body:
      a. NPS 2 and Smaller: Bronze.

b. NPS 2-1/2 and Larger: Cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
a. Strainers NPS 2 and Smaller: 0.033 inches.
b. Strainers NPS 2-1/2 to NPS 4: 0.045 inches.
6. Drain: Pipe plug or factory-installed, hose-end drain valve as indicated.

2.07 HOSE BIBBS:

A. Hose Bibbs:
1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral 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: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
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.

2.08 WALL HYDRANTS:

A. Nonfreeze Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products.
f. Woodford Manufacturing Company; a division of WCM Industries, Inc.
g. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
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.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

2.09 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 minimum CWP.
   3. Size: NPS 3/4.
   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.

2.10 WATER-HAMMER ARRESTERS:

A. Water-Hammer Arresters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMTROL, Inc.
      b. Josam Company.
      c. Precision Plumbing Products, Inc.
      d. Sioux Chief Manufacturing Company, Inc.
      e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      f. Watts Drainage Products.
      g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.
   2. Standard: ASSE 1010 or PDI-WH 201.
   3. Type: Metal bellows.
   4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.11 AIR VENTS:

A. Welded-Construction Automatic Air Vents:
   1. Body: Stainless steel.
   2. Pressure Rating: 150-psig minimum pressure rating.
   3. Float: Replaceable, corrosion-resistant metal.
   4. Mechanism and Seat: Stainless steel.
   5. Size: NPS 3/8 minimum inlet.
   6. Inlet and Vent Outlet End Connections: Threaded.

2.12 TRAP-SEAL PRIMER SYSTEMS:

A. Trap-Seal Primer Systems:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Precision Plumbing Products, Inc.
      b. Engineer-approved equal.
   2. Standard: ASSE 1044.
   3. Piping: NPS 3/4, ASTM B88, Type L; copper, water tubing.
   4. Cabinet: Surface-mounted steel box with stainless-steel cover.
   5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120Vac power.
      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.
   6. Vacuum Breaker: ASSE 1001.

7. Number Outlets: Six.
8. Size Outlets: NPS 1/2.

2.13 FLEXIBLE CONNECTORS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hyspan Precision Products, Inc.
   2. Metraflex, Inc.
   3. Engineer-approved equal.
B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
   1. Working-Pressure Rating: Minimum 250 psig.
   2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment (refrigerator) and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
B. Install water regulators with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.
C. Install water-control valves with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.
D. Install balancing valves in locations where they can easily be adjusted.
E. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.
F. Install water-hammer arresters in water piping according to PDI-WH 201.
G. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.
H. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1%, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.02 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. Water pressure-reducing valves.
   3. Calibrated balancing valves.
   4. Trap-seal primer systems.
B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.03 FIELD QUALITY CONTROL:

A. Perform the following tests and inspections:
   1. Test each pressure vacuum breaker and 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.

3.04 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 16 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY:
- A. This Section includes:
  1. Pipe, tube, and fittings.
  2. Specialty pipe fittings.

1.02 PERFORMANCE REQUIREMENTS:
- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.03 ACTION SUBMITTALS:
- A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS:
- A. Field quality-control reports.

1.05 QUALITY ASSURANCE:
- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS:
- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS:
- A. Pipe and Fittings: ASTM A888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. CISPI, Hubless-Piping Couplings:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
     a. ANACO-Husky.
     b. Dallas Specialty & Mfg. Co.
     c. Fernco, Inc.
     d. Matco-Norca, Inc.
     e. MIFAB, Inc.
     f. Mission Rubber Company; a division of MCP Industries, Inc.
     g. Stant.
     h. Tyler Pipe.
  2. Standards: ASTM C1277 and CISPI 310.
  3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.03 SPECIALTY PIPE FITTINGS:
- A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        (1) Dallas Specialty & Mfg. Co.
        (2) Fernco, Inc.
        (3) Mission Rubber Company; a division of MCP Industries, Inc.
        (4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
    b. Standard: ASTM C1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. Sleeve Materials:
        (1) For Cast-Iron Soil Pipes: ASTM C564, rubber.

PART 3 - EXECUTION

3.01 EARTH MOVING:

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.02 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 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% downward in direction of flow for piping NPS 3 and smaller; 2% downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Drainage Piping: 2% downward in direction of flow.
   3. Vent Piping: 1% 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. 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 in Section 22 13 19 - Sanitary Waste Piping Specialties.
   2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 13 19 - Sanitary Waste Piping Specialties.

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 - Escutcheons for Plumbing Piping.

3.03 JOINT CONSTRUCTION:

A. 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.

3.04 SPECIALTY PIPE FITTING INSTALLATION:

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in ODs.
   2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3.05 HANGER AND SUPPORT INSTALLATION:

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Vertical Piping: MSS Type 8 or Type 42 clamps.
   3. Install individual, straight, horizontal piping runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   4. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   5. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
   2. NPS 3: 60 inches with 1/2-inch rod.
   3. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
F. Install supports for vertical cast-iron soil piping every 15 feet.
G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 IDENTIFICATION:

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.07 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. 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. 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.

3.08 CLEANING AND PROTECTION:

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.09 PIPING SCHEDULE:

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
B. Aboveground, soil and waste piping shall be the following:
   1. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI hubless-piping couplings; and coupled joints.
C. Aboveground, vent piping shall be the following:
   1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
D. Underground, soil, waste, and vent piping shall be the following:
   1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

END OF SECTION 22 13 16

SECTION 22 13 19 – SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes:
   1. Cleanouts.
   2. Floor drains.
   3. Miscellaneous sanitary drainage piping specialties.

1.03 INFORMATIONAL SUBMITTALS:

A. Field quality-control test reports.

1.04 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.05 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.
C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

PART 2 - PRODUCTS

2.01 CLEANOUTS:

A. Exposed Metal Cleanouts (FCO):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products, Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
   3. Size: Same as connected drainage piping.
   4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
   5. Closure: Countersunk, plastic plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
B. Cast-Iron Wall Cleanouts (WCO):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded plug.
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.

2.02 FLOOR DRAINS:

A. Cast-Iron Floor Drains (FD-1):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Commercial Enameling Co.
b. Josam Company; Josam Div.
c. MIFAB, Inc.
d. Prier Products, Inc.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Tyler Pipe; Wade Div.
g. Watts Drainage Products, Inc.
h. Zurn Plumbing Products Group; Light Commercial Operation.
i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Not required.
6. Anchor Flange: Not required.
7. Clamping Device: Not required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Dimensions of Top or Strainer: As scheduled.
16. Top Loading Classification: Light Duty.
17. Funnel: Not required.
18. Inlet Fitting: Not required.
19. Trap Material: Not required.
20. Trap Pattern: Not required.
21. Trap Features: Not required.

B. Cast-Iron Floor Drains (FD-2):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Commercial Enameling Co.

b. Josam Company; Josam Div.
c. MIFAB, Inc.
d. Prier Products, Inc.
e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
f. Tyler Pipe; Wade Div.
g. Watts Drainage Products, Inc.
h. Zurn Plumbing Products Group; Light Commercial Operation.
i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Not required.
6. Anchor Flange: Not required.
7. Clamping Device: Not required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Dimensions of Top or Strainer: As scheduled.
16. Top Loading Classification: Light Duty.
17. Funnel: Required.
18. Inlet Fitting: Not required.
19. Trap Material: Not required.
20. Trap Pattern: Not required.
21. Trap Features: Not required.

2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES:

A. 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 side inlet.

B. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.04 FLASHING MATERIALS:

A. Lead Sheet: ASTM B749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
1. General Use: 4.0 lb./sq. ft., 0.0625 inch thickness.
2. Vent Pipe Flashing: 3.0 lb./sq. ft., 0.0469 inch thickness.
3. Burning: 6 lb./sq. ft., 0.0938 inch thickness.

B. Copper Sheet: ASTM B152/B152M, of the following minimum weights and thicknesses, unless otherwise indicated:
1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A653/A653M, with 0.20% copper content and 0.04 inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
D. Elastic Membrane Sheet: ASTM D4068, flexible, chlorinated polyethylene, 40 mil minimum thickness.
E. Fasteners: Metal compatible with material and substrate being fastened.
F. Metal Accessories: Sheetmetal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
G. Solder: ASTM B32, lead-free alloy.
H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping, unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.
B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches or Less: Equivalent to 1% slope, but not less than 1/4 inch total depression.
      b. Radius, 30 to 60 Inches: Equivalent to 1% slope.
      c. Radius, 60 Inches or Larger: Equivalent to 1% slope, but not greater than 1 inch 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 roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.
G. Install vent caps on each vent pipe passing through roof.
H. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes, unless trap is indicated.

3.02 FLASHING INSTALLATION:

A. Fabricate flashing from single piece, unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0 lbs./sq. ft., 0.0938 inch thickness or thicker. Solder joints of lead sheets 4.0 lbs./sq. ft., 0.0625 inch thickness or thinner.
   2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.03 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 33 00 – ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Commercial, electric, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.02 ACTION SUBMITTALS:

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
B. Shop Drawings:
   1. Wiring Diagrams: For power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS:

A. Source quality-control reports.
B. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.06 COORDINATION:

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

A. Commercial, Electric, Storage, Domestic-Water Heaters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Water Heaters.
      b. Bradford White Corporation.
      c. Cemline Corporation.
      d. Electric Heater Company (The).
      e. GSW Water Heating.
      f. HESco Industries, Inc.
      g. Lochinvar Corporation.
      h. Precision Boilers, Inc.
      i. PVI Industries, LLC.
      j. RECO USA.

k. Rheem Manufacturing Company.
l. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
m. State Industries.
n. Vaughn Manufacturing Corporation.

2. Standard: UL 1453.
3. Storage-Tank Construction: ASME-code, steel vertical arrangement.
   a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
      (1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

2.02 DOMESTIC-WATER HEATER ACCESSORIES:

A. Domestic-Water Compression Tanks:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMTROL, Inc.
      b. Flexcon Industries.
      c. Honeywell International, Inc.
      d. Pentair Pump Group (The); Myers.
      e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
      f. State Industries.
      g. Taco, Inc.
   2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
   3. Construction:
      a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
      b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
      c. Air-Charging Valve: Factory installed.
   4. Capacity and Characteristics:
      a. Working-Pressure Rating: 150 psig.
      b. Capacity Acceptable: 2 gal. minimum.
      c. Air Precharge Pressure: 40 psig (adj.).

2.03 SOURCE QUALITY CONTROL:

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and Division 01 for requirements for correcting the Work.
D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION:

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03.
    1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
    2. Maintain manufacturer's recommended clearances.
    3. Arrange units so controls and devices that require servicing are accessible.
    4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
    5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
    6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    7. Install anchor bolts to elevations required for proper attachment to supported equipment.
    8. Anchor domestic-water heaters to substrate.
B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
    1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 - General-Duty 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 in Section 22 11 19 - Domestic Water Piping Specialties.
E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 - Meters and Gauges for Plumbing Piping.
F. Fill electric, domestic-water heaters with water.
G. Charge domestic-water compression tanks with air.

3.02 IDENTIFICATION:

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.03 FIELD QUALITY CONTROL:

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and Division 01 for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.04 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION 22 33 00

SECTION 22 41 00 – RESIDENTIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section Includes:
   1. Faucets.
   2. Kitchen sinks.

1.02 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS:

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

B. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 KITCHEN SINKS:

A. Kitchen Sinks (KS-1): One bowl, counter mounted, stainless steel.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkay Manufacturing Co.
      b. Franke Consumer Products, Inc.
      c. Griffin Products, Inc.
      d. Houzer, Inc.
      e. Just Manufacturing.
      f. Kohler Co.
      g. Revere Sink.
      h. Sterling; a Kohler company.
      i. WhiteRock Corp.
   2. Fixture:
      a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
      b. Overall Dimensions: 31 inches long by 19 inches wide.
      c. Metal Thickness: 0.038 inch.
      d. Bowl:
         (1) Dimensions: 28 inches long by 16 inches wide by 7-1/2 inches deep.
         (2) Drain: 3-1/2-inch grid.
            (a) Location: Centered in bowl.
   3. Faucet: KS Faucet.
   4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.

5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.02 SINK FAUCETS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets (KS Faucet): Solid brass.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Standard America.
   b. Bradley Corporation.
   c. Chicago Faucets.
   d. Delta Faucet Company.
   e. Eljer, Inc.
   f. Elkay Manufacturing Co.
   g. Kohler Co.
   h. Moen, Incorporated.
   i. Price Pfister, Inc.
   j. Speakman Company.
   k. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
4. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
5. Finish: Polished chrome-plated brass.
6. Maximum Flow Rate: 1.5 gpm, unless otherwise indicated.
7. Mixing Valve: Single control.
8. Centers: Single hole .
9. Mounting: Deck.
10. Handles: Wrist blade, 4 inches.
11. Spout Type: Rigid gooseneck.
12. Spout Outlet: Aerator.
13. Drain: Grid.

2.03 DISPOSERS:

A. Disposers: Continuous-feed household, food waste.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Standard America.
   b. Anaheim Manufacturing, Inc.; a subsidiary of Western Industries, Inc.
   c. Franke Consumer Products, Inc.
   d. InSinkErator.
   e. KitchenAid.
   f. Maytag.
   g. WhiteRock Corp.
2. Standards: ASSE 1008 and UL 430, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. General: Include reset button; wall switch; corrosion-resistant chamber with jam-resistant cutlery or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
4. Model: Sound-insulated chamber and stainless-steel outer shell.
5. Motor: 115Vac, 1,725 rpm, 1/3 hp with overload protection.

2.04 SUPPLY FITTINGS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Kitchen Sink Supply Fittings:
    1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
    2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.
        a. Operation: Loose key.
    3. Risers:
        a. Size: NPS 1/2 for kitchen sinks.
        b. Material: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

2.05 WASTE FITTINGS:

A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/2 offset tailpiece for accessible kitchen sinks.
C. Trap:
    1. Size: NPS 1-1/2 for kitchen sinks.
    2. Material: ASTM F409 PVC one-piece trap and waste to wall and wall flange.

2.06 GROUT:

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
B. Characteristics: Nonshrink; recommended for interior and exterior applications.
C. Design Mix: 5,000-psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install plumbing fixtures level and plumb according to roughing-in Drawings.
B. Install counter-mounting fixtures in and attached to casework.
C. 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 valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.
D. 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.
E. Install disposer in outlet of each sink indicated to have a disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 22 07 19 - Plumbing Piping Insulation.
G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.
H. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07.

3.03 ADJUSTING:

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
B. Adjust water pressure at faucets to produce proper flow.

3.04 CLEANING AND PROTECTION:

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed plumbing fixtures and fittings.
D. Do not allow use of plumbing fixtures for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 41 00

SECTION 22 42 13.13 – COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section Includes:
   1. Water closets.
   2. Flushometer valves.
   3. Toilet seats.

1.02 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 WALL-MOUNTED WATER CLOSETS:

A. Water Closets (WC-1): Wall mounted, top spud.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.
      b. Crane Plumbing, LLC.
      c. Kohler Co.
      d. TOTO USA, Inc.
      e. Zurn Industries, LLC; Commercial Brass and Fixtures.
   2. Bowl:
      a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
      b. Material: Vitreous china.
      c. Type: Siphon jet.
      d. Style: Flushometer valve.
      e. Height: Standard.
      f. Rim Contour: Elongated.
      g. Water Consumption: 1.28 gal. per flush.
      h. Spud Size and Location: NPS 1-1/2; top.
   3. Flushometer Valve: WC Flushometer.
   4. Toilet Seat: WC Toilet Seat.
   5. Support:
      a. Standard: ASME A112.6.1M.
      b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.
      c. Water Closet Mounting Height: Standard.

B. Water Closets (WC-2): Wall mounted, top spud, accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Standard America.
    b. Kohler Co.
    c. TOTO USA, Inc.
    d. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Bowl:
    a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    b. Material: Vitreous china.
    c. Type: Siphon jet.
    d. Style: Flushometer valve.
    e. Height: Standard.
    f. Rim Contour: Elongated.
    g. Water Consumption: 1.28 gal. per flush.
    h. Spud Size and Location: NPS 1-1/2; top.
3. Flushometer Valve: WC Flushometer.
4. Toilet Seat: WC Toilet Seat.
5. Support:
    a. Standard: ASME A112.6.1M.
    b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.
    c. Water Closet Mounting Height: Handicapped/elderly per ICC/ANSI A117.1.

2.02 FLUSHOMETER VALVES:

A. Lever-Handle, Diaphragm Flushometer Valves (WC Flushometer):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Coyne & Delany Co.
    b. Gerber Plumbing Fixtures, LLC.
    c. Sloan Valve Company.
    d. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 1.28 gal. per flush.
9. Minimum Inlet: NPS 1.
10. Minimum Outlet: NPS 1-1/4.

2.03 TOILET SEATS:

A. Toilet Seats (WC Toilet Seat):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Standard America.
    b. Kohler Co.
    c. TOTO USA, Inc.
    d. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: IAPMO/ANSI Z124.5.

3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water closet installation.
B. Examine walls and floors for suitable conditions where water closets will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Water Closet Installation:
   1. Install level and plumb according to roughing-in Drawings.
   2. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
B. Support Installation:
   1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
   2. Use carrier supports with waste-fitting assembly and seal.
C. Flushometer Valve Installation:
   1. Install flushometer valve, water supply fitting on each supply to each water closet.
   2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
   3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
   4. Install actuators in locations that are easy for people with disabilities to reach.
D. Install toilet seats on water closets.
E. Wall Flange and Escutcheon Installation:
   1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
   2. Install deep-pattern escutcheons if required to conceal protruding fittings.
   3. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.
F. Joint Sealing:
   1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
   2. Match sealant color to water closet color.
   3. Comply with sealant requirements specified in Division 07.

3.03 ADJUSTING:

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
B. Adjust water pressure at flushometer valves to produce proper flow.

3.04 CLEANING AND PROTECTION:

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
B. Install protective covering for installed water closets and fittings.
C. Do not allow use of water closets for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 42 13.13

SECTION 22 42 13.16 – COMMERCIAL URINALS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Urinals.
   2. Flushometer valves.

1.02 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 WALL-HUNG URINALS:

A. Urinals (UR-1): Wall hung, back outlet, washout, accessible.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.
      b. Crane Plumbing, LLC.
      c. Kohler Co.
      d. TOTO USA, Inc.
      e. Zurn Industries, LLC; Commercial Brass and Fixtures.
   2. Fixture:
      a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
      b. Material: Vitreous china.
      c. Type: Washout with extended shields.
      d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
      e. Water Consumption: Water saving.
      f. Spud Size and Location: NPS 3/4, top.
      g. Outlet Size and Location: NPS 2, back.
      h. Color: White.
   3. Flushometer Valve: UR Flushometer.
   4. Waste Fitting:
      a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
      b. Size: NPS 2.
   5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

2.02 URINAL FLUSHOMETER VALVES:

A. Lever-Handle, Diaphragm Flushometer Valves (UR Flushometer):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Coyne & Delany Co.
b. Gerber Plumbing Fixtures, LLC.
c. Sloan Valve Company.
d. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 0.125 gal. per flush.
9. Minimum Inlet: NPS 3/4.
10. Minimum Outlet: NPS 3/4.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
B. Examine walls and floors for suitable conditions where urinals will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Urinal Installation:
1. Install urinals level and plumb according to roughing-in Drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, per ICC/ANSI A117.1.

B. Support Installation:
1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:
1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.

D. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.

E. Joint Sealing:
1. Seal joints between urinals, walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Division 07.

3.03 ADJUSTING:

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
B. Adjust water pressure at flushometer valves to produce proper flow.
C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.04 CLEANING AND PROTECTION:

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
B. Install protective covering for installed urinals and fittings.
C. Do not allow use of urinals for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 42 13.16

SECTION 22 42 16.13 – COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Lavatories.
   2. Faucets.

1.02 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.03 INFORMATIONAL SUBMITTALS:

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.04 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
   1. In addition to items specified in Division 01, include the following:
      a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.01 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES:

A. Lavatory (LAV-1): Oval, self-rimming, vitreous china, counter mounted.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.
      b. Crane Plumbing, LLC.
      c. Kohler Co.
      d. TOTO USA, Inc.
      e. Zurn Industries, LLC; Commercial Brass and Fixtures.
   2. Fixture:
      a. Standard: ASME A112.19.2/CSA B45.1.
      b. Type: Self-rimming for above-counter mounting.
      c. Nominal Size: Oval, 24 by 18 inches.
      d. Faucet-Hole Punching: Three holes, 4-inch centers.
      e. Faucet-Hole Location: Top.
      f. Color: White.
      g. Mounting Material: Sealant.
   3. Faucet: LAV Faucet.

2.02 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES:

A. Lavatory (LAV-2): Vitreous china, wall mounted, with back.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Standard America.
    b. Briggs Plumbing Products, Inc.
    c. Crane Plumbing, LLC.
    d. Ferguson Enterprises, Inc.; ProFlo Brand.
    e. Gerber Plumbing Fixtures, LLC.
    f. Kohler Co.
    g. Mansfield Plumbing Products, LLC.
    h. Peerless Pottery Sales, Inc.
    i. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Fixture:
    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Type: For wall hanging.
    c. Nominal Size: Oval, 19 by 16 inches.
    d. Faucet-Hole Punching: One hole.
    e. Faucet-Hole Location: Top.
    f. Color: White.
    g. Mounting Material: Chair carrier.
3. Faucet: LAV Faucet
4. Support: ASME A112.6.1M, Type I, exposed-arm lavatory carrier.

2.03 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets (LAV Faucet): Automatic-type, hard-wired, electronic-sensor-operated, nonmixing, solid-brass valve.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. American Standard America.
    b. Chicago Faucets.
    c. Kohler Co.
    d. Moen, Incorporated.
    e. Sloan Valve Company.
    f. Speakman Company.
    g. TOTO USA, Inc.
    h. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. 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.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Three hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Drain: Not part of faucet.

2.04 SUPPLY FITTINGS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
E. Operation: Loose key.
F. Risers:
    1. NPS 3/8.
    2. ASME A112.18.6, braided or corrugated stainless-steel, flexible hose riser.

2.05 WASTE FITTINGS:

A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
C. Trap:
    1. Size: NPS 1-1/2 by NPS 1-1/4.
    2. Material: Chrome-plated, one-piece, cast-brass trap with swivel 0.029-inch thick tubular brass wall bend; and chrome-plated, brass or steel wall flange.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
B. Examine counters and walls for suitable conditions where lavatories will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install lavatories level and plumb according to roughing-in Drawings.
B. Install supports, affixed to building substrate, for wall-mounted lavatories.
C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, per ICC/ANSI A117.1.
D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.
E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07.
F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 - Plumbing Piping Insulation.

3.03 ADJUSTING:

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
B. Adjust water pressure at faucets to produce proper flow.
C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.04 CLEANING AND PROTECTION:

A. After completing installation of lavatories, inspect and repair damaged finishes.
B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed lavatories and fittings.
D. Do not allow use of lavatories for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 42 16.13

SECTION 22 42 16.16 – COMMERCIAL SINKS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Service basins.
   2. Sink faucets.
   3. Supply fittings.
   4. Waste fittings.

1.02 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
   2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS:

A. Maintenance Data: For sinks to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 SERVICE BASINS:

A. Service Basins (MB-1): Terrazzo, floor mounted.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acorn Engineering Company.
      b. Crane Plumbing, LLC.
      c. Florestone Products Co., Inc.
      d. Stern-Williams Co., Inc.
      e. E.L. Mustee & Sons, Inc.
   2. Fixture:
      a. Standard: IAPMO PS 99.
      b. Shape: Square.
      c. Nominal Size: 24 by 24 inches.
      d. Height: 10 inches.
      e. Rim Guard: On front top surfaces.
      f. Wall Guard: For all surfaces adjacent to wall.
      g. Color: Not applicable.
      h. Drain: Grid with NPS 2 outlet.
   3. Mounting: On floor and flush to wall.
   4. Faucet: MB Faucet.

2.02 SINK FAUCETS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets (MB Faucet): Manual type, two-lever-handle mixing valve.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.

b. Bradley Corporation.
c. Chicago Faucets.
d. Delta Faucet Company.
e. Elkay Manufacturing Co.
f. Kohler Co.
g. Moen, Incorporated.
h. Speakman Company.
i. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Widespread.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 4.0 gpm.
8. Handle(s): Wrist blade, 4 inches.
9. Mounting Type: Back/wall, exposed.
10. Spout Type: Rigid, solid brass with wall brace.
11. Vacuum Breaker: Required for hose outlet.
12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.03 SUPPLY FITTINGS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
E. Operation: Loose key.
F. Risers:
1. NPS 3/8.
2. Chrome-plated, rigid-copper pipe.

2.04 WASTE FITTINGS:

A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
C. Trap:
1. Size: NPS 1-1/2.
2. Material: Chrome-plated, one-piece, cast-brass trap with swivel 0.029-inch; and chrome-plated brass or steel wall flange.

2.05 GROUT:

A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
B. Characteristics: Nonshrink; recommended for interior and exterior applications.
C. Design Mix: 5,000 psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install sinks level and plumb according to roughing-in Drawings.
B. Set floor-mounted sinks in leveling bed of cement grout.
C. Install water-supply piping with stop on each supply to each sink faucet.
    1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.
    2. Install stops in locations where they can be easily reached for operation.
D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.
E. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07.

3.03 ADJUSTING:

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
B. Adjust water pressure at faucets to produce proper flow.

3.04 CLEANING AND PROTECTION:

A. After completing installation of sinks, inspect and repair damaged finishes.
B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed sinks and fittings.
D. Do not allow use of sinks for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 42 16.16

SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.02 COORDINATION:

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.

2. Torque, speed, and horsepower requirements of the load.

3. Ratings and characteristics of supply circuit and required control sequence.

4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS:

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS:

A. Duty: Continuous duty at ambient temperature of 40º and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS:

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class F.

H. 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.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS:

A. Motors Used with 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. Bearing Protection: All motors operated on variable frequency drives shall be equipped with maintenance free, 360 degree circumferential conductive micro fiber shaft grounding ring with a minimum two continuous rows of conductive micro fibers completely surrounding the motor shaft to discharge electrical shaft voltages away from the motor's bearings to ground. Note: Friction/spring contact brushes shall not be acceptable.

3. Application Note: Motors up to 100HP shall be provided with a minimum of one shaft grounding ring as described above installed by the manufacturer internally to the motor or externally on the drive end. Motors over 100HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the manufacturer's recommendations.

4. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

5. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

6. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS:

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 23 05 13

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Duct labels.
   4. Warning tags.

1.02 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.

1.03 COORDINATION:

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.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS:

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: Black.
   3. Background Color: White.
   4. Maximum Temperature: Able to withstand temperatures up to 160ºF.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2 by 11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS:

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160ºF.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel rivets or self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 DUCT LABELS:

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
B. Letter Color: Black.
C. Background Color: White.
D. Maximum Temperature: Able to withstand temperatures up to 160ºF.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless-steel rivets or self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
    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. Lettering Size: At least 1-1/2 inches high.

2.04 WARNING TAGS:

A. Warning Tags: 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 minimum.
    2. Fasteners: Brass grommet and wire.
    3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
    4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.01 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.

3.02 EQUIPMENT LABEL INSTALLATION:

A. Install or permanently fasten labels on each major item of mechanical equipment.
B. Locate equipment labels where accessible and visible.

3.03 DUCT LABEL INSTALLATION:

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
   1. Blue: For cold-air supply ducts.
   2. Yellow: For hot-air supply ducts.
   3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
   4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
B. Locate labels near points where ducts enter concealed spaces and at maximum intervals of 50 ft. in each space where ducts are exposed or concealed by removable ceiling system.

3.04 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

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
   2. Other Systems/Equipment:
      a. Motors.
      b. Condensing units.
      c. Heat transfer coils.

1.02 SUBMITTALS:

A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
D. Certified TAB reports.
E. Sample report forms.
F. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.03 QUALITY ASSURANCE:

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.
   1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB, or TABB.
   2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.
B. TAB Conference: Meet with Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' notice of scheduled meeting time and location.
   1. Agenda Items:
      a. The Contract Documents examination report.
      b. The TAB plan.
      c. Coordination and cooperation of trades and subcontractors.
      d. Coordination of documentation and communication flow.
C. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
   1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.04 PROJECT CONDITIONS:
A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.05 COORDINATION:
A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
B. Notice: Provide seven days' notice for each test. Include scheduled test dates and times.
C. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 EXAMINATION:
A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
C. Examine the approved submittals for HVAC systems and equipment.
D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 23 31 13 - Metal Ducts and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
F. Examine Equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC Equipment when installed under conditions different from the conditions used to rate Equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
G. Examine system and equipment installations and verify that field quality control testing, cleaning, and adjusting specified in individual Sections have been performed.
H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC Equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
L. Examine operating safety interlocks and controls on HVAC Equipment.
M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.
N. Examine automatic temperature system components to verify the following:
    1. Dampers, valves, and other controlled devices are operated by the intended controller.
    2. Dampers and valves are in the position indicated by the controller.
    3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
    4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
    5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
    6. Sensors are located to sense only the intended conditions.
    7. Sequence of operation for control modes in according to the Contract Documents.
    8. Controller set points are set at indicated values.
    9. Interlocked system are operating.
    10. Changeover from heating to cooling mode occurs according to indicated values.

3.02 PREPARATION:

A. Prepare a TAB plan that includes strategies and step-by-step procedures.
B. Complete system-readiness checks and prepare reports. Verify the following:
    1. Permanent electrical-power wiring is complete.
    2. Hydronic systems are filled, clean, and free of air.
    3. Automatic temperature-control systems are operational.
    4. Equipment and duct access doors are securely closed.
    5. Balance, smoke, and fire dampers are open.
    6. Isolating and balancing valves are open and control valves are operational.
    7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
    8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING:

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
    1. Comply with requirements in ASHRAE 62.1, Section 7.2.2, "Air Balancing."
B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
    1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 - Duct Accessories.
    2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 00 - Mechanical Insulation.

C. Mark Equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS:

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
B. Prepare schematic diagrams of systems' "as-built" duct layouts.
C. For variable-air-volume systems, develop a plan to simulate diversity.
D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
G. Verify that motor starters are equipped with properly sized thermal protection.
H. Check dampers for proper position to achieve desired airflow path.
I. Check for airflow blockages.
J. Check condensate drains for proper connections and functioning.
K. Check for proper sealing of air-handling-unit components.
L. Verify that air duct system is sealed as specified in Section 23 31 13 - Metal Ducts.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS:

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
    1. Measure total airflow.
        a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
    2. Measure fan static pressures as follows to determine actual static pressure:
        a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
        b. Measure static pressure directly at the fan outlet or through the flexible connection.
        c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
        d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
    3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
        a. Report the cleanliness status of filters and the time static pressures are measured.
    4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
    5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
    6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
    7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor

amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
   1. Measure airflow of submain and branch ducts.
      a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
   3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
   1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR MOTORS:

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Efficiency rating.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 PROCEDURES FOR CONDENSING UNITS:

A. Verify proper rotation of fans.
B. Measure entering- and leaving-air temperatures.
C. Record compressor data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS:

A. Measure, adjust, and record the following data for each electric heating coil:
   1. Nameplate data.
   2. Airflow.
   3. Entering- and leaving-air temperature at full load.
   4. Voltage and amperage input of each phase at full load and at each incremental stage.
   5. Calculated kilowatt at full load.
   6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Wet-bulb temperature of entering and leaving air.
   3. Airflow.
   4. Air pressure drop.
   5. Refrigerant suction pressure and temperature.

3.09 TOLERANCES:

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: ±10%.
   2. Air Outlets and Inlets: 0 to +10%.

3.10 REPORTING:

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT:

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
    a. Total air flow rate in cfm.
    b. Total system static pressure in inches w.g..
    c. Fan rpm.
    d. Discharge static pressure in inches w.g.
    e. Filter static-pressure differential in inches w.g.
    f. Preheat-coil static-pressure differential in inches w.g.
    g. Cooling-coil static-pressure differential in inches w.g.
    h. Heating-coil static-pressure differential in inches w.g.
    i. Outdoor airflow in cfm.

j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:
1. Coil Data:
a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in ft.^{2}.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches w.g.
d. Outdoor-air, wet- and dry-bulb temperatures in ºF.
e. Return-air, wet- and dry-bulb temperatures in ºF.
f. Entering-air, wet- and dry-bulb temperatures in ºF.
g. Leaving-air, wet- and dry-bulb temperatures in ºF.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in ºF.

G. Electric-Coil Test Reports: For electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/hr.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in ft.^{2}
j. Minimum face velocity in fpm.
2. Test Data (Indicated and Actual Values):
a. Heat output in Btu/hr.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in ºF.
e. Leaving-air temperature in ºF.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
a. System identification.

b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches w.g.
c. Fan rpm.
d. Discharge static pressure in inches w.g.
e. Suction static pressure in inches w.g.

I. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in ºF.
d. Duct static pressure in inches w.g.
e. Duct size in inches.
f. Duct area in ft.²
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in ft.²

2. Test Data (Indicated and Actual Values):
a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.

e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in ºF.

K. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
1. Unit Data:
a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in ºF.
2. Test Data (Indicated and Actual Values):
a. Inlet-duct static pressure in inches w.g.
b. Outlet-duct static pressure in inches w.g.
c. Entering-air, dry-bulb temperature in ºF.
d. Leaving-air, dry-bulb temperature in ºF.
e. Control settings.
f. Unloader set points.
g. Low-pressure-cutout set point in psig.
h. High-pressure-cutout set point in psig.
i. Suction pressure in psig.
j. Suction temperature in ºF.
k. Condenser refrigerant pressure in psig.
l. Condenser refrigerant temperature in ºF.
m. Oil pressure in psig.
n. Oil temperature in ºF.
o. Voltage at each connection.
p. Amperage for each phase.
q. Kilowatt input.
r. Crankcase heater kilowatt.
s. Number of fans.
t. Condenser fan rpm.
u. Condenser fan airflow rate in cfm.
v. Condenser fan motor make, frame size, rpm, and horsepower.
w. Condenser fan motor voltage at each connection.
x. Condenser fan motor amperage for each phase.

L. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.12 INSPECTIONS:

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
    a. Measure airflow of at least 10% of air outlets.
    b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    c. Verify that balancing devices are marked with final balance position.
    d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10% of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10% of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB work will be considered defective if it does not pass final inspections. If TAB work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.13 ADDITIONAL TESTS:

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13 – DUCT INSULATION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes requirements for insulating sheet metal ductwork.

1.02 SUBMITTALS:

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and field-applied jackets (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.

C. Qualification Data: For qualified Installer.

D. 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.

E. Field quality-control reports.

1.03 QUALITY ASSURANCE:

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.05 COORDINATION:

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 - Hangers and Supports for HVAC Equipment.

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.06 SCHEDULING:

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS:

A. Comply with requirements in "Duct Insulation Schedule, General," and "Aboveground 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 C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. Aeroflex USA, Inc.; Aerocel.
   b. Armacell, LLC; AP Armaflex.
   c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type I.

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corp.; SoftTouch Duct Wrap.
   b. Johns Manville; Microlite.
   c. Knauf Insulation; Friendly Feel Duct Wrap.
   d. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with FSK or ASJ factory-applied jacket.

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corp.; Commercial Board.
   b. Fibrex Insulations, Inc.; FBX.
   c. Johns Manville; 800 Series Spin-Glas.
   d. Knauf Insulation; Insulation Board.
   e. Owens Corning; Fiberglas 700 Series.

2.02 ADHESIVES:

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide products by one of 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.

C. Mineral-Fiber Board or Blanket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

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. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2.03 MASTICS:

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide products by one of 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 E96/E96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: -20 to +180ºF.
4. Solids Content: ASTM D1644, 58% by volume and 70% by weight.
5. Color: White.

2.04 SEALANTS:

A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide products by one of 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: -40 to +250ºF.
5. Color: Aluminum.

2.05 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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C1136, Type II.

2.06 TAPES:

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
   1. Products: Subject to compliance with requirements, provide products by one of 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.
   3. Thickness: 6.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2%.
   6. Tensile Strength: 40 lbf/inch in width.
   7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Products: Subject to compliance with requirements, provide products by one of 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.
   3. Thickness: 3.7 mils.
   4. Adhesion: 100 ounces force/inch in width.
   5. Elongation: 5%.
   6. Tensile Strength: 34 lbf/inch in width.

2.07 SECUREMENTS:

A. Bands:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. ITW Insulation Systems; Gerrard Strapping and Seals.
      b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
   2. Stainless Steel: ASTM A167 or ASTM A240, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Insulation Pins and Hangers:
   1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated.

a. Products: Subject to compliance with requirements, provide products by one of the following:
(1) AGM Industries, Inc.; CWP-1.
(2) GEMCO; CD.
(3) Midwest Fasteners, Inc.; CD.
(4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
a. Products: Subject to compliance with requirements, provide products by one of 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.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide products by 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 thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch 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.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.
D. Wire: 0.062-inch soft-annealed, stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. C & F Wire.

2.08 CORNER ANGLES:
A. Aluminum Corner Angles: 0.040 inch thick, minimum 1- by 1-inch aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.01 EXAMINATION:
A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS:

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Keep insulation materials dry during application and finishing.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
    1. Install insulation continuously through hangers and around anchor attachments.
    2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
    3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.
L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS:

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
    1. Seal penetrations with flashing sealant.
    2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
    3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
    4. Seal jacket to roof flashing with flashing sealant.
B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. 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.
   1. Comply with requirements in DIVISION 07.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION:

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 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.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.
      f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50ºF at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
   5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
   6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-inches o.c.

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.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16-inches o.c.
      b. On duct sides with dimensions larger than 18 inches, space pins 16-inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50ºF at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
   5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-inches o.c.

3.07 FINISHES:

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.08 DUCT INSULATION SCHEDULE, GENERAL:

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, supply and return ductwork serving RTUs.
B. Items Not Insulated:
   1. Metal ducts with duct liner are only allowed where indicated for sound attenuation. (ex: return air grille boots in ceiling plenum and transfer air ducts)
   2. Factory-insulated flexible ducts.
   3. Flexible connectors.

4. Vibration-control devices.
5. Factory-insulated access panels and doors.

3.09 ABOVEGROUND INDOOR DUCT AND PLENUM INSULATION SCHEDULE:

A. Indoor supply, return, and outside air duct insulation shall be one of the following:
   1. Flexible Elastomeric: 1 inch thick.
   2. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb./cu. ft. nominal density.
   3. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb./cu. ft. nominal density.

END OF SECTION 23 07 13

SECTION 23 31 13 – METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Single-wall rectangular ducts and fittings.
   2. Single-wall round and fittings.
   3. Sheet metal materials.
   4. Sealants and gaskets.
   5. Hangers and supports.

1.02 RELATED REQUIREMENTS:

A. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for testing, adjusting, and balancing requirements for metal ducts.

B. Section 23 33 00 - Air Duct Accessories for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 PERFORMANCE/DESIGN CRITERIA:

A. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.04 SUBMITTALS:

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.

B. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top of ducts.
   5. Dimensions of main duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
   12. Hangers and supports, including methods for duct and building and vibration isolation.

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
   2. Suspended ceiling components.
   3. Structural members to which duct will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Penetrations of smoke barriers and fire-rated construction.
   6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

D. Welding Procedure Specification (WPS) and Welder Performance Qualification Record (WPQR)

E. Field quality-control reports.

1.05 QUALITY ASSURANCE:

A. Welding Qualifications: Qualify welding procedures, welders, and welding operators 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.

PART 2 - PRODUCTS

2.01 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."

2.02 SINGLE-WALL ROUND 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, provide products by one of the following:
a. Lindab, Inc.
b. McGill AirFlow, LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Transverse Joints in Ducts Larger than 60 inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS:

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653.
   1. Galvanized Coating Designation: G60 (Z180).
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A36, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 SEALANT AND GASKETS:

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65%.
   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 w.g., positive and negative.
   8. Service: Indoor or outdoor.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C920.
   1. General: Single-component, acid-curing, silicone, elastomeric.

2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch w.g. and shall be rated for 10-inch w.g. 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.

2.05 HANGERS AND SUPPORTS:

A. Hanger Rods for Noncorrosive Environments: Zinc-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Zinc-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION:

A. Coordinate duct layout and duct accessory arrangement with Drawings. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated, unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 - 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."

3.02 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.

3.03 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."

3.04 HANGER AND SUPPORT INSTALLATION:

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
    1. Where practical, install concrete inserts before placing concrete.
    2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
    3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick. These fasteners shall not be used to support ductwork larger than 24 inches square.
    4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
D. Hangers Exposed to View: Threaded rod and angle or channel supports.
E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 FIELD QUALITY CONTROL:

A. Perform tests and inspections.
B. Duct system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.06 START UP:

A. Air Balance: Comply with requirements in Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

3.07 DUCT SCHEDULE:

A. Fabricate ducts with galvanized sheet steel, except as otherwise indicated, and as follows:
B. Supply Ducts:
   1. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive w.g. 3-inch w.g..
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.
C. Return Ducts:
   1. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive or negative 2-inch w.g.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.
D. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 1-inch w.g..
      b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.
E. Intermediate Reinforcement:
   1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
F. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1,000 fpm or Lower:
         Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
         Mitered Type RE 4 without vanes.
      b. Velocity 1,000 to 1,500 fpm:
         Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
         Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
         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 1,500 fpm or Higher:
         Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
         Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
         Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
   2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      Velocity 1,000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      Velocity 1,000 to 1,500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      Velocity 1,500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      Radius-to Diameter Ratio: 1.5.
   b. Round Elbows, 12 inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 inches and Larger in Diameter: Standing seam.

G. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.
   2. Round: 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 1,000 fpm or Lower: 90-degree tap.
      b. Velocity 1,000 to 1,500 fpm: Conical tap.
      c. Velocity 1,500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Manual volume dampers.
   2. Flange connectors.
   3. Turning vanes.
   4. Duct-mounted access doors.
   5. Flexible connectors.
   6. Flexible ducts.
   7. Duct accessory hardware.

1.02 RELATED DOCUMENTS:

A. DIVISION 28 for duct-mounted fire and smoke detectors.

1.03 SUBMITTALS:

A. Product Data: For each type of product.
   1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
   1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
      a. Special fittings.
      b. Manual volume damper installations.
      c. Control-damper installations.
      d. Fire-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
      e. Wiring Diagrams: For power, signal, and control wiring.
C. Source quality-control reports.
D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION:

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating 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.

2.02 MATERIALS:

A. Galvanized Sheet Steel: Comply with ASTM A653.
   1. Galvanized Coating Designation: G60 (Z180).
   2. Exposed-Surface Finish: Mill phosphatized.
B. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS:

A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Warming and Ventilating; a division of Mestek, Inc.
b. McGill AirFlow, LLC.
c. Nailor Industries, Inc.
d. Pottorff.
e. 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.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
a. Molded synthetic.
b. Dampers in ducts with pressure classes of 3-inch w.g. 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.

2.04 FLANGE CONNECTORS:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings, Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
C. Material: Galvanized steel.
D. Gage and Shape: Match connecting ductwork.

2.05 TURNING VANES:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne, Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO, Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
   1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
C. 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 for ducts up to 48 inches wide and double wall for larger dimensions.

2.06 DUCT-MOUNTED ACCESS DOORS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Ductmate Industries, Inc.
   3. Greenheck Fan Corporation.
   4. McGill AirFlow, LLC.
   5. Nailor Industries, Inc.
   6. Pottorff.
B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "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 butt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Number of Hinges and Locks:
      a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
      b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
      c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

2.07 FLEXIBLE CONNECTORS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Duro Dyne, Inc.
   3. Elgen Manufacturing.
   4. Ventfabrics, Inc.
   5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
B. Materials: Flame-retardant or noncombustible fabrics.
C. Coatings and Adhesives: Comply with UL 181, Class 1.
D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4 inches wide, 0.028 inch thick, galvanized sheet steel or 0.032 inch thick aluminum sheets. Provide metal compatible with connected ducts.

2.08 FLEXIBLE DUCTS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Flexmaster U.S.A., Inc.
   2. McGill AirFlow, LLC.
   3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
B. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
   1. Pressure Rating: 4-inch w.g. positive and 0.5-inch w.g. negative.
   2. Maximum Air Velocity: 4,000 fpm.
   3. Temperature Range: -20 to +175ºF.
C. 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, to suit duct size.

2.09 DUCT ACCESSORY HARDWARE:

1. 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.
2. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 EXAMINATION:

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.
C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
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 duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Upstream from duct filters.
   3. At outdoor-air intakes and mixed-air plenums.
   4. At drain pans and seals.
   5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
   6. 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.
   7. Control devices requiring inspection.
   8. Elsewhere as indicated.
H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:
   1. One-Hand or Inspection Access: 8 by 5 inches.
   2. Two-Hand Access: 12 by 6 inches.
   3. Head and Hand Access: 18 by 10 inches.
   4. Head and Shoulders Access: 21 by 14 inches.
   5. Body Access: 25 by 14 inches.
   6. Body plus Ladder Access: 25 by 17 inches.

J. Label access doors according to Section 230553 - Identification for HVAC Equipment to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

M. Connect flexible ducts to metal ducts with adhesive.

N. Install duct test holes where required for testing and balancing purposes.

O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 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. Inspect turning vanes for proper and secure installation.
   4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 34 23 – HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SUMMARY:
- A. This Section includes:
  1. Centrifugal roof ventilators.

1.02 PERFORMANCE REQUIREMENTS:
- A. Operating Limits: Classify per AMCA 99.

1.03 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. Roof curbs.
  7. Fan speed controllers.
- B. Field quality-control reports.
- C. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE:
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. 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.

1.05 COORDINATION:
- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.01 CENTRIFUGAL ROOF VENTILATORS:
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Aerovent; a division of Twin City Fan Companies, Ltd.
  2. Greenheck Fan Corporation.
  3. Hartzell Fan, Incorporated.
  4. Loren Cook Company.
  5. PennBarry.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 12 inches.
3. Pitch Mounting: Manufacture curb for roof slope.

2.02 MOTORS:

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.03 SOURCE QUALITY CONTROL:

A. Certify sound-power level ratings per AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans per 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 per AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install power ventilators level and plumb.

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 for installation of roof curbs.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Section 23 05 53 - Identification for HVAC Piping and Equipment.

3.02 FIELD QUALITY CONTROL:

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension.
   6. Adjust damper linkages for proper damper operation.
   7. Verify lubrication for bearings and other moving parts.
   8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   10. Shut unit down and reconnect automatic temperature-control operators.
   11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.03 ADJUSTING:

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 23 05 93 - 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 37 13 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Rectangular and square ceiling diffusers.
   2. Linear slot diffusers.
   3. Adjustable bar registers and grilles.
   4. Fixed face registers and grilles.

1.02 RELATED REQUIREMENTS:

A. DIVISION 08 for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
B. Section 23 33 00 - Air Duct Accessories for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.03 SUBMITTALS:

A. Action Submittals:
   1. Product Data: For each type of product indicated, include the following:
      a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
      b. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
B. Informational Submittals:
   1. 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:
      a. Ceiling suspension assembly members.
      b. Method of attaching hangers to building structure.
      c. Size and location of initial access modules for acoustical tile.
      d. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
      e. Duct access panels.
   2. Source quality-control reports.

PART 2 - PRODUCTS

2.01 DIFFUSERS, REGISTERS, AND GRILLES:

A. For all diffusers, registers, and grilles:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. Nailor Industries, Inc.
      c. Price Industries.
      d. Titus.
   2. All products shall conform to the schedules.

2.02 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

3.01 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.

3.02 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.

D. Coordinate diffusers, registers, and grille color/finish with Architectural finish schedules, and provide color/finish for review during equipment submittal process.

3.03 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 74 13 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
   1. Direct-expansion cooling.
   2. Electric-heating coils.
   3. Economizer outdoor- and return-air damper section.
   4. Integral, space temperature controls.
   5. Roof curbs.

1.02 DEFINITIONS:

A. DDC: Direct-digital controls.
B. ECM: Electrically commutated motor.
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. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
F. 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.
G. 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.

1.03 ACTION SUBMITTALS:

A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Power, signal, and control wiring.

1.04 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 RTUs will be attached.
   2. Roof openings
   3. Roof curbs and flashing.
B. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE:

A. ARI Compliance:
   1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
   2. Comply with ARI 270 for testing and rating sound performance for RTUs.
B. 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 Startup."
C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."
D. NFPA Compliance: Comply with NFPA 90A.
E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Corporation.
   2. Lennox Industries, Inc.
   3. McQuay International.
   4. Trane; American Standard Companies, Inc.
   5. YORK International Corporation.

2.02 CASING:

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.
   1. Exterior Casing Thickness: 0.052 inch thick.
C. Inner Casing Fabrication Requirements:
   1. Inside Casing: Galvanized steel, 0.034 inch thick.
D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
   1. Materials: ASTM C1071, Type I.
   2. Thickness: 1 inch.
   3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
   4. Liner Adhesive: Comply with ASTM C916, Type I.
E. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches deep, and complying with ASHRAE 62.1.
   1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
   2. Drain Connections: Threaded nipple.

3. Pan-Top Surface Coating: Corrosion-resistant compound.

F. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.03 FANS:

A. Direct-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, ECM motor, resiliently mounted in the fan inlet. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Condenser-Coil Fan: Propeller, mounted on shaft of permanently lubricated ECM motor.

C. Powered Exhaust Fan: Propeller, shaft mounted on permanently lubricated motor.

D. Fan Motor: Comply with requirements in SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT.

2.04 COILS:

A. Supply-Air Refrigerant Coil:

1. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
2. Coil Split: Interlaced.
3. Baked phenolic coating.
4. Condensate Drain Pan: Stainless steel formed with pitch and drain connections complying with ASHRAE 62.1.

B. Electric-Resistance Heating:

1. Open Heating Elements: Resistance wire of 80% nickel and 20% chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
2. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
   a. Magnetic contactors.
   b. Step Controller: Pilot lights and override toggle switch for each step.
   c. Time-delay relay.
   d. Airflow proving switch.

2.05 REFRIGERANT CIRCUIT COMPONENTS:

A. Number of Refrigerant Circuits: Two.

B. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.

C. 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.

2.06 AIR FILTRATION:

A. Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

2.07 DAMPERS:

A. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
   1. Damper Motor: Modulating with adjustable minimum position.
   2. Relief-Air Damper: Motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.

2.08 ELECTRICAL POWER CONNECTION:

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.09 CONTROLS:

A. Basic Unit Controls:
   1. Control-voltage transformer.
   2. Wall-mounted thermostat or sensor with the following features:
      a. Heat-cool-off switch.
      b. Fan on-auto switch.
      c. Fan-speed switch.
      d. Manual changeover.
      e. Adjustable deadband.
      f. Concealed set point.
      g. Concealed indication.
      h. Deg F indication.
      i. Unoccupied-period-override push button.
      j. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.
   3. Remote Wall-Mounted Annunciator Panel for Each Unit:
      a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
      b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
      c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

B. Electronic Controller:
   1. Controller shall have volatile-memory backup.
   2. Safety Control Operation:
      a. Firestats: Stop fan and close outdoor-air damper if air greater than 130ºF enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
      b. Fire Alarm Control Panel Interface: Provide control interface to coordinate with operating sequence described in DIVISION, 28 Section "Fire Detection and Alarm."
      c. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40ºF.

3. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of two programmable periods per day.
4. Unoccupied Period:
   a. Heating Setback: 10ºF.
   b. Cooling Setback: System off.
   c. Override Operation: Two hours.
5. Supply Fan Operation:
   a. Occupied Periods: Run fan continuously.
   b. Unoccupied Periods: Cycle fan to maintain setback temperature.
6. Refrigerant Circuit Operation:
   a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain room temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
   b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
   c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.
7. Electric-Heating-Coil Operation:
   a. Occupied Periods: Stage coil to maintain room temperature.
   b. Unoccupied Periods: Energize coil to maintain setback temperature.
8. Economizer Outdoor-Air Damper Operation:
   a. Occupied Periods: Open to fixed minimum intake corresponding to outside air rate in schedules, and maximum 100% of the fan capacity to comply with ASHRAE Cycle II. Controller shall permit air-side economizer operation when outdoor air is less than 60ºF . Use mixed-air and outdoor-air temperature to adjust mixing dampers. Start relief-air fan with end switch on outdoor-air damper. During economizer cycle operation, lock out cooling.
   b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.

2.10 ACCESSORIES:

A. Duplex, 115V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
B. Low-ambient kit using variable-speed condenser fans for operation down to 0ºF.
C. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
D. Coil guards of painted, galvanized-steel wire.

2.11 ROOF CURBS:

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
   1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
      a. Materials: ASTM C1071, Type I or II.
      b. Thickness: 1 inch.
   2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
      a. Liner Adhesive: Comply with ASTM C916, Type I.
      b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.

c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C916, Type I.

B. Curb Height: 14 inches .

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
C. Examine roofs for suitable conditions where RTUs will be installed.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in DIVISION 07. Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

3.03 FIELD QUALITY CONTROL:

A. Perform tests and inspections and prepare test reports.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
B. Tests and Inspections:
1. After installing RTUs 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.
C. Remove and replace malfunctioning units and retest as specified above.

3.04 STARTUP SERVICE:

A. Engage a factory-authorized service representative to perform startup service.
B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.

10. Remove packing from vibration isolators.
11. Verify lubrication on fan and motor bearings.
12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.
    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.
15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.
17. Calibrate thermostats.
18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15ºF 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.
21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. 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.
23. 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.
24. 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. Firestat alarms.
25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.05 CLEANING AND ADJUSTING:

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.06 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to DIVISION 01.

END OF SECTION 237413

SECTION 23 81 26 – SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

1.02 SUBMITTALS:

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

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.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

F. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

G. 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 for each air-handling unit.
   2. Fan Belts: One set for each air-handling unit fan.

1.03 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:
   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
   2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4, "Outdoor Air Quality," Section 5, "Systems and Equipment," Section 6, "Procedures," and Section 7, "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
   2. Lennox International, Inc.
   3. Trane; a business of American Standard companies.
   4. YORK; a Johnson Controls company.

2.02 INDOOR UNITS (DSS-1):

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with AHRI 210/240.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:
   a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
   b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
   c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in DIVISION 26 Sections.
   d. Mount unit-mounted disconnect switches on exterior of unit.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:
   a. Fabricated with 1% slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
      (1) Length: Extend drain pan downstream from leaving face by one half the vertical dimension of the refrigerant coil.
      (2) Depth: A minimum of 2 inches deep.
   b. Single-wall, stainless-steel sheet.
   c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
      (1) Minimum Connection Size: NPS 1.
   d. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.
7. Air Filters: Permanent, cleanable.

2.03 OUTDOOR UNITS (ACCU-1):

A. Air-Cooled, Compressor-Condenser Components:
   1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gauge ports on exterior of casing.
   2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
      a. Compressor Type: Scroll.
      b. Compressors shall be specifically selected to match related evaporator coil.
      c. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
      d. Refrigerant Charge: See Schedule.
      e. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with AHRI 210/240.
   3. Fan: Aluminum-propeller type, directly connected to motor.
   4. Motor: Permanently lubricated, with integral thermal-overload protection.
   5. Low Ambient Kit: Permits operation down to 45ºF.

2.04 ACCESSORIES:

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
B. Automatic-reset timer to prevent rapid cycling of compressor.
C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
D. Drain Hose: For condensate.
E. Condensate Pump.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install units level and plumb.
B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
C. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. See Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.02 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
B. 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.
C. Tests and Inspections:
    1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
    2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
D. Remove and replace malfunctioning units and retest as specified above.
E. Prepare test and inspection reports.

3.03 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.

3.04 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 26

SECTION 23 82 39 - UNIT HEATERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Cabinet unit heaters with centrifugal fans and electric-resistance heating coils.

1.02 DEFINITIONS:

A. CWP: Cold working pressure.
B. PTFE: Polytetrafluoroethylene plastic.
C. TFE: Tetrafluoroethylene plastic.

1.03 SUBMITTALS:

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
C. Field quality-control test reports.
D. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

PART 2 - PRODUCTS

2.01 CABINET UNIT HEATERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brasch.
   2. Carrier Corporation.
   3. Daikin Applied.
   4. Indeeco.
   5. QMark Electric Heating; a division of Marley Engineered Products.
   6. Trane.
B. Description: A factory-assembled and -tested unit complying with AHRI 440.
   1. Comply with UL 2021.
C. Coil Section Insulation: ASTM C1071; surfaces exposed to airstream shall be erosion-resistant coating to prevent erosion of glass fibers.
   1. Thickness: 1/2 inch.
   2. Thermal Conductivity (k-Value): 0.26 Btu by in./h by sq. ft. at 75ºF mean temperature.
   3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

4. Adhesive: Comply with ASTM C916 and with NFPA 90A or NFPA 90B.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Engineer.
1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch thick, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
2. Recessing Flanges: Steel, finished to match cabinet.
3. Control Access Door: Key operated.
4. False Back: Minimum 0.0428-inch thick steel, finished to match cabinet.

E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.

F. Fan and Motor Board: Removable.
1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
3. Wiring Terminations: Connect motor to chassis wiring with plug connection.

G. Basic Unit Controls:
1. Control voltage transformer.
2. Wall-mounting thermostat with the following features.
a. Heat-off switch.
b. Fan on-auto switch.
c. Concealed set point.
d. Concealed indication.
e. ºF indication.

H. Electrical Connection: Factory wire motors and controls for a single field connection.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install cabinet unit heaters to comply with NFPA 90A.

B. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Section 23 05 48 - Vibration Controls for HVAC Equipment.

3.03 FIELD QUALITY CONTROL:

A. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.04 ADJUSTING:

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 23 82 39

SECTION 26 05 10 – BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. This Section specifies general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in DIVISION 01:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   4. Maintenance manuals.
   5. Rough-ins.
   6. Electrical installations.
   7. Cutting and patching.
   8. Electrical Demolition.
   9. Touch-up Painting.

1.02 SUMMARY:

A. This Contract includes, but is not limited to, the following work components:
   1. Furnish and install (including supports) the following equipment as per the Drawings and Specifications:
      a. Electrical Distribution Equipment including, but not limited to, panelboards.
      b. Electric Metering.
      c. Grounding System.
      d. Lightning Protection System.
      e. Interior and Exterior Lighting.
      f. Lighting Controls.

1.03 RELATED REQUIREMENTS:

A. DIVISION 31 for excavation for electrical installations within the building boundaries and from building to utility connections.
B. Section 01 78 00 - Contract Closeout.
A. Section 09 90 00 - Protective Coatings.
B. Section 23 05 13 - Common Motors Requirements for HVAC Equipment.

1.04 REFERENCE STANDARDS:

A. Federal Information Processing Standards Publication (FIPS).
B. National Electrical Contractors Association (NECA).
C. National Electrical Installation Standards (NEIS): Except where the NEIS requirements specifically deviate from specific requirements of the NEC, the NEC shall take precedence.
D. National Fire Protection Association (NFPA):
   1. NFPA - 70 National Electrical Code (NEC).
E. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE C2 National Electrical Safety Code (NESC).
F. Underwriters Laboratories (UL).

1.05 DEFINITIONS:

A. EPA: Environmental Protection Agency.
B. PCB: Polychlorinated biphenyl.
C. PVC: Polyvinyl Chloride.

1.06 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Refer to each Section of this Division for specific Submittal requirements.
C. Provide Conforming to Construction Records schematic diagrams and wiring diagrams.
D. Provide product data on electrical material and products.
E. Prepare record documents in accordance with the requirements in DIVISION 01. In addition to the requirements specified in DIVISION 01, indicate installed conditions for:
   1. Locations of control devices; distribution and branch electrical circuitry; fuse sizes, circuit breaker sizes and arrangements.
   2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
   3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
F. Engage the services of a licensed Land Surveyor or licensed Professional Engineer registered in the state in which the Project is located to record the locations and invert elevations of underground installations.
G. Prepare maintenance manuals in accordance with Section 01 78 00 - Contract Closeout. In addition to the requirements specified in DIVISION 01, include the following information for equipment items:
   1. Description of function, normal operating characteristics and limitations, performance curves, engineering data, tests, and complete nomenclature and commercial numbers of replacement parts.
   2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; lockout/tagout procedures; and summer and winter operating instructions.
   3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, reassembly; aligning and adjusting instructions.
   4. Servicing instructions, lubrication charts and schedules.
   5. "Conforming to Construction Records" schematic and wiring diagrams.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Deliver products to the Project Site properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.08 PROJECT SITE CONDITIONS:

A. Altitude = 6601.71 feet above mean sea level.
B. Maximum Outdoor Ambient Temperature = 120ºF.
C. Minimum Outdoor Ambient Temperature = 0ºF.
D. Maximum Outdoor Relative Humidity = 100%.
E. Seismic Factors: See Structural Drawing S001.

1.09 WARRANTY:

A. Provide a minimum one-year warranty on all electrical equipment. Warranty period shall begin when equipment is permanently energized or started unless specified otherwise. Contractor shall provide written notification to Owner's Representative prior to this warranty start date.

PART 2 - PRODUCTS

2.01 PRODUCTS:

A. Unless indicated otherwise, all equipment and material shall be new, undamaged and meet the requirements of Underwriters Laboratories, Inc. (UL). Where UL requirements are not applicable, equipment and material shall be identified as such by Contractor and approved by Owner before purchase and installation.

2.02 ELECTRONIC EQUIPMENT COMPLIANCE:

A. Contractor warrants that all equipment, devices, items, systems, software, hardware, or firmware provided shall properly, appropriately, and consistently function and accurately process date and time data (including without limitation: calculating, comparing, and sequencing). This warranty supersedes anything in the Specifications or other Contract Documents which might be construed inconsistently. This warranty is applicable whether the equipment, device, item, system, software, hardware, or firmware is specified with or without reference to a manufacturer's name, make, or model number.

2.03 FINISHES:

A. For equipment: Equipment manufacturer's paint selected to match installed equipment finish.
B. Galvanized surfaces: Zinc-rich paint recommended by item manufacturer.
C. Provide finishes in accordance with Section 09 90 00 - Protective Coatings.

PART 3 - EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
B. Refer to equipment specifications in DIVISIONS 26 and the equipment submittals for rough-in requirements.
C. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. All electrical work and material shall comply with the following requirements:
    1. NFPA 70 - The National Electrical Code (NEC).
    2. IEEE C2, National Electrical Safety Code, Federal Information Processing Standards Publication (FIPS).
    3. NECA National Electrical Installation Standards (NEIS) (all except Table 1 of NECA 1).
    4. Coordinate electrical systems, equipment, and materials installation with other building components. Equipment motor horsepower sizes and kilowatt sizes shown are approximate. If equipment of a different size is furnished by Contractor, Contractor shall furnish and install the proper support equipment, motor starter, switchgear, feeders, fuses, circuit breaker, disconnect switch, wire, and conduit required for the equipment furnished, at no additional cost to Owner.
    5. Verify all existing dimensions by field measurements.
    6. Arrange for chases, slots, and openings in other building components during progress of construction to allow for electrical installations.
    7. 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.
    8. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring

positioning prior to closing in the building. Coordinate concrete pads, bases, roof curbs, and related items.

9. Coordinate with all other building trades.
10. Where mounting heights are not specifically detailed, specified, or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
11. Coordinate connection of electrical 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.
12. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Should coordination requirements conflict with individual system requirements, refer conflict to Owner's Representative in writing.
13. Install systems, materials, and equipment level, plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
14. Install electrical equipment to facilitate servicing, 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.
15. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
16. All equipment and materials shall be installed in accordance with NFPA 70 - The National Electrical Code (NEC).
17. All equipment conductor termination provisions shall be UL listed for 75ºC conductors.
18. All electrical equipment and installations shall be of adequate strength to withstand, without failure, forces encountered in defined Seismic conditions.
19. Install raceways, cables, wireways, cable trays and busways clear of obstructions and clear of the required working space of equipment.

D. Refer to each section of this Division for specific performance requirements.

E. Disposal of existing fluorescent lamps shall be by Contractor shipping the lamps to an EPA approved recycler for recycling. All shipping and disposal costs will be paid by Contractor at no additional expense to Owner.

F. Existing pre-1980 fluorescent lamp ballasts and ballasts not marked "no PCBs" (or are not dated with manufacturing date) shall be assumed to contain PCBs. Contractor shall dispose of PCB fluorescent ballasts by shipping the ballasts to an EPA approved PCB incineration facility. All shipping and disposal costs will be paid by Contractor at no additional expense to Owner.

3.02 DEMOLITION:

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring indicated to be abandoned in place, 2 inches below surface of adjacent construction. Cap raceways and patch surface to match existing surface finish.

D. Remove demolished material from Project Site.

E. Remove, store, clean, re-install, reconnect and make operational components indicated for relocation.

3.03 CUTTING AND PATCHING:

A. General: Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of the trades involved. Perform cutting and patching in accordance with the following requirements:
   1. Perform cutting and patching for electrical equipment and materials required to:
      a. Uncover work to provide for installation of ill-timed work.
      b. Remove and replace defective work.
      c. Remove and replace work not conforming to requirements of the Contract Documents.
      d. Remove samples of installed work as specified for testing.
      e. Install equipment and materials in existing structures.
      f. Upon written instructions from Engineer, uncover and restore work to provide for Engineer's observation of concealed work if installed without using the proper specified procedures.

B. For work in existing installations, the Contractor shall cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by the new work.

C. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

E. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

F. All penetrations through fire-rated walls, ceilings and floors shall be sealed with a UL listed and FM Global approved sealant system that matches the fire rating of the surface penetrated.

G. Patch existing finished surfaces and building components that must be cut for the electrical installation or are damaged by Contractor using new materials matching existing materials.

H. Patch finished surfaces and building components using new materials specified for the original installation.

I. All cutting, patching, and repairing shall be subject to the supervision and the approval of Owner's Representative.

J. Repair and re-finish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fire proofing where existing fireproofing has been disturbed. Repair and re-finish materials and other surfaces by skilled mechanics of trades involved.

3.04 FINISHES:

A. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit degree of damage at each location.

B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

C. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

D. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

E. Repair damage to protective coatings in accordance with Section 09 90 00 - Protective Coatings.

3.05 CLEANING:

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

3.06 PROTECTION:

A. Protect equipment and installations and maintain conditions to ensure that coatings, finishes and cabinets are without damage or deterioration at time of Substantial Completion.

3.07 CLOSEOUT:

A. Instructions, training, and manufacturer's service representative:
   1. Provide on-site instructions and training of Owner's personnel as specified.
   2. Provide on-site services of a manufacturer's authorized service representative as specified.

END OF SECTION 26 05 10

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes the following:
   1. Building wires and cables rated 600V and less.
   2. Connectors, splices, and terminations rated 600V and less.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (latest edition):
   1. American Society for Testing and Materials (ASTM):
      a. ASTM A53/A53M - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   2. Code of Federal Regulations (CFR):
      a. 29 CFR - Labor, Chapter XVII - Occupational Safety and Health Administration, Department of Labor, Part 1910 - "Occupational Safety and Health Standards," Subpart A - "General," Section 1910.7 - "Definition and Requirements for a Nationally Recognized Testing Laboratory."
   3. The Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. IEEE 141 - Recommended Practice for Electric Power Distribution for Industrial Plants (the Red Book).
      b. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings (the Gray Book).
   4. International Electrical Testing Association (NETA):
      a. NETA Acceptance Testing Specification - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
   5. National Electrical Manufacturers Association (NEMA):
      a. NEMA WC 26 - Binational Wire and Cable Packaging Standard (EEMAC 201).
      b. NEMA WC 70 - Non-Shielded Power Cable 2,000V or less.
   6. National Fire Protection Association (NFPA):
      a. NFPA 70 - National Electrical Code.
   7. Underwriters Laboratories Inc. (UL):
      a. UL 4 - Armored Cable.
      b. UL 44 - Thermoset-Insulated Wires and Cables.
      c. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
      d. UL 486B - Wire Connectors for Use with Aluminum Conductors.
      e. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables.
      f. UL 83 - Thermoplastic-Insulated Wires and Cables.
      g. UL 854 - Service-Entrance Cables.
      h. UL 1569 - Metal-Clad Cables.

1.04 DEFINITIONS:

A. EPDM: Ethylene-propylene-diene terpolymer rubber.
B. NBR: Acrylonitrile-butadiene rubber.

1.05 SUBMITTALS:

A. Product Data: For each type of product indicated.
B. Qualification Data: For testing agency.
C. Field quality-control test reports.

1.06 QUALITY ASSURANCE:

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. American Insulated Wire Corp.; a Leviton Company.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.
   6. Pyrotenax.
C. Copper Conductors: Comply with NEMA WC 70.
D. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.02 WIRE AND CABLES:

A. General: Provide wire and cable suitable for the location where installed.
B. Conductors: Minimum conductor size shall be #12 AWG. Except #14 AWG stranded can be used for controls unless indicated or specified otherwise. Provide solid conductors for power and lighting circuits No. 10 AWG and smaller unless indicated or specified otherwise. Provide stranded conductors for sizes No. 8 AWG and larger unless indicated or specified otherwise.
C. Conductor Material: Use copper for all sizes.
D. Provide wire and cable numbers that match electrical schematics.
E. Provide stranded hookup wire with appropriate voltage rating and ampere rating inside of all control enclosures.

2.03 CONNECTORS AND SPLICES:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Hubbell Power Systems, Inc.
   3. O-Z/Gedney; EGS Electrical Group LLC.
   4. 3M; Electrical Products Division.
   5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

D. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings to or greater than those of the wires upon which used. Connectors shall be identified for the conductor material.
   1. Lighting and receptacle circuit connectors for No. 10 AWG and smaller shall be twist-on spring solderless connectors. Provide silicone filled twist-on watertight/raintight connectors for all lighting circuits and receptacles circuits routed outdoors or indoors in wet locations.
   2. Nonlighting and nonreceptacle circuit connectors for No. 12 No. 10 AWG and connectors for No. 8 AWG and larger shall be solderless connectors.
   3. All uninsulated joints shall be taped to provide an insulation value equal to that of the wire.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS:

A. General: Provide wire and cable suitable for the location where installed.

B. Conductors: Minimum conductor size shall be #12 AWG.

C. Conductor Material: Use copper for all sizes.

D. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

E. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS:

A. All areas: Type THHN-THWN, single conductors in raceway

3.03 INSTALLATION OF CONDUCTORS AND CABLES:

A. General: Install electrical cables, wires, and connectors in compliance with NEC.

B. Coordinate cable installation with other Work.

C. Do not pull wire and cable until raceway system is complete. Pull conductors simultaneously where more than one is being installed in same raceway.

D. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

E. 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.

F. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

G. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
H. Support cables according to SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.
I. Identify and color-code conductors and cables according to SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS.
J. Keep conductor splices to a minimum. All splices shall be made in junction boxes.
K. Provide adequate length of conductors within electrical enclosures and neatly train the conductors to terminal points. Circuits with conductors larger than No. 10 AWG shall be bundled together inside of enclosures. Make terminations so there are no bare conductors visible at the terminal.
L. Table 1:
    1. Insulation Color Coding for Phase Identification:
    2. Color code 600V insulated, service entrance, feeder, and branch circuit conductors with factory-applied colored insulation for No. 8 AWG and smaller (except: No. 6 AWG and smaller for green ground wire); 1-inch band of colored tape at all splices and terminations for No. 6 AWG and larger (except: No. 4 AWG and larger for green ground wire) as follows:

240/120 Volts	Phase
Black	A
Red	B
White	Neutral
Green	Ground

M. Single phase circuits shall be grouped with one phase conductor, one neutral conductor, and one ground conductor unless indicated or specified otherwise. Shared nuetrals for multiwire branch circuit is not allowed.
N. Install wire and cable numbers on all field wiring that matches electrical schematics.
O. Leave 12 inches of each wire in each receptacle and wall switch device box.
P. Install an equipment grounding conductor in all conduits.

3.04 CONNECTIONS:
A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated.
    1. Lighting and receptacle circuit connectors for No. 10 AWG and smaller shall be twist-on spring solderless connectors. Provide silicone filled twist-on watertight/raintight connectors for all lighting circuits and receptacles circuits routed outdoors or indoors in wet locations.
    2. Nonlighting and nonreceptacle circuit connectors for No. 12 AWG and larger shall be solderless connectors.
    3. All uninsulated joints shall be taped to provide an insolation value equal to that of the wire.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
C. Make splices 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 and tap conductor for aluminum conductors.
D. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS:
A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING.

3.06 FIELD QUALITY CONTROL:
A. Tests and Inspections:
   1. Prior to energizing, test wires and cables for electrical continuity and for short circuits.
   2. Prior to energizing, check all installed feeders and building service wires and cables with insulation megohm meter to determine insulation resistance levels to assure requirements are fulfilled. Record and submit all field test data. Megger 300V cables with 500Vdc megohm meter between each conductor and ground. Megger 600V cables with 1,000Vdc megger between each conductor and ground. Also, megger between adjacent conductors. Megger cables after installation (not on cable reel) with cables disconnected at both ends. The values must be approximately as follows:

Conductor Size AWG or MCM)	Resistance (Megohms-1,000 ft.)
14-8	200
6-2/0	100
3/0-500	50

   3. Do not test wires or cables with an ac test set.
   4. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   5. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
      a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
      b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
      c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 260526 - GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies electrical grounding and bonding as indicated on Drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.

B. Type of electrical grounding and bonding work specified in this Section includes the following:

1. Solidly grounded. Grounded through a ground connection in which no impedance has been intentionally inserted.

C. Applications of electrical grounding and bonding work in this Section include the following:

1. Underground metal piping.
2. Underground metal water piping.
3. Metal building frames.
4. Electrical power systems.
5. Grounding electrodes.
6. Counterpoise grounding loops.
7. Separately derived systems.
8. Raceways.
9. Service equipment.
10. Boxes and enclosures.
11. Equipment.
12. Lighting standards and poles.
13. Lightning protection systems.

D. Refer to other DIVISION 26 Sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this Section.

1.03 RELATED REQUIREMENTS:

A. SECTION 26 41 13 - LIGHTNING PROTECTION FOR STRUCTURES for lightning protection.

1.04 REFERENCES:

A. Applicable Standards:

1. Institute of Electrical and Electronic Engineers (IEEE): Comply with applicable requirements and recommended installation practices of the following IEEE Standards pertaining to grounding and bonding of systems, circuits, and equipment:
   a. 32 - Requirements, Terminology, and Test procedures for Neutral Grounding Devices.
   b. 80 - Guide for Safety in Substation Grounding.
   c. 81 - Guide for Measuring Ground Resistance, and Potential Gradient in the Earth.
   d. 141 - Recommended Practice for Electric Power Distribution for Industrial Plants.
   e. 142 - Recommended Practice for Grounding Industrial and Commercial Power Systems.
2. National Fire Protection Association (NFPA):

a. 70 - National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment.
b. 780 - Lightning Protection Code.

3. Underwriters Laboratories (UL): Comply with applicable requirements of the following standards. Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
   a. 467 - Electrical Grounding and Bonding Equipment.
   b. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   c. 869 - Electrical Service Equipment.

1.05 SUBMITTALS:

A. Refer to DIVISION 01 and SECTION 26 05 10 - BASIC ELECTRICAL REQUIREMENTS for administrative and procedural requirements for Submittals.
B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.
   2. Qualification Data: For Qualified Testing Agency and testing agencies field Supervisor.
   3. All field test reports.

1.06 QUALITY ASSURANCE:

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):
   1. Grounding Products:
      a. Adalet-PLM Div; Scott Fetzer Co.
      b. Anderson/Square D.
      c. Burndy Corporation.
      d. Cadweld Div; Erico Products Inc.
      e. Crouse-Hinds Div; Cooper Industries.
      f. Ideal Industries, Inc.
      g. Joslyn Corporation.
      h. Myers Electric Products, Inc.
      i. O. Z. Gedney Div; General Signal Corp.
      j. Thomas and Betts Corp.

2.02 GROUNDING AND BONDING:

A. Materials and Components:
   1. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires,

connectors, solderless lug terminals, grounding electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Contractor's code-compliance option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications.

2. Conductors: Unless otherwise indicated, provide insulated electrical grounding conductors for equipment grounding conductor connections that match power supply wiring materials and as a minimum are sized according to the NEC. Provide uninsulated, stranded, tinned, copper cable for ground electrode conductors.
3. Service Lightning Arrester:
   a. Service Lightning Arrester: 2-pole, 1-phase, 120/240V, #14 AWG 3-wire including ground, 18-inch leads, with watertight enclosure.
4. 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, 600V. Lexan or PVC, impulse tested at 5,000V.
5. Bonding Plates, Connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.
   a. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   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 [compression] [exothermic]-type wire terminals and long-barrel, two-bolt connection to ground bus bar.
6. Ground Rods or Ground Electrodes:
   a. Grounding Electrodes: Steel with copper clad exterior, 3/4-inch diameter by 10 feet (minimum) long.
   b. Ground Rods or Grounding Electrodes: Stainless steel, 3/4-inch diameter by 10 feet.
   c. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
      (1) Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1,200 mm) long.
7. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service required or indicated.
8. Field Welding: Provide exothermic welded connections where grounding conductors connect to underground grounding conductors and underground grounding electrodes.

PART 3 - EXECUTION

3.01 APPLICATIONS:

A. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements.

B. Conductors: Install solid conductor for No. 8AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
C. Underground Grounding Conductors: Install bare copper conductor, No. 4/0AWG minimum.
   1. Bury at least 24 inches (600 mm) below grade.
D. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Install bus horizontally, on insulated spacers 2 inches (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 to specified height above floor; connect to horizontal bus.
F. 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.
   5. Clean metal contact surfaces of clamp-on connectors to ensure electrical conductivity and circuit integrity.

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS:

A. Comply with IEEE C2 grounding requirements.
B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

3.03 EQUIPMENT GROUNDING:

A. Install insulated equipment grounding conductors with all feeders and branch circuits.
B. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug on substation, switchgear, switchboard, motor control center, or panelboard ground bus. When conduit enters from below and is not connected to the enclosure, ground equipment grounding conductor on conduit grounding bushing and then bond to ground bus (or grounded enclosure if there is no ground bus).
C. 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. Flexible raceway and power cords runs.
6. Ground wireway at least once and at 10-foot intervals.

D. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

F. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a sep0arate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
   1. For telephone, alarm, voice and data, and other communication equipment, provide No.-4-AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
   2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4- by 4- by 12-inch (6.3- by 100- by 300-mm) grounding bus.
   3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

G. Metal and Wood 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.

3.04 INSTALLATION:

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground 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 10 inches below finished floor or final grade unless otherwise indicated. Do not drill or jet. Drive ground rods into unexcavated portions of earth where possible. If rods must be driven into excavated areas, drive rods after compaction of backfill is completed.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least eight 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.
   3. At grounding receptacles, drive rods to a depth such that the top of the receptacle is flush with the finished surface.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in SECTION 26 05 44 - UNDERGROUND DUCT BANKS AND MANHOLES, and shall be at least 12 inches (300 mm) deep, with cover.
   1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. 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.

F. 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.

G. 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.

H. 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.

I. Ground Counterpoise Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
   1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
   2. Bury ground ring not less than 24 inches (600 mm from building's foundation).

J. Weld grounding conductors to underground grounding conductors and underground electrodes. Ground electrode conductor shall not contain splices between the ground electrode and the service entrance equipment.

K. Ground electrical service system neutral at service entrance equipment to grounding electrodes.

L. Ground each separately derived system neutral to:
   1. Main building ground system.

M. Bond the system neutral to service entrance equipment enclosures.

N. Ground all exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductors in raceways and cables, receptacle ground conductors, and metallic plumbing systems.

O. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts.

Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

P. Tuss Conductors: Route grounding connections and conductors to ground and protective devices per manufacturer's instructions. Maintain conductor minimum length requirements.

Q. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

3.05 LABELING:

A. Comply with requirements in SECTION 26 05 53 - ELECTRICAL IDENTIFICATION for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.06 FIELD QUALITY CONTROL:

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10ohms.
2. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies hangers, supports, anchors, sleeves, and seals for electrical equipment and systems as well as construction requirements for concrete bases as indicated by Drawings and schedules and/or specified in other Division 26 Sections.
B. Types of hangers, supports, anchors, sleeves, and seals specified in this Section include the following:
   1. Clevis hangers.
   2. Riser clamps.
   3. Steel rod coupling.
   4. C-clamps.
   5. I-beam clamps.
   6. One-hole conduit straps.
   7. Two-hole conduit straps.
   8. Hexagonal nuts.
   9. Round threaded steel rods.
   10. Conduit clamps.
   11. U-bolts.
   12. Lead expansion anchors.
   13. Toggle bolts.
   14. Wall, ceiling, roof and floor seals.
   15. Conduit cable supports.
   16. U-channel strut system.
   17. Fire and smoke stop compounds.

1.03 RELATED REQUIREMENTS:

A. Concrete materials, reinforcement, and placement requirements are specified in Division 03 – Concrete.
B. Supports, anchors, sleeves, and seals furnished as part of factory-fabricated equipment, are specified as part of that equipment assembly in other Division 26 Sections.
C. Section 07 72 36 - Roof Scuttles.
D. Section 26 05 10 – Basic Electrical Requirements.
E. Section 26 05 26 – Grounding.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. ASTM International(ASTM):
   1. ASTM-A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   2. ASTM-E814 REV A - Standard Test Method for Fire Tests of Penetration Firestop Systems, pertaining to fire stop components.

C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
D. National Fire Protection Association (NFPA):
   1. NFPA-70 - National Electrical Code (NEC).
E. National Electrical Contractors Association (NECA):
   1. NECA 1 – Standard Practice of Good Workmanship In Electrical Construction.
F. Society of Protective Coatings (SSPC):
   1. SSPC-PA 1 - Shop, Field and Maintenance Painting of Steel.
G. Underwriters Laboratories (UL):
   1. Provide electrical devices, components, and fire stops which are UL-listed and labeled.

1.05 PERFORMANCE/DESIGN CRITERIA:

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.06 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 - Basic Electrical Requirements for administrative and procedural requirements for submittals.
B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacture's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve, and seal.
C. Shop Drawings: Submit dimensioned drawings of fabricated products, indicating weights, strength, details of fabrication, and details of materials.

1.07 QUALITY ASSURANCE:

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
B. Comply with NFPA 70.

1.08 COORDINATION:

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete specifications.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 07 72 00 - Roof Accessories.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Anchor Manufacturers: Subject to compliance with requirements, provide anchors of one of the following manufacturers.
   1. Hilti, Inc.

2. Ideal Industries, Inc.
3. Joslyn Manufacturing Co., Inc.
4. Eaton/Cooper; McGraw Edison Co.
5. Unistrut; Atkore International.

B. Channel System Manufacturers: Subject to compliance with requirements, provide channel system of one of the following manufacturers.
1. Allied Tube & Conduit Corp.
2. Eaton/Cooper; B-Line Systems, Industries.
3. Erico International Corp.
4. Kindorf; Thomas & Betts Corp.
5. Power-Strut; Power Engineering Co.
6. Unistrut; Atkore International.

C. Fire and Smoke Stop Compounds: Subject to compliance with requirements, provide channel system of one of the following manufacturers.
1. 3M Company.
2. Hilti, Inc.

2.02 MATERIALS:

A. General: Provide supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published product information, as required for complete installation, and as herein specified. All supports shall be designed for the support of the maximum number of conduits and their maximum conductor weights for maximum conduit loading. Where more than one type of supporting device meets indicated requirements, selection is Contractor's option. Do not use perforated metal straps for supports.

B. Supports: Supporting devices of types, sizes, and materials indicated, and having the following construction features.
1. Clevis Conduit Hangers: For supporting conduit; galvanized steel; with 3/8-, 1/2-, 5/8- or 3/4-inch rod, size of clevis and rod as required.
2. Riser Clamps: For supporting conduit, galvanized steel, with two bolts and nuts.
3. Steel Rod Couplings: Provide 3/8-, 1/2-, 5/8- or 3/4-inch straight rod couplings, size as required.
4. C-Beam Clamps: Malleable iron, 3/8-, 1/2-, 5/8-, or 3/4-inch rod, size as required.
5. I-Beam Clamps: Galvanized steel, with 3/8, 1/2-, 5/8-, or 3/4-inch rod, size as required; 3/8-inch horizontal "J" hook safety rod that bolts across the flange, flange width as required.
6. One-Hole Conduit Straps: For supporting conduit; stamped plated steel, size as required.
7. Two-Hole Conduit Straps: For supporting conduit, stamped plated steel, size as required.
8. Hexagonal Nuts, Flat Washers and Lock Washers: For 3/8-, 1/2-, 5/8-, or 3/4-inch rod, size as required; galvanized steel.
9. Round Threaded Steel Rod: Galvanized steel, 3/8-, 1/2-, 5/8-, or 3/4-inch diameter, size as required. Minimum size is 3/8-inch diameter.
10. Conduit Clamps: For supporting conduit; galvanized stamped steel, size as required.
11. U-Bolts: For supporting conduit; galvanized, size as required.

C. Anchors: Anchors of types, sizes and materials indicated, with the following construction features.
1. Lead Expansion Anchors: 1/2, 5/8, or 3/4 inch as required.
2. Toggle Bolts: Springhead, 3/16 by 4 inch or larger size as required.

D. Sleeves and Seals: Sleeves and seals of types, sizes, and materials indicated, with the following construction features:
   1. Pipe Sleeves: When penetrating a wall, ceiling roof or floor, provide pipe sleeves of one of the following:
      a. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gauge metal: 3 inch and smaller, 20 gauge; 4 inch to 6 inch, 16 gauge; over 6 inches, 14 gauge.
      b. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
      c. Iron Pipe: Fabricate from cast iron or ductile-iron pipe; remove burrs.
      d. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.
   2. Wall, Roof and Floor Seals: Provide sleeves for conduit which penetrate foundation walls below grade, floors, ceilings, or exterior walls. Caulk between sleeve and conduit with nontoxic, UL-classified caulking material to ensure watertight seal.
   3. Provide a fire-rated sleeve and seal equal to or exceeding the fire rating of the ceiling, floor or wall being penetrated.

E. Conduit Cable Supports: Cable supports with insulating wedging plug for nonarmored type electrical cables in risers; construct for rigid metal conduit (size as required) number of wires as required, type wire as specified; construct body of malleable-iron casting with hot-dip galvanized finish.

F. U-Channel Strut Systems: Unless indicated otherwise, U-channel strut system for supporting electrical equipment, 12-gauge steel hot-dip galvanized after fabrication for wet and outdoor locations, 12-gauge standard green paint finish for dry and indoor locations, of types and sizes indicated; construct with 9/16-inch diameter holes, 8 inch o.c. on top surface, and with the fittings as required which mate and match with U-channel.

G. Fire and Smoke Stop Compounds: Provide one of the following:
   1. 3M Fire Barrier 2000+.
   2. Hilti, Inc. FS-ONE MAX.

PART 3 - EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION:

A. Install hangers, anchors, sleeves, and seals as specified, required, indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NFPA 70 for installation of supporting devices.

B. Install hangers, supports, clamps, and attachments to support conduit properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacing indicated and as required by NFPA 70 or as indicated when less than NFPA 70 required spacing.

C. Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form watertight seal.

D. Design trapeze type supports, including fasteners to the structure to carry the following loads:
   1. Outdoor supports shall have the following added to the calculated load:
      a. Ice weighing 57 pounds per cubic foot to a thickness of 0.5 inches over the projected area of the supports and conduit being supported.
      b. Snow weighing 8 pounds per square foot over the projected area of the conduit being supported.

c. Wind at 25 pounds per square foot acting in a downward direction.

2. The greater of the following:
   a. The total calculated load multiplied by a factor of 4.
   b. The total calculated load +200 pounds.

E. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

F. Repair damage to painted finishes with paint recommended by manufacturer.

G. Install fire and smoke stop compounds at all penetrations of fire rated walls, floors, ceilings and roofs. Install fire and smoke stop compounds in accordance with manufacturer's instructions to provide a fire seal rating equal to or greater than that of the surface penetrated.
   1. Testing shall be performed in accordance with ASTM-E814 REV A and applicable local codes.

3.02 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. Concrete materials, reinforcement, and placement requirements are specified in Division 03 - Concrete.

C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.03 PAINTING:

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAYS, BOXES, SLEEVES, SEALS AND FITTINGS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies the following:
   1. Conduit.
   2. Outlet and device boxes.
   3. Weatherproof boxes.
   4. Junction boxes.
   5. Pull boxes.
   6. Floor boxes.
   7. Fittings.
   8. Bushings and ground bushings.
   9. Locknuts.
   10. Knockout closures.
   11. Supports and accessories.
   12. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   13. Sleeve-seal systems.
   14. Sleeve-seal fittings.
   15. Grout.
   16. Silicone sealants.

1.03 RELATED REQUIREMENTS:

A. Division 07 - Penetration Firestopping for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.
B. Division 27 - Communications.
C. Division 31 - Trenching and Backfilling.
D. Section 26 05 10 - Basic Electrical Requirements for administrative and procedural requirements for submittals.
E. Section 26 05 26 – Grounding.
F. Section 26 05 29 - Hangers and Supports for Electrical Systems.
G. Section 26 05 53 - Electrical Identification.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. National Electrical Contractors Association (NECA):
   1. NECA NEIS 1 - Standard Practice of Good Workmanship in Electrical Construction.
C. National Electrical Manufacturers Association (NEMA):
   1. NEMA C80.1 - Electrical Rigid Steel Conduit (ERSC).
   2. NEMA C80.3 - Steel Electrical Metallic Tubing (EMT).
   3.
   4. NEMA TC-2 - Electrical Polyvinyl Chloride (PVC) Conduit.

5. NEMA TC-3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
6. NEMA TC-6 and 8 - Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installation.
7. NEMA TC-9 - Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation.
8. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
9. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
10. NEMA 250 - Enclosures for Electrical Equipment (1,000V Maximum).

D. National Fire Protection Association (NFPA):
1. NFPA-70 - National Electrical Code, (NEC). Comply with applicable requirements of NEC pertaining to construction and installation of raceway systems.

E. Underwriters Laboratories (UL):
1. Provide all devices and equipment which are UL listed and labeled.
2. UL 1 - Standards for Flexible Metal Conduit.
3. UL 6 - Electrical Rigid Metal Conduit – Steel.
4. UL 50, 50E - Standard for Enclosures for Electrical Equipment.
5. UL 360 - Standard for Liquid-Tight Flexible Metal Conduit.
6. UL 467 - Grounding and Bonding Equipment.
7. UL 514A - Metallic Outlet Boxes.
8. UL 514B - Conduit, Tubing, and Cable Fittings.
9. UL 514C - Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
10. UL 651 - Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
11. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit.
12. UL 797A - Standard for Electrical Metallic Tubing – Aluminum and Stainless Steel.
13. UL 870 - Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

1.05 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 - Basic Electrical Requirements for administrative and procedural requirements for submittals.

B. Submittals shall include, but not be limited to, the following:
1. Product Data:
a. Submit manufacturer's technical product data, including specifications and installation instructions, for each type of product required. Include data substantiating that materials comply with requirements.
b. Submit layout drawings of electrical floor, junction and pull boxes showing accurately scaled box layouts and their spatial relationship to associated equipment.
2. Samples: For wireways and surface raceways and for each color and texture specified, 12 inches long.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturer:
1. Subject to compliance with requirements, provide each type of raceway from one of the following:
a. Rigid Steel Conduit:

(1) Allied Tube & Conduit; Atkore International.
(2) Republic Conduit, Inc.
(3) Wheatland Tube Co.

b. EMT:
(1) Allied Tube and Conduit; Atkore International.
(2) Republic Conduit, Inc.
(3) Wheatland Tube Co.; JMC Steel Group.

c. PVC Coated Rigid Steel Conduit:
(1) Externally Coated:
(a) Allied Tube and Conduit; Atkore International.
(b) Calbond; Calpipe Industries, Inc.
(c) Perma-Cote Coated Conduit; Robroy Industries.
(2) Externally and Internally Coated:
(a) Perma-Cote Coated Conduit; Robroy Industries.
(b) Calbond; Calpipe Industries, Inc.

d. Liquid-Tight, Flexible Metal Conduit:
(1) AFC Cable Systems; Atkore International.
(2) Anaconda Sealtite; Division of ANAMET Electrical, Inc.
(3) Electri-Flex Co.
(4) Southwire Company.

e. Rigid Metal Conduit Fittings:
(1) Appleton; EGS Electrical Group.
(2) Raco; Hubbell Company.
(3) Thomas & Betts Corp.

f. Flexible Metal Conduit Fittings:
(1) Appleton; EGS Electrical Group.
(2) Electri-Flex Co.
(3) O-Z/Gedney; EGS Electrical Group.

g. Liquid-tight Flexible Metal Conduit Fittings:
(1) Appleton; EGS Electrical Group.
(2) Electri-Flex Co.
(3) O-Z/Gedney; EGS Electrical Group.

h. EMT Fittings:
(1) Appleton; EGS Electrical Group.
(2) Raco; Hubbell Company.
(3) Thomas & Betts Corp.

i. Nonmetallic Rigid Conduit and Fittings:
(1) Carlon; Thomas & Betts Corp.
(2) Prime Conduit.

j. Conduit Bodies:
(1) Appleton; EGS Electrical Group.
(2) Arrow-Hart Div; Cooper Industries.
(3) Killark; Hubbell Inc.
(4) O-Z/Gedney; EGS Electrical Group.

k. Interior Boxes:
(1) Appleton; EGS Electrical Group.
(2) Bell; Hubbell, Inc.
(3) O-Z/Gedney; EGS Electrical Group.

(4) Pass and Seymour; Legrand.
(5) Raco; Hubbell, Inc.
(6) Steel City; Thomas & Betts Corp.

l. Weatherproof Boxes:
(1) Appleton; EGS Electrical Group.
(2) Arrow Hart; Eaton.
(3) Hubbell, Inc.
(4) O-Z/Gedney; EGS Electrical Group.
(5) Pass and Seymour; Legrand.

m. Junction and Pull Boxes:
(1) Appleton; EGS Electrical Group.
(2) Arrow Hart; Eaton.
(3) Bell Electric, Square D Company.
(4) Hoffman Engineering Company.
(5) O-Z/Gedney; EGS Electrical Group.

n. Poke Throughs & Floor Boxes:
(1) Arrow Hart; Eaton.
(2) FSR, Inc.
(3) Hubbell, Inc.
(4) MonoSystems.
(5) Steel City; Thomas & Betts Corp.
(6) Wiremold; Legrand.

o. Bushings, Grounding Bushings and Locknuts:
(1) Arrow Hart; Eaton.
(2) Appleton; EGS Electrical Group.
(3) O-Z/Gedney; EGS Electrical Group.
(4) Raco; Hubbell, Inc.
(5) Steel City; Thomas & Betts Corp.

p. Electrical Enclosures:
(1) Hoffman; Pentair Equipment Protection.
(2) Wiegmann; Hubbell, Inc.

q. Sleeve-Seal Systems:
(1) Advance Products & Systems, Inc.
(2) CALPICO, Inc.
(3) Metraflex Company (The).
(4) Pipeline Seal and Insulator, Inc.
(5) Proco Products, Inc.

r. Sleeve-Seal Fittings:
(1) Link-Seal.
(2) Presealed Systems.

2.02 METAL CONDUIT AND TUBING:

A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) for each service indicated. Where types and grades are not specified or indicated, provide proper selection to fulfill specified requirements, and comply with applicable portions of NEC for raceways. Minimum size shall be 3/4 inch, unless indicated or specified otherwise.
1. Factory-applied, closed-end thread protectors.

B. Rigid Steel Conduit: Rigid steel, zinc coated, threaded type conforming to UL 6A.
   1. Zinc coating fused to inside and outside walls.
C. Intermediate Steel Conduit: Rigid intermediate grade (IMC) hot-dip galvanized conforming to UL 1242.
D. Electrical Metallic Tubing (EMT): UL 797.
E. Flexible Metal Conduit: UL 1. Formed from continuous length of spirally-wound, interlocked zinc-coated strip steel. Minimum size shall be 1/2 inch unless indicated or specified otherwise. Approved as a grounding path for circuits rated 20 amperes or less and in lengths of 6 feet and less.
F. Liquid-Tight, Flexible Metal Conduit: Liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coat with (oil-resistant,) liquid-tight thermoplastic jacket. Approved as a grounding path in conduit sizes 1-1/4 inch and smaller and in lengths 6 feet or less when protected as follows:
   1. 3/8 inch and 1/2 inch protected at 20 amperes or less.
   2. 3/4 inch, 1 inch and 1-1/4 inch protected at 60 amperes or less.
G. Rigid Metal Conduit Fittings: Threaded cast-malleable iron, galvanized or cadmium plated, conforming to UL 514B.
   1. Provide steel fittings for steel conduit.
   2. Provide aluminum fittings for aluminum conduit.
H. Liquid-Tight Flexible Metal Conduit Fittings: Provide cadmium plated, malleable-iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated or noninsulated throat. Fittings shall be approved for grounding in conduit sizes 1-1/4 inch and smaller per NFPA 70 Article 350.60.
I. EMT Fittings: Steel compression type.
J. Conduit Bodies: Galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements and NFPA-70 requirements. Construct conduit bodies with threaded conduit entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws.
K. Conduit and Tubing Accessories: Provide conduit and tubing accessories of types, sizes, and materials, complying with manufacturer's published product information which mate and match conduit and tubing.
L. Conduit Bushings: Provide insulated throat for all bushings. Grounding bushings shall have an integral copper set-screw type cable grounding lug.

2.03 NONMETALLIC CONDUIT AND FITTINGS:

A. General: Provide nonmetallic conduit, ducts, and fittings of types, sizes, and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements which comply with provisions of NFPA 70 for raceways. Minimum size shall be 3/4 inch, unless indicated otherwise.
B. Electrical Plastic Conduit:
   1. Heavy-Wall Conduit: Schedule 40, 90ºC, UL rated, constructed of polyvinyl chloride and conforming to NEMA TC-2, for direct burial or normal aboveground use, UL listed, and in conformity with NFPA 70 Article 352.
   2. Extra-Heavy-Wall Conduit: Schedule 80, 90ºC, UL rated, constructed of polyvinyl chloride compound C 200 PVC, and UL listed in accordance with NFPA 70 Article 352 for direct burial or aboveground use.

C. PVC Conduit Fittings: NEMA TC-3, mate and match to conduit or tubing type and material.
D. Underground PVC Plastic Utilities Duct: (NEMA TC-6 and -8, Type EB-20 for encased burial in concrete, Type DB-60 for direct burial, Type EB-35 for encased burial in concrete, Type DB-120 for direct buried.)
E. PVC and ABS Plastic Utilities Duct Fittings: NEMA TC-9, mate and match to duct type and material.
F. Conduit and Tubing Accessories: Provide conduit, tubing, and duct accessories of types, sizes, and materials, complying with manufacturer's published information which mate and match conduit and tubing.

2.04 FABRICATED MATERIALS:

A. Outlet Boxes: Galvanized, coated, flat rolled, sheet-steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as required, indicated, and specified, suitable for installation at respective locations. Construct outlet boxes with mounting holes and with conduit knockout openings in bottom and sides. Provide boxes with threaded screw holes for grounding screws, fastening devices, box covers, and for equipment grounding. Minimum box size shall be 4-inch by 4-inch by 1.5 inches, provide larger box if required, specified or indicated otherwise.
B. Device Boxes: Galvanized, coated, flat rolled, sheet-steel gangabledevice boxes, of shapes, cubic inch capacities, and sizes, including box depths as required, indicated, and specified, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, with conduit knockout openings in bottom and sides, and with threaded screw holes for fastening devices and box covers. Provide corrosion-resistant screws for equipment grounding. Minimum box size shall be 4-inch by 4-inch by 1.5 inches, provide larger box if required, specified or indicated otherwise.
    1. Device Box Accessories: Provide as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners (use only in existing walls) which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is Contractor's code-compliance option.
C. Weatherproof Boxes: Corrosion-resistant, cast-metal, weatherproof, outlet wiring boxes, of types, shapes, and sizes, including depth of boxes as required with threaded conduit hubs for fastening electrical conduit. Provide cast-metal face plates with spring-hinged, watertight caps suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners.
D. Junction and Pull Boxes: Galvanized, code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes, and sizes, to suit each respective location and installation; with welded seams and equipped with manufacturer's standard corrosion resistant steel nuts, bolts, screws and washers.
E. Floor Boxes: Cast-iron, raintight, adjustable floor boxes as indicated, with threaded-conduit-entrance ends and vertical adjusting rings, gaskets, brass floor plates with flush screw-on covers with ground flange and stainless steel cover screws.
    1. Floor Boxes Accessories: Flush type, duplex, 2-pole, 3-wire, grounding, 125V, 20 ampere, floor-type receptacles with flanges.
F. Bushings: Provide threaded, nylon insulated metallic bushings. Provide steel bushings for conduit sizes 1.5 inches and smaller. Provide malleable iron bushings for conduit sizes 2 inches and larger.

G. Grounding Bushings: Provided where indicated, specified and required by NEC. Provide threaded, insulated, malleable iron bushing with lay-in screw clamp lug.
H. Locknuts: Provide steel locknuts for conduit sizes 2 inches and smaller. Provide malleable iron for conduit sizes 2.5 inches and larger.
I. Sealing Hub: Provide watertight, threaded, insulated sealing hub connectors for all outdoor and indoor wet locations where conduit enters into enclosures. Sealing hub threaded lengths shall be adequate to allow installation of bushing.
J. Knockout Closures: Provide steel press-in knockout seals for all unused punched out knockouts 2 inches and smaller. Provide steel two-piece bolt on knockout seals for all unused punched out knockouts 2.5 inches and larger.
K. Fittings: Provide all threaded nipples, insulated short elbows, offset nipples, offset connectors, enlargers and reducers as required. Provide EMT compression type connectors with insulated throat. Provide EMT compression type insulated short elbows as required. Provide EMT set-screw type offset connectors as required.

2.05 SLEEVES:

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
C. PVC-Pipe Sleeves: ASTM D1785, Schedule 40.
D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
F. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.06 SLEEVE-SEAL SYSTEMS:

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Sealing Elements: EPDMrubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating length required to secure pressure plates to sealing elements.

2.07 SLEEVE-SEAL FITTINGS:

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.08 GROUT:

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.09 SILICONE SEALANTS:

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 INSTALLATION OF RACEWAYS:

A. General:
   1. Install raceways as indicated in accordance with manufacturer's written installation instructions and in compliance with NEC. Install raceways plumb and level, and maintain NEC recommended clearances. Provide raceway supports in accordance with the NEC and Section 26 05 29 - Hangers and Supports for Electrical Systems.
B. Coordinate with other work including wires/cables, boxes, and panel work as necessary to interface installation of electrical raceways and components with other work.

3.02 INSTALLATION OF CONDUITS:

A. General: Install concealed conduits in new construction work - in walls, in slabs, or above suspended ceilings. Run conduits concealed in existing work where practicable. Where conduits cannot be concealed in finished areas, use surface metal raceways only where indicated. Provide holes for conduit in all boxes, panels and enclosures as required.
   1. All conduit installed above grade (including exposed and concealed above removable suspended ceilings) that contains emergency power and emergency lighting conductors shall be identified in accordance with Section 26 05 53 – Electrical Identification.
   2. Mechanically fasten together metal conduits, enclosures, and raceways to form continuous electrical conductor. Connect to electrical boxes, fittings, and cabinets to provide electrical continuity and firm mechanical assembly.

3. Avoid use of dissimilar metals throughout system to eliminate possibility of galvanic corrosion. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
4. Install miscellaneous fittings such as reducers, close nipples, 3 piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install telescoping type linear expansion fittings in raceways every 200 foot linear run and wherever structural expansion joints are crossed.
5. Use roughing-in dimensions of electrically powered units furnished by unit manufacturer. Set conduit and boxes for connection to units only after receiving dimensions and after checking location with other trades.
6. Test conduits (witnessed by the Owner's representative) required to be installed but left empty with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition. Provide 200-pound tensile strength nylon conduit fish line throughout the entire length of all empty conduits. Leave 12 inches of slack at each end.
7. Do not install conduit in front of covers of new and existing electrical equipment, pull boxes, and junction boxes.
8. Provide all openings in floors, walls, ceilings and roofs for passage of conduit. Fire ratings of walls, floors, ceiling and roofs shall be maintained when passing through them by providing fire seals in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.
9. Where different conduits contain circuits of different noise levels the horizontal and vertical spacing in inches between the outside surfaces of the conduits (or conduit to cable tray) shall not be less than indicated below (unless specified otherwise, indicated otherwise, or required otherwise by the equipment manufacturer):
    a. Noise Level 1 Circuits: Analog circuits less than 50V, digital circuits less than 12V or telephone circuits.
    b. Noise Level 2 Circuits: Analog circuits greater than 50V or digital circuits greater than 12V.
    c. Noise Level 3 Circuits: 120Vac or dc circuits operating at less than 20 amperes.
    d. Noise Level 4 Circuits: Ac or dc circuits less than 800V operating with currents less than 800 amperes.
    e. Noise Level 5 Circuits: Circuits over 800Vac or dc and/or over 800 amperes.

MINIMUM HORIZONTAL AND VERTICAL SPACING BETWEEN DIFFERENT CONDUIT OUTSIDE SURFACES (OR CONDUIT TO CABLE TRAY) IN INCHES					
NOISE LEVEL	1	2	3	4	5
1	*	1	3	12	12
2	1	*	3	9	12
3	3	3	*	*	6
4	12	9	*	*	*
5	12	12	6	*	*
* = MINIMUM SEPARATION REQUIRED FOR INSTALLATION OF LOCKNUTS AS IF ADJACENT CONDUIT WERE TERMINATING IN AN ENCLOSURE.					

10. Provide a weatherproof duct seal compound between the conductors and the inner walls of all conduit that are routed to NEMA 3, 3R, 3S, 4 and 4X enclosures to prohibit moisture and/or humid air from entering the raceway and condensing.
11. Repair damage to galvanized finishes with a zinc-rich paint recommended by the manufacturer.
12. Repair damage to PVC finishes with matching touch-up coating recommended by the manufacturer.
13. Where metallic conduit leaves cast-in-place concrete (to air, to earth or to compacted fill) coat the conduit 2 inches on either side of the line formed by the finished concrete surface with a bitumastic asphalt coating.

B. Conduit Installation: Provide rigid steel zinc-coated conduit where embedded in cast-in-place concrete, in hazardous locations, routed below floor slabs, when containing circuits over 600Vac, routed through cast-in-place masonry, or installed outdoors. Follow minimum requirements in other areas as follows:
1. Use rigid steel zinc-coated conduit in mechanical equipment rooms, electrical equipment rooms, penthouses where exposed to physical damage, crawl spaces, tunnels, service splines, kitchens and cafeterias, and in warehouse spaces below 18 feet-0 inches height, and for240 V feeder circuits topanelboards.
2. Use steel zinc-coated EMT for interior 240V branch circuits, interior concealed 120V power, lighting, alarms, controls, and communications in offices, corridors, toilets, lunchroom areas, lab areas, ceiling plenum areas, and in warehouse spaces above 18 feet-0 inches height.
3. Use flexible steel conduit only in movable partitions and from outlet boxes to interior recessed lighting fixtures (Maximum of 6 feet long and a minimum of 4 feet long in nonenvironmental air plenums. Maximum length in environmental air plenums shall be 4 feet long), and final 24 inches of connection to motors, transformers, and control items. Provide where subject to movement and vibration where connections are in dry, nonhazardous, interior locations. Provide in cells of precast concrete panels. Provide a "green" insulated equipment ground wire suitably sized per NEC 250.122 unless indicated otherwise in all flexible steel conduit. Except equipment ground wire is not required on control circuits rated 20 amperes or less where flexible steel conduit 6 feet or

less in length is used only for vibration elimination purposes and not for purposes of providing flexibility for movement.

4. Use liquid-tight flexible conduit in nonhazardous locations,length shall not exceed 6 feet, unless indicated otherwise, where subjected to movement and vibration where connections are subjected to one or more of the following conditions:
   a. Exterior location.
   b. Moist or humid atmosphere where condensation can be expected to accumulate.
   c. Corrosive atmosphere.
   d. Subjected to water spray or dripping oil, water or grease.
   e. Connected to a motor driving a nonsubmerged pump.
5. Provide a "green" insulated equipment ground wire suitably sized per NEC 250.122 unless indicated otherwise in all liquid-tight flexible conduit.
6. Cut conduits straight, properly ream, and cut threads for threaded conduit deep and clean.
7. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
8. Size conduits as indicated, unless no size is indicated then size per NEC, except no conduit smaller than 3/4 inch shall be embedded in concrete or masonry.
9. Fasten indoor, dry location threaded conduit terminations in sheet metal enclosures by 2 locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.
10. Conduits shall not cross pipe shafts, access openings or ductwork openings.
11. Keep conduits a minimum distance of 6 inches from parallel runs of flues, hot water pipes or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
12. Support riser conduit at each floor level with clamp hangers.
13. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split coupling.
14. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
15. Use externally PVC coated (and internally urethane coated) rigid steel conduit on all 90 bends into buildings and where specified or indicated.
16. Conduit installed above suspended ceilings shall comply with the following:
    a. Install exposed conduits and extensions from concealed conduit systems neatly and parallel with or at right angles to walls of building or structure.
    b. Install exposed conduit work so as not to interfere with ceiling inserts, windows, doors, lights, ventilation ducts or outlets.
    c. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed NEC requirements.

C. Concealed Conduits:
1. Metallic raceways in floors below grade or outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure watertightness.
2. For floors-on-grade, install PVC externally coated rigid steel conduit under concrete slabs. Provide only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.
3. Install underground conduits a minimum of 24 inches below finished grade.

D. Conduits in Concrete Slabs:
1. Place conduits between bottom reinforcing steel and top reinforcing steel.
2. Place conduits either parallel or at 90 degrees to main reinforcing steel.

3. Separate conduits by not less than the outside diameter of the largest conduit to ensure proper concrete bond.
4. Conduits crossing in slab must be reviewed for proper cover by the Owner's Representative.
5. Embedded conduit outside diameter shall not exceed 1/3 of slab thickness.

E. Install conduits so as not to damage or run through solid structural members. Avoid horizontal or cross runs in building partitions or side walls.

F. Exposed Conduits:
1. Install exposed conduits and extensions from concealed conduit systems neatly and parallel with or at right angles to walls of building or structure.
2. Install exposed conduit work so as not to interfere with ceiling inserts, windows, doors, lights, ventilation ducts or outlets.
3. Support exposed conduits by use of hangers, clamps, or clips. Support conduits on each side of bends and on spacing not to exceed NEC requirements.
4. Run conduit for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
5. Above requirements for exposed conduits also apply to conduits installed in space above suspended ceilings and in crawl spaces.

G. Nonmetallic Conduits:
1. Provide only where indicated. Do not install in hazardous locations.
2. Make solvent cemented joints in accordance with recommendations of manufacturer.
3. Install PVC conduits in accordance with NEC and in compliance with local utility practices.
4. All duct banks shall be a minimum of 3 feet below grade. Conduit in duct banks shall have a minimum of 3 inches of concrete cover in all directions. There shall be a minimum of 2 inches of concrete separation between all conduit.
5. All conduit risers from buried conduit or duct banks shall be made with (internally urethane coated and) externally PVC coated galvanized rigid steel conduit elbows.

H. Conduit Fittings:
1. Provide locknuts for securing conduit to metal enclosures with a sharp edge for digging into metal and ridged outside circumference for proper fastening. Standard locknuts are not acceptable.
2. Provide threaded, nylon insulated bushings for terminating conduits which have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
3. Provide threaded, grounding bushings of insulated type with copper set screw clamp type lay-in grounding terminal where required by NEC, where indicated or specified.
4. Provide miscellaneous fittings such as reducers, close nipples, 3 piece unions, split couplings, and plugs as required which are specifically designed for their particular application.
5. Provide grounding in accordance with Section 26 05 26 - Grounding.
6. Provide raintight hubs on all outdoor conduit that are terminated in a nonthreaded enclosure hole.
7. Provide identification of all raceways as specified in Section 26 05 53 - Electrical Identification.
8. EMT shall have galvanized compression type box connectors at all boxes.
9. Provide raceway sealing fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, install each fitting in a flush

steel box with a blank cover plate having a finish similar to adjacent wall plate or surfaces. Provide sealing fittings where:

a. Conduit enters or leaves hazardous locations.
b. Where conduit passes from warm locations to cold locations, such as boundaries of refrigerated spaces and air-conditioned spaces.

3.03 INSTALLATION OF SURFACE METAL RACEWAYS AND WIREWAYS:

A. General: Mechanically assemble metal enclosures and surface metal raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings, and cabinets to provide effective electrical continuity and rigid mechanical assembly.
   1. Provide only where indicated. Avoid use of dissimilar metals throughout system to eliminate possibility of galvanic corrosion. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
   2. Install expansion fittings in all raceways, surface metal raceways, and wireways wherever structural expansion joints are crossed.
   3. Make changes in direction of surface metal raceway and wireway with proper fittings supplied by raceway manufacturer. No field bends of surface metal raceway or wireway sections will be permitted.
   4. Properly support and anchor surface metal raceways for their entire length with structural materials. Surface metal raceways are not to span any space unsupported.
   5. Use boxes as supplied by surface metal raceway manufacturer wherever junction, pull or devices boxes are required. Standard electrical "handy" boxes, etc. shall not be permitted for use with surface metal raceway installations.
   6. Provide identification of all raceways as specified in Section 26 05 53 – Electrical Identification.
   7. Provide tap location nameplates for wireways when used as auxiliary gutters as specified in Section 26 05 53 – Electrical Identification.
   8. Ground wireways at 10-foot intervals per Section 26 05 26 – Grounding.

3.04 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. General: Install electrical boxes, bushings, locknuts, nipples, connectors, sealing hubs, and fittings as required, indicated, in accordance with applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.
B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
C. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
D. All boxes containing emergency power and lighting circuits shall be identified as specified in Section 26 05 53 – Electrical Identification.
E. Provide (oil-tight) knockout closures to cap unused knockout holes where blanks have been removed.
F. Install electrical boxes in only those locations which ensure ready accessibility to enclosed electrical wiring.
G. Maximum box size in a fire-rated wall shall be 4 inches by 4 inches square. Do not install boxes back-to-back in walls. In nonfire-rated and nonacoustic- rated walls, provide not less than 6 inches (150 mm) horizontal separation between boxes installed in opposite sides of wall. Provide not less than 24 inches (610 mm) horizontal separation between boxes installed in opposite sides of fire-rated and acoustic- rated walls.

H. Do not install aluminum products in concrete.
I. Position recessed outlet boxes accurately to allow for surface finish thickness.
J. Set floor boxes level and flush with finish flooring material.
K. Fasten electrical boxes firmly and rigidly to the surfaces to which attached, structural surfaces to which attached, or solidly embed them in concrete or masonry.
L. Box support must be independent of conduit.
M. Provide electrical connections for installed boxes.
N. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.05 GROUNDING:

A. Properly ground electrical boxes and demonstrate compliance with NEC requirements. Bond all non-isolated equipment grounding conductors to all electrical boxes.

3.06 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS:

A. Comply with NECA 1.
B. Comply with NECA VE-2 for cable tray and cable penetrations.
C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
    1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
        a. a. 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".
        b. b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
    2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
    3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed[or unless seismic criteria require different clearance].
    4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
    5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) > above finished floor level. Install sleeves during erection of floors.
D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
    1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
    2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [steel] [cast-iron] 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.
G. Underground, Exterior-Wall and Floor 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 sleeve-seal system.

3.07 SLEEVE-SEAL-SYSTEM INSTALLATION:

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
B. Install 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.

3.08 SLEEVE-SEAL-FITTING INSTALLATION:

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
C. Secure nailing flanges to concrete forms.
D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 33

SECTION 26 05 44 - UNDERGROUND DUCT BANKS AND MANHOLES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the following:
   1. Complete underground duct systems consisting of banks of nonmetallic ducts encased in plain and reinforced concrete, and reinforced concrete manholes.
   2. All necessary earth and rock excavation and backfill.
   3. Removal and disposal of all excess excavation material.

B. Related Work Specified Elsewhere:
   1. Grounding: SECTION 26 05 26.
   2. Site Work: DIVISION 31.
   3. Concrete: DIVISION 3.
   4. Masonry: DIVISION 4.

1.02 REFERENCES:

A. Applicable Standards:
   1. National Electrical Manufacturer's Association (NEMA):
      a. TC-2: Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
      b. TC-6: PVC and ABS Plastic Utilities Duct for Underground Installation.
      c. TC-8: Extra-Strength PVC Plastic Utilities Duct for Underground Installation.
   2. American Society for Testing and Materials (ASTM):
      a. F512: Standard Specification for Smooth-Wall Polyvinyl Chloride (PVC) Conduit and Fittings for Underground Installation.
   3. Federal Specifications:
      a. W-C-1094A: Conduit and Conduit Fittings Plastic, Rigid.
   4. Underwriters Laboratories, Inc. (UL):
      a. 651 - Schedules 40 and 80 Rigid PVC Conduit.
      b. 651A - Type EB and a Rigid PVC Conduit and HDPE Conduit.

PART 2 - PRODUCTS

2.01 DUCTS:

A. Conduit Types for Concrete Encasement:
   1. Type EB:
      a. Tested to Underwriters' Laboratories, Inc. (UL) Standard UL 651A.
      b. Type EB20, Standard Wall, Thickness conforming to NEMA TC-6 and ASTM F512.
      c. Type EB35, Heavy Wall, Thickness conforming to NEMA TC-8 and ASTM F512.
   2. Type Schedule 40 Polyvinyl Chloride (PVC):
      a. Underwriters' Laboratories, Inc. (UL) Listed.
      b. Conforms to ANSI/NEMA TC-2, Federal Specifications WC-1094A and UL 651.

B. Rated for use with 90°C conductors.

C. Complete with all necessary end bells, couplings, offset couplings, elbows, and other fittings.

D. Sizes as indicated.

E. Long radius elbows for all duct termination risers.

F. Interlocking type plastic duct spacers for duct spacing as indicated.

2.02 REINFORCING STEEL: Provide as specified in DIVISION 3.

2.03 CONCRETE: Provide as specified in DIVISION 3.

2.04 MASONRY: Provide as specified in DIVISION 4.

2.05 HARDWARE:
- A. Manhole frames and covers of type, size and load capacity as indicated.
- B. Pulling irons, steps, inserts, cable racks and additional hardware as indicated.
- C. Grounding as indicated or as specified in SECTION 26 05 26.

2.06 "PULLING IN" ROPE:
- A. Nylon.
- B. Minimum breaking strength: 2000 pounds.

PART 3 - EXECUTION

3.01 EXCAVATION AND TRENCHING FOR DUCT BANKS AND MANHOLES: Perform as specified in DIVISION 31.

3.02 INSTALLATION:
- A. Duct Banks:
  1. Ducts:
     - a. Assemble as follows:
       - (1) On spacers to maintain horizontal and vertical separation indicated.
       - (2) With joints in adjacent ducts staggered.
       - (3) All joints watertight by application of joint sealer compound furnished by duct manufacturer.
       - (4) No reinforcing steel or other ferrous material between individual ducts.
     - b. Securely tie overall at 5-foot or closer intervals as required.
     - c. Secure to anchors after assembling to prevent flotation when placing concrete.
     - d. Slope as indicated with a minimum continuous slope of 1/2 percent.
     - e. Align ducts for each 100 feet not greater than 4 inches horizontal.
     - f. Install end bells flush with face of concrete at each manhole and termination point unless indicated otherwise.
     - g. Immediately after cleaning, install a "pulling in" rope in each duct as indicated, and plug each end of all ducts.
  2. Reinforcing: Place as specified in DIVISION 3.
  3. Concrete:
     - a. Do not place prior to inspection and approval of duct and reinforcing installation by Engineer.
     - b. Place as specified in DIVISION 3.
- B. Manholes:
  1. Construction:
     - a. Construct with formed roof and walls to the dimensions and at locations indicated.
     - b. Install the following as indicated:
       - (1) Inserts.
       - (2) Pulling irons.
       - (3) Steps.
       - (4) Other hardware items.
       - (5) Conduit.

(6) Cable tray.
(7) Cable racks.
(8) Supports
(9) Holes
(10) Sleeves.
(11) Openings.

c. Place forming, reinforcing and concrete as specified in DIVISION 3.
d. Provide ground rods and ground connections to all metal items as indicated or as specified in SECTION 26 05 26.

3.03 CLEANING: Rod and clean all ducts with suitable cleaners, swabs and mandrels after completion of the duct bank.

3.04 BACKFILLING: Backfill as specified in DIVISION 31.

END OF SECTION 26 05 44

SECTION 26 05 53 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies electrical identification work including the following:
   1. Buried cable and duct bank warnings.
   2. Electrical power, control, and communication conductors (and raceways).
   3. Operational instructions and warnings.
   4. Danger, caution and warning signs.
   5. Equipment/system identification nameplates.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. Applicable Standards: Comply with the applicable requirements of the following standards.
   1. The American Society of Mechanical Engineers (ASME):
      a. A13.1 - Scheme for the Identification of Piping Systems.
   2. ASTM International (ASTM):
      a. ASTM D709 - Standard Specification for Laminated Thermosetting Materials.
   3. National Electrical Manufacturers Association (NEMA):
      a. Z535.1 – Safety Colors.
      b. Z535.4 – Product Safety Signs and Labels.
   4. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC), as applicable to installation of identifying labels and markers for wiring and equipment.
      b. 70E – Standard For Electrical Safety In The Workplace.
      c. 72 – National Electric Safety Code (NESC) – IEEE C2.
   5. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910.144 – Safety Color Code for Marking Physical Hazards.
      b. 29 CFR 1910.145 - Specifications for Accident Prevention Signs and Tags.
   6. Underwriters Laboratories (UL), pertaining to electrical identification systems:
      a. 969-1995 – Standards for Marking and Labeling Systems.- Fourth Edition; Reprint with Revisions Through and Including September 19, 2014.

1.04 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 - Basic Electrical Requirements for administrative and procedural requirements for submittals.

B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacturer's data on electrical identification materials and products.
   2. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.

1.05 QUALITY ASSURANCE:

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.
C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
D. Comply with NEMA Z535.4 – Product Safety Signs and Labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.06 COORDINATION:

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):
   1. Brady Worldwide, Inc.
   2. Panduit Corp.
   3. Seton Identification Products.
   4. Thomas & Betts Corp.

2.02 ELECTRICAL IDENTIFICATION MATERIALS:

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option; but provide single selection for each application.
B. Orange "Emergency" Conduit, Equipment, Box, and Cable Tray Markers:
   1. General: Self-adhesive vinyl tape marker not less than 3 mils thick. Provide 1-1/8 inch wide by 4-1/2 inch long marker for 2 inch and smaller conduit. Provide 2-1/4 inch wide by 9 inch long marker for 2-1/2 inch and larger conduit and all cable tray. Except as otherwise indicated, provide black lettering which indicates highest voltage of cables(s) in conduit or cable tray. Provide black lettering that indicates "Emergency" power circuit is in conduit or cable tray.
   2. Colors: Unless otherwise indicated or required by governing regulations, provide orange background tape marker.
C. Underground Type Plastic Line Marker:
   1. General: Permanent, bright-colored, continuous-printed plastic tape marker, intended for direct-burial service; not less than 6 inches wide by 4 mils thick. Provide tape marker with printing which most accurately indicates type of service of buried cable or duct bank. (Provide embedded continuous metallic strip or core.)
D. Wire/Cable Identification Bands:
   1. General: Vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either prenumbered plastic coated type or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification number indicated on Drawings or Shop Drawings.

E. Plasticized Tags:
   1. General: Preprinted or partially preprinted accident-prevention and operational tags, on plasticized card stock with matt finish suitable for writing, approximately 3-1/4 inches by 5-5/8 inches, with brass grommets and wire fasteners, and with appropriate preprinted wording, including large-size primary wording, e.g., "DANGER, DO NOT OPERATE." Tags shall comply with OSHA requirements.

F. Self-Adhesive Plastic Signs:
   1. General: Self-adhesive or pressure-sensitive, preprinted, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., "EXHAUST FAN."
      a. Colors: Unless otherwise indicated or required by governing regulations, provide white signs with black lettering.

G. Baked Enamel "Danger" Signs:
   1. "DANGER" signs of baked enamel finish on 20-gauge steel (unless specified otherwise); of standard safety red, safety black, and safety white ; 14 inches by 10 inches size, except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., "_____VOLTS, KEEP AWAY." Sign shall conform to OSHA and NEMA Z535.4.

H. Baked Enamel "Caution" Signs:
   1. "CAUTION" signs of baked enamel finish on 20 gauge steel (unless specified otherwise); of standard safety yellow with safety black letters; 14 inches by 10 inches size, except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., "Caution for Ear Protection Required in this Area."

I. Based Enamel "WARNING" Signs:
   1. "WARNING" signs of baked enamel finish on 20 gauge steel (unless specified otherwise); of standard safety orange with safety black letters; 14 inches by 10 inches size, except where 10 inches by 7 inches is largest size that can be applied where needed and except where larger size is needed for adequate vision; with recognized standard explanation wording. Sign shall conform to OSHA and NEMA Z535.4.

J. Engraved Plastic-Laminate Nameplates:
   1. General: Engraving stock melamine plastic laminate nameplates, in sizes (minimum height of characters shall be 1/8 inch) and thicknesses specified or indicated, engraved with engraver's standard letter style of sizes and wording indicated, white face and black core plies (letter color) except as otherwise indicated, specified or required. Colors shall comply with OSHA and NEMA Z535.1. Nameplate shall be punched for mechanical fastening except where adhesive mounting is necessary because of surface it is mounted to.
      a. Thickness: 1/16-inch, for units up to 20 square inches or 8 inch length; 1/8-inch for larger units.
      b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate surface it is mounted to.
   2. Lettering and Graphics:
      a. Coordinate names, abbreviations, and other designations used in electric identification work with corresponding designations shown, specified, or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ASME

A13.1 pertaining to minimum sizes for letters and numbers. Comply with OSHA and NEMA Z535.4 requirements.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION:

A. General Installation Requirements:
   1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
   2. Coordination: Where identification is to be applied to surfaces which require finish painting, install identification after completion of painting.
   3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit and Cable Tray Identification Markers:
   1. General: Where electrical conduit is exposed, apply identification markers on electrical conduit at 20 foot intervals (visible from the floor) and within 3 feet of all panelboards, switchboards, switchgear, automatic transfer switches, emergency generators, substations, switches, devices, and circuit breakers (readily visible when standing in front of equipment). Identification on cable tray shall be on outside of both sidewalls at 20 foot intervals.

C. Underground Cable, Conduit, and Duct Bank Identification Marker:
   1. General: During back-filling/top-soiling of each exterior underground direct buried electrical, signal or communication cable, conduit and duct bank, install continuous underground-type plastic line marker, located directly over the direct buried cable, conduit or duct bank at 12 inches below finished grade. Where multiple small direct buried cables are buried in a common trench and do not exceed an overall width of 16 inches, install a single line marker.
   2. Install line marker for every cable below grade, regardless of whether direct-buried, protected in conduit, or conduit in duct bank.

D. Wire/Cable Identification Bands:
   1. General: Apply cable/conductor identification bands, including circuit number, on each wire/cable in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

E. Operational Identification and Warning Plasticized Tags and Metal Signs and Plastic Signs:
   1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install signs with instruction or warnings. When signs are installed on switches, outlets, controls, devices and covers of electrical enclosures they may be self-adhesive vinyl or plastic. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

F. Danger Signs:
   1. General: In addition to installation of danger signs specified, indicated, and required by governing regulations and authorities, install appropriate danger signs at locations

indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about Project.

2. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons or damage to or loss of property.
3. Provide the following danger signs on the doors leading to the equipment indicated:
   a. "Danger Hearing Protection Required" on all emergency generator room doors.
   b. "Danger: No Smoking, Matches or Open Flames" on all emergency generator room doors (, personnel doors opening into aircraft hangar,) and battery room doors.

G. Warning Signs:
1. Provide an orange background sign with black letters reading "WARNING: LOAD SIDE OF SWITCH MAY BE ENERGIZED BY BACKFEED" on all tie switches and tie circuit breakers.
2. Provide cable tray warning signs with 1-1/2-inch high black letters on an orange background that reads: "Warning! Not to be used as a walkway, ladder or support for ladders for personnel." Provide on each side of cable tray at 10-foot intervals, visible from the floor below.
3. Provide Arc Flash Warning signs on electrical equipment such as switchboards, switchgear, panelboards, transfer switches, industrial control panels, motor control centers and meter socket enclosures that are likely to require examination, adjustment, servicing, or maintenance while energized. Marking shall be permanently affixed and of a durable nature to withstand the environment within which it is installed.
4. Provide Available Fault Current Warning signs on electrical equipment as specified in Section 26 05 73. Label shall include possible incident energy exposure within arc flash boundary in front of equipment as well as meet NFPA 70E for additional content.

H. Caution Signs:
1. Provide yellow background caution signs with black letters on the doors leading to the equipment indicated:
   a. "Caution Ear Protection Required in this Area" on all emergency generator room doors.
2. Provide the following yellow background caution sign with black letters on all panelboards, substations, switches, circuit breakers, and switchboards where turning off a circuit will automatically start an emergency generator:
   a. "Caution Turning Off this Circuit will Automatically Start Emergency Generator XX"
3. Provide the following yellow background caution sign with black letters on all automatic transfer switches, switches, circuit breakers, equipment, and emergency panelboards that are energized by the emergency power system:
   a. "Caution Automatically Energized by the Emergency Power System."

I. Equipment/System Identification Nameplates:
1. General: Install engraved plastic-laminated nameplates on each major unit of electrical equipment in the building; including central or master unit of each electrical system including communication/control/signal/alarm systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2-inch high lettering on 1-1/2-inch high sign (2 inches high were two lines are required), black lettering on white field. Provide text matching terminology and numbering of the contract documents and shop drawings. Nameplate shall include unit designation, normal source circuit number ("Fed from..."), circuit voltage, and other data specifically indicated. Nameplate shall indicate normal source

circuit number ("Fed from..."), and emergency source circuit number ("Fed from..."), when the equipment is a transfer switch or fed directly from a transfer switch. Provide nameplates for each unit of the following categories of electrical work:

a. Switchboards, panelboards, electrical cabinets, and enclosures. (Include main bus ampacity on the nameplate.)
b. Access panel/doors to electrical facilities.
c. Disconnect switch.
d. Push buttons, selector switches, indicating lights. (Circuit number and voltage not required on nameplate).
e. Lighting control equipment and contactors.
f. Remote controlled switches, dimmer modules, and control devices.
g. Transformers (Include primary voltage, secondary voltage, number of phases, feeder, and panelboards or equipment supplied by the secondary.)
h. Power generating units.
i. Provide "EMERGENCY" conduit markers on all conduit and pullboxes that contain emergency power conductors.

2. Install markers, tags, nameplates, and signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure the identification with fasteners, except use adhesive where fasteners should not or cannot penetrate surface.

END OF SECTION 26 05 53

SECTION 260923 - LIGHTING CONTROL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. Types of lighting control equipment specified in this Section include the following:
   1. Photo sensor controls.
   2. Indoor occupancy sensors.
   3. Manual modular dimming controls.
   4. Integrated, multipreset modular dimming controls.

1.03 RELATED REQUIREMENTS:

A. DIVISION 26 Sections for wires/cables, electrical boxes, fittings, and wiring devices which are required in conjunction with lighting control equipment work.
B. SECTION 262416 for lighting distribution panels with integral lighting control.
C. SECTION 262726 - WIRING DEVICES.

1.04 REFERENCE STANDARDS:

A. Applicable Standards: Comply with applicable requirements of following standards.
   1. Electronic Industries Association (EIA):
      a. RS-232 - Interface between data terminal and equipment data communication equipment employing serial binary data interchange.
      b. RS-453 - Dimensional, Mechanical, and Electrical Characteristics Defining Phone Plugs and Jacks.
   2. Federal Communications Commission (FCC): Comply with Part 68 of Federal Communications Commission Rules pertaining to telephone equipment registration by manufacturer.
      a. Provide telephone equipment with FCC labels indicating applicable FCC registration and numbering of equipment.
   3. National Electrical Manufacturers' Association (NEMA):
      a. Pub. No. 250 - Enclosures for Electrical Equipment (1,000V Maximum).
   4. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to construction and installation of lighting control and communications equipment.
   5. Underwriters Laboratories (UL): Provide lighting control equipment and components which are UL-listed and labeled.
      a. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.05 SUBMITTALS:

A. Refer to DIVISION 01 and SECTION 26 05 10 - BASIC ELECTRICAL REQUIREMENTS for administrative and procedural requirements for submittals.
B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacturer's data on lighting control equipment and components.
   2. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.

3. Device plates and plate color and material.
4. Ballasts and lamp combinations compatible with dimmers.
5. Wiring Diagrams: Power, signal, and control wiring.
6. Shop Drawings: Submit dimensioned drawings of lighting control equipment and components including, but not necessarily limited to, programmable controllers, transceivers, printers, relays, sensors, contactors, and switches. Provide floor plans that clearly identify each controlled zone, including the address code of each zone.
7. Wiring Diagrams: Submit wiring diagrams for lighting control equipment and components showing control wiring and interconnection wiring, including connections to equipment components and electrical power. Differentiate between portions of wiring that are manufacturer factory installed and portions that are field installed.
8. Agreement to Maintain: Prior to time of final acceptance, the Contractor shall submit four copies of an agreement for continued service and maintenance of lighting control equipment for Owner's possible acceptance. Offer terms and conditions for furnishing parts and providing continued testing and servicing, including replacement of materials and equipment, for a one year period with an option for renewal of the Agreement by the Owner.
9. Operation and Maintenance Manuals: Furnish maintenance manuals which contain equipment cuts, operating instructions, shop drawings, wiring diagrams, troubleshooting procedures, and spare parts list for equipment. Ensure that the manual includes operating instructions in addition to instructions for revising the system's software package.

C. Samples for Initial Selection: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.
D. Samples for Verification: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver lighting control equipment and components in factory-fabricated type containers or wrappings that properly protect equipment from damage.
B. Store lighting control equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
C. Handle lighting control equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.

1.07 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide lighting control equipment of one of the following (for each type of equipment):
1. Cestron.
2. Cooper Industries, Inc.

3. Cutler-Hammer.
4. Eaton Corporation.
5. General Electric Co.
6. Hubbell Building Automation, Inc.
7. Intermatic, Inc.
8. Leviton Manufacturing Company, Inc.
9. Lighting Control and Design; Acuity Lighting Group, Inc.
10. Lightolier Controls.
11. Lithonia Lighting; Acuity Lighting Group, Inc.
12. Lutron Electronics, Inc.
13. RAB Lighting.
14. Sensor Switch, Inc.Square D Co.; a brand of Schneider Electric.
15. NSi Industries LLC; TORK Products.
16. Watt Stopper.

2.02 INDOOR OCCUPANCY SENSORS:

A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operation: 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.
   3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
   4. Power Pack: Dry contacts rated for 20-A ballast load at 120 and 277Vac, for 13-A tungsten at 120Vac, and for 1 hp at 120Vac. Sensor has 24Vdc, 150-mA, Class 2 power source, as defined by NFPA 70.
   5. 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.
   6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
   7. Bypass Switch: Override the "on" function in case of sensor failure.
   8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

B. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
   1. Detector Sensitivity: Detect occurrences of 6 inch- (150 mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inches (232 sq. cm).
   2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1,000 sq. ft. (93 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.
   3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10 foot- (3 m-) high ceiling.

C. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy .

1. Detector Sensitivity: 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).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 sq. ft. (93 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2,000 sq. ft. (186 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10 foot- (3 m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

D. Dual-Technology Type: 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. inches (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 1,000 sq. ft. (93 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.

2.03 CONDUCTORS AND CABLES:

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

2.04 GENERAL DIMMING DEVICE REQUIREMENTS:

A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.

B. Dimmers and Dimmer Modules: Comply with UL 508.
1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
2. Dimmer or Dimmer-Module Rating: Not less than 125% of connected load unless otherwise indicated.

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION:

A. 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.
B. Install and aim sensors in locations to achieve not less than 90% coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 CONTACTOR INSTALLATION:

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION:

A. Wiring Method: Comply with SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Minimum conduit size is 1/2 inch (13 mm).
B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 GROUNDING:

A. Provide equipment ground connections for lighting control equipment. Tighten connectors to comply with tightening torques specified in UL 486A to assure permanent and effective grounding.

3.05 IDENTIFICATION:

A. Provide equipment grounding connections for lighting control equipment. Tighten connectors to comply with tightening torques specified in UL 486A to assure permanent and effective grounding.
B. Identify components and power and control wiring according to SECTION 26 05 53 - ELECTRICAL IDENTIFICATION .
    1. Identify controlled circuits in lighting contactors.
    2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
C. Label time switches and contactors with a unique designation.
D. Label each dimmer module with a unique designation.
E. Label each scene control button with approved scene description.

3.06 FIELD QUALITY CONTROL:

A. Perform the following tests and inspections:
    1. Continuity tests of circuits.
    2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
        a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
    3. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Remove and replace malfunctioning modular dimming control components and retest as specified above.

D. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.07 ADJUSTING:

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.08 PERSONNEL TRAINING:

A. Building Operational Personnel on-site Training: Train Owner's building operating personnel on-site in procedures for starting-up, testing, operating, trouble shooting, servicing and preventive maintenance of the lighting control system equipment for a minimum period of eight hours.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies panelboards and mini-power centers, including cabinets and boxes, as indicated by drawings and schedules, and as specified herein.

B. Types of panelboards and enclosures required for the project include the following:

1. Service entrance panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.03 RELATED REQUIREMENTS:

A. Wires/cables, electrical boxes, fittings, and raceways required in conjunction with the installation of panelboards and enclosures: Other DIVISION 26 Sections.

B. SECTION 26 05 26 - GROUNDING for grounding.

C. SECTION 26 05 53 – ELECTRICAL IDENTIFICATION for electrical identification.

1.04 REFERENCE STANDARDS:

A. National Electrical Manufacturers Association (NEMA):

1. 250 - Enclosures for Electrical Equipment (1,000V Maximum).
2. PB1 - Panelboards.
3. PB1.1 - Instructions for Safe Installation, Operation, and Maintenance of Panelboards Rated 600V or Less.
4. PB2.2 - Application Guide for Ground-Fault Protective Devices for Equipment.

B. National Fire Protection Association (NFPA):

1. 70 - National Electrical Code (NEC): Comply with applicable local code requirements of the authority having jurisdiction and NEC as applicable to installation and construction of electrical panelboards and enclosures.

C. Underwriters Laboratories (UL): Provide panelboard units which are UL listed and labeled.

1. 50 - Electrical Cabinets and Boxes.
2. 67 - Electrical Panelboards.
3. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
4. 489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.
5. 869A - Service Equipment.
6. 1053 - Ground-Fault sensing and Relaying Equipment.
7. 1283 - Electromagnetic Interference Filters.
8. 1449 - Transient Voltage Surge Suppressors.
9. Special Use Markings: Provide panelboards constructed for special use with appropriate UL markings which indicate that they are "Suitable for Use as Service Equipment."

1.05 PERFORMANCE REQUIREMENTS:

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

EVALUATIONS: continued

1.06 SUBMITTALS:

A. Refer to DIVISION 01 and SECTION 26 05 10 - BASIC ELECTRICAL REQUIREMENTS for administrative and procedural requirements for submittals.

B. Includes, but not limited to, the following:

1. Product Data: Submit manufacturer's data on panelboards and enclosures.
   a. Panelboard dimensions and weight.
   b. Complete data on circuit breakers and fuses. Submit time - current characteristic curves of all devices.
   c. Panelboard short-circuit interrupting capacity, and information on buses: phase, neutral, and ground.
   d. Information on whether panelboard is fed from top or bottom.
   e. Data on maximum and minimum incoming and outgoing feeder and branch circuit wire size.
   f. Data on door, locks, and mounting: surface or flush.
   g. Data on total number of poles and number of unused poles that are available for future use.

1.07 MAINTENANCE MATERIAL SUBMITTALS:

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10% of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10% of quantity installed for each size and type, but no fewer than three of each size and type.

1.08 QUALITY ASSURANCE:

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. 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.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.09 DELIVERY, STORAGE, AND HANDLING:

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 PROJECT CONDITIONS:

A. Environmental Limitations:

EVALUATIONS: continued

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding -23ºF to +104ºF.
   b. Altitude: Not exceeding 6,600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6,600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 COORDINATION:

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.

1.12 WARRANTY:

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide panelboard and mini-power center products of one of the following (for each type and rating of panelboard and enclosure):
1. Cooper Crouse-Hinds.
2. Eaton Cutler-Hammer.
3. General Electric Company.
4. Siemens-Energy and Automation, Inc.
5. Square D, a brand of Schneider Electric.

2.02 GENERAL REQUIREMENTS FOR PANELBOARDS:

A. Except as otherwise indicated, provide panelboards, enclosures, and ancillary components of types, size, and ratings indicated, which comply with manufacturer's standard materials and with the design and construction in accordance with published product information.

B. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.

EVALUATIONS: continued

C. Equip with proper number of panelboard switching and protective devices as required for complete installation.
D. Provide ground fault circuit interrupter type circuit breakers where indicated.
E. Enclosures: Flush- and surface-mounted cabinets as indicated.
    1. Provide enclosures fabricated by same manufacturer as panelboards which mate and match properly with panelboards.
    2. Rated for environmental conditions at installed location. Provide NEMA type as described below, unless indicated or specified otherwise.
        a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
        b. Outdoor Locations: NEMA 250, Type 3R.
    3. Materials: Galvanized sheet steel cabinet type enclosures, in sizes required. Provide code gage (minimum 16-gage) thickness steel.
    4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Front doors shall have flush locks with three keys per panelboard, all panelboard enclosures keyed alike.
    5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
    6. Finishes:
        a. Color: Enamel finish over a rust inhibitor coating.
        b. 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.
        c. Back Boxes: Galvanized steel.
    7. Directory Card: Inside panelboard door, equip with interior circuit directory frame and removable card with clear plastic covering.
F. Phase, Neutral, and Ground Buses:
    1. Bus shall be braced to withstand available short circuit currents as indicated.
    2. Provide suitable lugs on neutral bus for incoming and outgoing feeders requiring neutral connections.
    3. Equipment Ground Bus: Bare, uninsulated, adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
    4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. Provide as indicated.
    5. Extra-Capacity Neutral Bus and Lugs: Neutral bus and lugs rated 200% of phase bus and UL listed as suitable for nonlinear loads. Provide as indicated.
    6. Material: Tin-plated aluminum.
G. Conductor Connectors: Suitable for use with conductor material and sizes.
    1. Material: Tin-plated aluminum.
    2. Main and Neutral Lugs: Compression type.
    3. Ground Lugs and Bus-Configured Terminators: Compression type.
    4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
    5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
    6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
    7. Extra-Capacity Neutral Lugs: Rated 200% of phase lugs mounted on extra-capacity neutral bus.
    8. Provide terminals UL rated for 75ºC (Minimum) conductors.

EVALUATIONS: continued

H. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
I. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals as indicated.

2.03 PANELBOARDS:

A. General: Except as otherwise indicated, provide panelboards, enclosures, and anxillary components of types, size, and ratings indicated, which comply with manufacturer's standard materials and with the design and construction in accordance with published product information. Equip with proper number of panelboard switching and protective devices as required for complete installation. Main circuit breakers, when indicated on drawings, specified or required, shall be placed ahead of the main panelboard bus. Backfeeding a branch circuit device for a main circuit breaker is not acceptable. Provide terminals UL rated for 75ºC (Minimum) conductors. All bus shall be tin plated copper. Ground bars shall be copper. Bus shall be braced to withstand available short circuit currents indicated. Series rated panelboards and circuit breakers are not acceptable. Provide ground fault circuit interrupter type circuit breakers where indicated. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.
B. Lighting and Small Power Panelboards: Dead-front, safety type, 240/120V (voltage rating as required), 1-phase, 3-wire, 60-hertz main, lighting and small power panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangements shown; with anti-turn solderless pressure type lug connectors approved for use with copper conductors; construct unit for connecting incoming feeder at top or bottom of panel as required; Equip with full-sized neutral bar, with bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide common trip for all poles. Provide suitable lugs on neutral bus for each incoming and outgoing feeder required; and provide bare uninsulated grounding bars suitable for bolting to enclosures. Provide insulated ground bus for isolated ground circuits that terminate in or pass through the panelboard, as indicated. Provide enclosures fabricated by same manufacturer as panelboards, which mate and match properly with panelboards. Provide double neutral where indicated.
C. Panelboard Enclosures: Galvanized sheet steel cabinet type enclosures, in sizes required, NEMA type 1 on all indoor applications (unless indicated or specified otherwise) and code gage (minimum 16-gage) thickness. NEMA type 3R on all outdoor applications (unless indicated or specified otherwise). Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable trim clamps and front doors with flush locks and three keys per panelboard, all panelboard enclosures keyed alike, with concealed piano front door hinges. Equip with interior circuit directory frame and removable card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed or surface mounting as indicated. Provide enclosures which are fabricated by same manufacturer as panelboards, which mate and match properly with panelboards to be enclosed.
D. Molded-Case Circuit Breakers: Circuit breakers shall be manufactured by the panelboard manufacturer and shall be U.L. listed to be installed in the panelboard. Factory-assembled, bolt-on, molded-case circuit breakers of frame sizes, characteristics, voltage, poles, RMS symmetrical interrupting ratings indicated and other ratings indicated. The minimum

interrupting rating for 120Vac, and 240Vac circuit breakers shall be 10,000 amperes, rms symmetrical unless indicated otherwise. All circuit breakers applied at 208 or 240Vac shall be rated 240Vac. Provide breakers with thermal and instantaneous magnetic trip, with fault-current limiting protection when required and ampere ratings as indicated. Provide fixed, noninterchangeable trips for circuit breakers rated 15-400A. Provide fixed, interchangeable magnetic and thermal trips for circuit breakers rated higher than 400A. Construct with over center, trip free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication. Construct breakers for mounting and operating in any physical position, and operating in an ambient temperature of 40ºC. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.

E. Accessories: Provide panelboard accessories and devices including, but not necessarily limit to circuit breaker handle locks, etc., as recommended by panelboard manufacturer for ratings and applications indicated. Provide circuit breaker handle locks on all circuits that supply night lights, exit signs, emergency lights, emergency power, energy management and control system (EMCS) panels, and fire alarm panels.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Receive, inspect, handle, and store panelboards according to NECA 407.
B. Examine panelboards before installation. Reject panelboards that are damaged or 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.

3.02 INSTALLATION OF PANELBOARDS:

A. Install panelboards, mini-power centers, and enclosures as indicated, providing NEC required working space, in accordance with manufacturer's written instructions, applicable requirements of NEC and in compliance with recognized industry practices to ensure that products fulfill requirements.
B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.
C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.
D. Provide properly wired electrical connections for panelboards within enclosures.
E. Install numbers on all circuit breakers, and type the panelboard's circuit directory card upon completion of installation work. Clearly identify the load on each circuit and the circuit number.

3.03 GROUNDING:

A. Provide equipment grounding connections for panelboard enclosures as indicated and as required by NEC. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds. Provide grounding as specified in SECTION 26 05 26 - GROUNDING.

3.04 IDENTIFICATION:

EVALUATIONS: continued

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with SECTION 26 05 53 – ELECTRICAL IDENTIFICATION.
B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in SECTION 26 05 53 – ELECTRICAL IDENTIFICATION.
D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified SECTION 26 05 53 – ELECTRICAL IDENTIFICATION.

3.05 FIELD QUALITY CONTROL:

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Perform tests and inspections.
C. Acceptance Testing Preparation:
    1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
    2. Test continuity of each circuit.
D. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.
E. Prior to energization, check panelboard circuits for short circuits, electrical continuity of circuits, enclosure grounding and neutral grounding at service entrance and at incoming derived source transformer.
F. Prior to energization of panelboards, check with insulation resistance tester: phase-to-phase and phase-to-ground insulation resistance levels of each phase bus to ensure requirements are fulfilled. Record and submit test results.

3.06 ADJUSTING AND CLEANING:

A. Set all adjustable trip settings to values provided by the Manufacturer.
B. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
    1. Measure as directed during period of normal system loading.
    2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
    3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
    4. Tolerance: Difference exceeding 20% between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
D. Upon completion of installation, clean interior and exterior of panelboards. Remove paint splatters, spots, dirt and debris.
E. Touch-up scratched or marred surfaces to match original finishes.
F. Adjust transformer taps of mini-power centers.

3.07 PROTECTION:

EVALUATIONS: continued

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.08 DEMONSTRATION:

A. Subsequent to wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

3.09 PROTECTION:

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 26 27 13 - ELECTRICITY METERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:
A. This Section includes equipment for electricity metering by utility company and electricity metering by Owner.

1.03 REFERENCED STANDARDS:
A. National Electrical Contractors Association (NECA).
1. 1 – Standard Practice of Good Workmanship in Electrical Construction.
2. 400 – Installing and Maintaining Switchboards.
B. National Electrical Manufacturers Association (NEMA).
1. 250 – Enclosures for Electrical Equipment (1000V Maximum).
C. National Fire Protection Association (NFPA):
1. 70 - National Electrical Code (NEC).
D. Underwriters Laboratories (UL).
1. UL 1244 – Electrical or Electronic Measuring or Testing Equipment.

1.04 DEFINITIONS:
A. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.
B. PC: Personal computer.

1.05 SUBMITTALS:
A. Product Data: For each type of product indicated.
B. Shop Drawings: For electricity-metering equipment.
1. Dimensioned plans and sections or elevation layouts.
2. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
C. Field quality-control reports.

1.06 QUALITY ASSURANCE:
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.07 DELIVERY, STORAGE, AND HANDLING:
A. Receive, store, and handle modular meter center according to NECA 400.

1.08 PROJECT CONDITIONS:
A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.09 COORDINATION:

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
   1. Comply with requirements of utilities providing electrical power services.
   2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.01 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY:

A. Meters will be furnished by utility company.
B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
C. Meter Sockets: Comply with requirements of electrical-power utility company.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Comply with equipment installation requirements in NECA 1.
B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
C. Install modular meter center according to NECA 400 switchboard installation requirements.

3.02 IDENTIFICATION:

A. Comply with requirements for identification specified in DIVISION 26, Section "Electrical Identification."
   1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.
   2. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with occupant's name.

3.03 FIELD QUALITY CONTROL:

A. Perform tests and inspections.
B. Tests and Inspections:
   1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
   2. Turn off circuits supplied by metered feeder and secure them in off condition.
   3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.

4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.

C. Electricity metering will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

END OF SECTION 262713

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies the following:
   1. Straight Blade Duplex Receptacles.
   2. Weather-Resistant Receptacles.
   3. Ground-Fault Circuit Interrupter Receptacles.
   4. Wall Plates.
   5. Floor Receptacles.
   6. Poke-Through Assemblies.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 10 - Basic Electrical Requirements: General electrical requirements that are common to more than one section of this Division.
B. Section 26 05 26 – Grounding: Grounding for Safety and Electrical Systems.
C. Section 26 05 53 – Electrical Identification: Electrical identification requirements for identification to be engraved on wall plates.
D. Section 26 09 23 - Lighting Control Equipment: Controls for dimmers other than those covered by this Section.
E. Section 26 28 16 – Circuit and Motor Disconnect Switch: Devices other than snap switches and plug/receptacle sets used as disconnects for motors.
F. Section 27 10 00 - Structured Cabling System: Telecommunications wiring devices.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. National Electrical Manufacturers Association (NEMA):
   1. FB-11 - Plugs, Receptacles and Connectors of the Pin and Sleeve Type for Hazardous Locations.
   2. WD-1 - General Color Requirement for Wiring Devices.
   3. WD-6 - Dimensions for Wiring Devices.
C. National Fire Protection Association (NFPA):
   1. - National Electrical Code (NEC).
   2. 99 - Healthcare Facilities.
D. Underwriters Laboratories (UL):
   1. 20 - General Use Snap Switches.
   2. 94 - Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing.
   3. 486A-486B - Wire Connectors.
   4. 514D - Cover Plates for Flush-Mounted Wiring Devices.
   5. 943 - Ground-Fault Circuit Interrupters.
   6. 1010 - Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.
   7. 1310 - Class 2 Power.
   8. 1449 - Standard for Surge Protection Devices.
   9. 1917 - Standard for Solid-State Fan Speed Controls.

EVALUATIONS: continued

E. National Electrical Contractors Association (NECA):
   1. NECA 1 - Standard for Good Workmanship in Electrical Construction.
   2. NECA 130 - Standard for Installing and Maintaining Wiring Devices.
F. Federal Specifications (FS):
   1. W-C-596 - Connector, Electrical, Power, General Purpose.
   2. W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted.

1.05 SUBMITTALS:
A. Refer to Division 01 and Section 26 05 10 - Basic Electrical Requirements for administrative and procedural requirements for submittals.
B. Includes, but not limited to, the following:
   1. Product data for each type of product specified.
   2. Samples of those products indicated for Sample submission for Engineer's comments. Include color and finish Samples of device plates and other items per Engineer's request.

1.06 QUALITY ASSURANCE:
A. Conform to the requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION:
A. Store in a clean, dry space in original manufacturer's packing until ready for installation.

1.08 SEQUENCE AND SCHEDULING:
A. Schedule installation of wall plates after the surface upon which they are installed has received the final finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:
A. Subject to compliance with requirements, provide wiring devices from the following:
   1. Cooper Industries.
   2. Pass & Seymour, a brand of Legrand North America.
   3. Hubbell Inc.
   4. Leviton.
B. Source Limitation: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 WIRING DEVICES:
A. General: Provide wiring devices, in types, characteristics, heavy duty, specification grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD-1, WD-6, and other applicable UL standards. Provide wall plates as specified except as otherwise indicated. Verify color selections with Engineer.
B. Receptacles: As scheduled in Specifications and on Drawings. Comply with UL 498 and NEMA WD-1. Receptacles shall have thermoplastic faces and bodies. Receptacles shall comply with UL 498, NEMA WD-1, NEMA WD-6 and FS W-C-596.
   1. Straight Blade Duplex Receptacle: Heavy-duty, specification grade, 20A, 125Vac, 2-pole, 3-wire, grounding type receptacle, straight blade type and NEMA configuration 5-20R unless otherwise indicated. Receptacles shall have only side wiring screw

terminals. Back-wired receptacles are not acceptable. Device color shall be White. Controlled receptacles shall comply with requirement in this Division Section.

2. Weatherproof receptacles must be UL listed for wet locations with cord and plug connected. Provide as grade and ampacity in accordance with straight-blade requirements. Comply with UL 498 Supplement SE. Device color shall be Black.
3. Ground-Fault Circuit Interrupter (GFCI) Receptacles: "Feed-through" type, 20A ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Receptacles shall have only side wiring screw terminals. Provide unit designed for installation in a 2-3/4-inch deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 943. Receptacles used in hospitals or healthcare facilities shall comply with hospital grade requirements. Tamper-resistant GFCI receptacles shall comply with tamper-resistant duplex receptacle requirements in this Division Section. Weatherproof GFCI receptacles shall comply with weatherproof receptacle requirements in this Division Section. Device color shall be Black.

C. Snap Switches: 20-ampere, 120-277Vac, quiet type, AC switches. Single-pole, double-pole, three-way, four-way, as indicated. Switch handle and switch body shall be high strength nylon. Switches shall have only side wiring screw terminals. Comply with UL 20 and NEMA WD1.

2.03 WIRING DEVICE ACCESSORIES:

A. Wall Plates: One-piece cover, single and combination, types shall match corresponding devices. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plates with engraved legend where indicated. Conform to requirements of Section 26 05 53 - Electrical Identification. Provide plates possessing the following additional construction features :
   1. Finished Rooms (unless indicated or specified otherwise):
      a. Material and Finish: Smooth, 0.32-inch thick, Type 302/304, satin finished stainless steel.
   2. Weatherproof cover plates for wet locations: NEMA 250.
      a. Comply with type 3R, weather resistant.
      b. Gasketed thermoplastic with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.04 FLOOR RECEPTACLES:

A. Modular, flush type service outlets and fittings of types and ratings indicated in Division 26. Service fittings shall be compatible with floor boxes provided in Section 26 05 33. Use design compatible with floor outlet wiring methods indicated on Drawings. Provide 20-ampere, 125V, 2-pole, 3-wire, grounding, gray quadplex receptacles, NEMA configuration 5-20R. Provide with 3/4-inch knock-out for power and 1-inch NPT, 1-inch long, locking nipple for telecommunication conduit installation.
B. Compartments: Barrier separation between power and voice/data cabling and devices.
C. Service Plate: Rectangular with satin finish.
D. Reference Division 27 for telecommunication voice and data outlets.
E. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
F. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

EVALUATIONS: continued

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Perform Work in a neat and workmanlike manner in accordance with NECA 1 and NECA 130, including mounting heights listed in the standards, unless otherwise indicated.

B. Coordinate with other trades:

1. Protect installed devices and boxes from damage. Do not place wall finish materials over device boxes. Do not cut holes for boxes with routers that are guided by riding against outside of boxes. Replace damaged items prior to final acceptance.
2. Keep outlet boxes free of debris, dirt, plastic, dry wall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. When installing wiring device in brick or block wall, install shelf 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 in accordance with manufacturer's instruction and after wire pulling and wall penetrations are complete.
5. Install wall plate after painting work is complete.

C. Install wiring devices and accessories as indicated in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to fulfill Project requirements.

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. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
4. Do not connect more than one conductor to wiring device terminals.
5. Connect wiring devices by wrapping conductor clockwise 2/3 to 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-activated binding.
6. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
7. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
8. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
9. When conductors larger than No. 12 AWG are installed on 15 or 20A circuits, splice No. 12 AWG pigtails for device connections.
10. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plate in lieu of meeting this requirement.

D. Coordinate with other work, including painting, electrical boxes, and wiring installations, as necessary to interface installation of wiring devices with other work.

E. Coordinate locations of outlet boxes provided under Section 26 05 33 as required for installation of wiring devices provided under this Section.

1. Receptacles: 18 inches (450 mm) above finished floor; 6 inches (150 mm) above counter.
2. Snap Switches: 48 inches (1.2 m) above finished floor.

EVALUATIONS: continued

3. Dimmer Switches: 48 inches (1.2 m) above finished floor.
4. Pendant Cord Connector Devices: Within 72 inches of intended use.

F. GFCI and Isolated Ground Receptacles and Service Suppression:
1. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
2. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding connector.
3. Circuits connected to isolated ground receptacles, GFCI receptacles, or surge suppression receptacles shall have a dedicated neutral conductor that is not shared with any other branch circuits.

G. Wall Switches and Dimmers:
1. Install wall switches with "off" position down.
2. Install wall dimmers to achieve full rating specified and indicated after derating for gauging as instructed by manufacturer.
3. Do not share neutral conductor on line and load side of dimmers.
4. Group adjacent switches under single, multigang wall plate.
5. If dimmer yoke does not automatically ground the metal wall plate, bond the yoke to ground such that the metal wall plate is grounded when connected to yoke.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A-486B. Use properly scaled torque-indicating hand tool.

I. Install wall-mounted vertical convenience receptacles with ground pin down and horizontal convenience receptacles with ground pin to the left.

3.02 IDENTIFICATION:

A. Comply with Section 26 05 53 - Electrical Identification.

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. Controlled receptacles shall be identified with controlled receptacle marking symbol complying with requirements in NFPA 70.

3.03 FIELD QUALITY CONTROL:

A. Testing: Prior to energizing circuits, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements.

B. Test each receptacle with a receptacle tester to ensure proper polarity. Insure that the phase rotation is identical on all multiphase receptacles of each rating type.

C. Inspect each wiring device for damage and defects.

D. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

E. Test ground-fault circuit interrupter operation with both local test button and remote ground-fault simulation with receptacle tester.

EVALUATIONS: continued

3.04 CLEANING:

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

SECTION 262730 - ELECTRICAL CONNECTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies electrical connections as required or indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power or control to Equipment.

B. Applications of electrical connections are specified in this Section include the following:
   1. To resistance type heaters.
   2. From electrical source to motor starters.
   3. From motor starters to motors.
   4. To lighting fixtures and wiring devices.
   5. To converters, rectifiers, transformers, specified in this Division, inverters, switchgear, switchboards, panelboards, generators, and similar equipment specified in this Division.
   6. To grounds including ground electrode connections.
   7. Splices.
   8. Terminations.
   9. Equipment furnished in other divisions (unless indicated otherwise).
   10. All controls.

1.03 RELATED REQUIREMENTS:

A. Electrical connections for Equipment not furnished as integral part of Equipment are specified in DIVISIONS 21, 22, 23, and other DIVISION 26 Sections.

B. Motor starters and controllers not furnished as integral part of Equipment: Applicable DIVISION 26 Sections.

C. DIVISIONS 21, 22, and 23 - Motor starters and controllers furnished integrally with Equipment:

D. DIVISIONS 23 and 25 - Temperature control system wiring.

E. SECTION 260519 - LOW VOLTAGE ELECTRICA POWER CONDUCTORS AND CABLES - wires/cables required for connecting motors and other electrical units of equipment.

F. SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS - Junction boxes and disconnect switches required for connecting motors and other electrical units of Equipment: Applicable DIVISION 26 Sections.

G. SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS - electrical identification for wire/cable conductors.

H. SECTION 262816 - ENCLOSED SWITCHES AND CIRCUTI BREAKERS - disconnect switches required for connecting motors and other electrical units of equipment.

I. Electrical connections to all Equipment in other divisions unless specifically indicated otherwise.

1.04 REFERENCE STANDARDS:

A. American National Standards Institute (ANSI):
   1. ANSI C119.1 - Sealed Insulated Underground Conductor Systems Rated 600V.
   2. ANSI C119.4/NEMA CC3 - Connectors for Use between Aluminum-to-Aluminum or Aluminum-to-Copper Conductors.

EVALUATIONS: continued

3. ANSI/NEMA CC1 - Electric Power Connection for Substations.
4. ANSI/EIA RS-364-21A - Insulation Resistance Test.

B. Institute of Electrical and Electronic Engineers (IEEE):
1. 241 - IEEE Recommended Practice for Electric Power Systems in Commercial Buildings, pertaining to connections and terminations.

C. National Fire Protection Association (NFPA):
1. 70 - National Electrical Code (NEC) - Comply with applicable requirements of NEC as to type of products used and installation of electrical power connections (terminals and splices), junction boxes, motor starters, and disconnect switches.

D. Underwriters Laboratories (UL) Compliance - Provide electrical connection products and materials which are UL-listed and labeled. Comply with applicable requirements of the following standards:
1. 486A - 486B - Wire Connectors.
2. 486C - Splicing Wire Connectors.
3. 486D - Sealed Wire Connector Systems.
4. 486E - Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.

1.05 SUBMITTALS:

A. Refer to DIVISION 01 and SECTION 260510 - BASIC ELECTRICAL REQUIREMENTS for administrative and procedure requirements for Submittals.

B. Includes, but not limited to, the following:
1. Product Data: Submit manufacturer's data on electrical connections for equipment products and materials.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver electrical connection products wrapped in proper factory-fabricated type containers.

B. Store electrical connection products in original cartons and protect from weather, construction traffic, and debris.

C. Handle electrical connection products carefully to prevent breakage, denting, and scoring finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (for each type of product).
1. Cable connectors, terminations, termination kits and splice kits:
a. AMP Netconnect, Tyco Electronics.
b. Appleton Electric.
c. Arrow-Hart, Cooper Wiring Devices.
d. Burndy Corporation.
e. Hubbell Wiring Device-Kellems.
f. Ideal Industries, Inc.
g. King Innovation.
h. Minnesota Mining and Manufacturing (3M).
i. OZ Gedney.
j. Panduit.
k. Raychem, TE Connectivity.
l. Square D.

EVALUATIONS: continued

m. Thomas and Betts.

2. Tape:
   a. 3M.
   b. Nitto Denko.
3. Terminal Blocks:
   a. AMP Netconnect, Tyco Electronics.
   b. Cooper Bussmann.
   c. General Electric.
   d. Rockwell Automatic, Allen-Bradley.
   e. Square D.
   f. States Division, Megger.

2.02 MATERIALS AND COMPONENTS:

A. General: For each electrical connection provide complete assembly of materials, including, but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, stress cones, splice kits, termination kits, solderless wirenuts, and other items and accessories as needed to complete splices and/or terminations of types indicated or recommended for use by accessories manufacturers for type services indicated. Electrical connectors shall be marked for the suitable conductor material. All Equipment conductor terminations shall be UL listed for 75ºC conductors.

B. Connectors and Terminals: Provide UL-listed factory-fabricated electrical connectors and terminals which mate and match, including sizes and ampacity ratings, with Equipment terminals and which are recommended by Equipment manufacturer for intended applications. Provide insulated compression ring lugs for all control wire terminations. Wirenut splices shall only be used for No. 10 AWG and No. 12 AWG lighting circuits, receptacle circuits, motor terminal box connections size 10 AWG and smaller and control devices with size 10 AWG and smaller factory wired leads. Provide silicone filled watertight/raintight wirenuts for receptacle circuits and light fixture circuits installed outdoors and in wet locations. Provide compression connectors for all power conductors #8 AWG and larger.

C. Use connectors with temperature ratings equal to or greater than those of the wires being used.

D. Power Connectors (sizes 8-3 AWG) 600V and Below:
   1. Noninsulated ring-tongue type.
   2. Ring tongue sized to match terminal stud size.
   3. Brazed barrel seam.
   4. Application tooling designed to crimp the wire barrel [conductor grip] with a one-step crimp.

E. Power Connectors (sizes 2 AWG - 500 kcmil) 600V and Below:
   1. Noninsulated one-hole rectangular tongue for sizes 2 AWG through 3/0 AWG and two-hole rectangular tongue for 4/0 AWG through 500 kcmil.
   2. Application tooling shall be hydraulic operated.

F. Power Connectors (sizes 2 AWG - 500 kcmil) above 600V:
   1. Noninsulated one-hole rectangular tongue for sizes 2 AWG through 3/0 AWG and two-hole rectangular tongue for 4/0 AWG through 500 kcmil.
   2. Voltage rating equal or greater than that of the cable being used.

G. Motor Lead Termination/Splice (Low-Voltage, 600V and Below, Power Cable):
   1. Splices shall be made using compression-type connectors bolted together. The compression-type connectors shall be properly sized for the cables. Reference acceptable connector manufacturer's cross-reference chart.

EVALUATIONS: continued

2. Splice to be covered with heat-shrinkable tubing connector insulators.

H. Terminal Blocks:
   1. For Mounting in Terminal Boxes (TBs):
      a. Designed and sized for the cables being terminated.
      b. Thermoplastic block rated 600V.
      c. Solderless box lug type terminals for power cables and flat terminal connectors with wire clamp for control and instrument cables.
      d. Rated current carrying capacity equal to or greater than the cable being terminated.
      e. Marking strip.
   2. For Mounting in Cabinets, Panels, Control Boards, etc.:
      a. Designed and sized for the cables being terminated.
      b. Thermoplastic block rated 600V.
      c. Solderless box lug type terminals for power cables. Flat terminal connectors for current transformer circuits. Sliding link type flat terminal connectors with wire clamp for control and instrument cables.
      d. Rated current carrying capacity equal to or greater than the cable being terminated.
      e. Marking strip on blocks for power cables, control and instrument cables.
      f. Short-circuit straps with one shorting screw for each terminal for current transformer circuits.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Inspect area and conditions under which electrical connections for Equipment are to be installed. If unsatisfactory conditions exist, do not proceed with the work until they have been corrected.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Install electrical connections as indicated, as required and as specified. Provide in accordance with Equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.

B. All medium voltage splices and terminations above 600V shall be made by a certified cable splicer/terminator.

C. Connect electrical power supply conductors to Equipment conductors in accordance with Equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed Equipment.

D. Maintain existing electrical service and feeders to occupied areas and operational facilities, unless otherwise indicated or when authorized otherwise in writing by Owner or Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages to replace existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove temporary wiring and existing wiring as indicated.

E. Cover splices with electrical insulating material equivalent to, or of greater insulation rating, than electrical insulation rating of those conductors being spliced.

F. Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated.

EVALUATIONS: continued

Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while stripping insulation from wire.

G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing, and maintenance.

H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for Equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL 486A-486B.

I. Adjust overhead door and coiling door travel limit switches and torque switches in accordance with the manufacturer's instructions.

J. Connect all nonisolated ground conductors to equipment ground bus, equipment ground lug, or equipment enclosure [where no other equipment grounding provisions are available].

K. Control conductor terminations made on terminal blocks or terminal strips shall comply with the following:
   1. All current transformer terminations shall be made with insulated, compression type, ring lugs.
   2. All control terminations shall be made with insulated, compression type, ring lugs. Provide one lug per conductor.
   3. All control terminations shall be made by inserting the striped, bare, conductor under the flat terminal wire clamp. No more than two wires shall be terminated under one wire clamp connection point.

L. Keep conductor splices to a minimum.

M. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.

N. Use splice and tap connectors which are compatible with conductor material.

O. In-line splices shall not be accepted unless provided in a junction box.

3.03 FIELD QUALITY CONTROL:

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor is correct. Correct improper motor rotation, then retest to demonstrate compliance.

END OF SECTION 26 27 30

SECTION 26 28 13 – FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies fuse work as indicated by Drawings and by requirements of this Section. Types of fuses specified in this section include the following:
   1. Class J current-limiting.
   2. Class L current-limiting and time-delay.
   3. Class L current-limiting and fast-acting.
   4. Class RK1 current-limiting and time-delay.
   5. Class RK1 and Class J current-limiting.
   6. Class RK5 current-limiting and time-delay.
   7. Cable Limiters.

1.03 RELATED REQUIREMENTS:

A. Section 26 28 16 – Circuit and Motor Disconnect Switch.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. Applicable Standards: Comply with applicable requirements of following standards.
   1. American National Standards Institute (ANSI):
      a. C97.1 - Low-Voltage Cartridge Fuses 600V or Less.
   2. National Electrical Manufacturer's Association (NEMA):
      a. FU1 - Low-Voltage Cartridge Fuses.
   3. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC). Comply with NEC as applicable to construction and installation of fusible devices.
   4. Underwriters Laboratories (UL): Provide overcurrent protective devices which are UL-listed and labeled.
      a. 248-1 - Low-Voltage Fuses - Part 1: General Requirements.
      b. 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses.
      c. 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses.
      d. 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.

1.05 SUBMITTALS:

A. Refer to DIVISION 01 and Section 26 05 10 - Basic Electrical Requirements, for administrative and procedural requirements for Submittals.

B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacturer's technical product data on fuses, including specifications, electrical characteristics, and time current curves.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide fuses of one of the following:

1. Eaton's Bussmann Business, Inc.
2. Mersen.
3. Littelfuse, Inc.

2.02 FUSES:

A. General: Except as otherwise indicated, provide fuses of types, sizes, ratings, and average melting-time-current and peak let-through current characteristics which comply with manufacturer's standard design and materials, are constructed in accordance with published product information, and constructed with industry standards and configurations.

B. For applications less than or equal to 600A: Class RK1 Current-Limiting and Time-Delay Fuses.
   1. UL Class RK1 time-delay fuses rated 250 or 600V (voltage rating as required), 60 hertz, amperes as indicated, with 200,000 RMS amperes symmetrical interrupting current rating for protecting motors, transformers, and circuit breakers.

C. For applications less than or equal to 600A: Class RK1 Current-Limiting and Fast-Acting Fuses.
   1. UL Class RK1 current-limiting fuses rated 250 or 600V (voltage rating as required), 60 hertz, amperes as indicated, with 200,000 RMS amperes symmetrical interrupting current rating for protecting service entrances and feeder circuit breakers.

D. For applications less than or equal to 600A: Class J Fast-Acting Current-Limiting Fuses.
   1. UL Class J current-limiting fuses rated 600V, 60 hertz, amperes as indicated with 200,000 RMS amperes symmetrical interrupting current rating.

E. For applications less than or equal to 600A: Class RK5 Current-Limiting and Time-Delay Fuses.
   1. UL Class RK5 time-delay fuses rated 250 or 600V (voltage rating as required), 60 hertz, amperes as indicated, with 200,000 RMS amperes symmetrical interrupting current rating for protecting motors.

2.03 CABLE LIMITERS:

A. Cable Limiters: Rated 600V, 60 hertz, 100,000 RMS amperes symmetrical interrupting current rating with tubular compression type terminals for copper cable, cable size as indicated.

2.04 ACCESSORIES:

A. Clip-clamps sized for fuse clip and manufactured by the fuse manufacturer.

B. Fuse reducers manufactured by the fuse manufacturer.

2.05 SPARE FUSES:

A. Maintenance Stock Fuses: For types and ratings required, furnish additional fuses, amounting to two units for every ten installed units, but not less than one set of three of each type and rating.

B. Provide one wall-mounted, gray enamel, 18-gage steel spare fuse cabinet for each room containing a switchboard, switchgear, panelboard, or motor control center that utilizes fused devices. Cabinet shall be large enough to contain 20% of the fuses used in that room. The words "SPARE FUSES" shall be stenciled in 1-1/2-inch high black letters on the door.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which fuses are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FUSES:

A. Install fuses as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of fuses.
B. Fuses shall not be installed until equipment is ready to be energized.
C. Install fuses in fused switches.
D. All fuses in each switch (or circuit breaker) shall be the same rating, same type, and from the same manufacturer.
E. Install fuses in disconnect switches as required to provide protection as indicated on packaged HVAC equipment nameplates. Fuse sizes indicated on Drawings are approximate. Install fuse size as indicated on packaged HVAC equipment nameplates.
F. Install fuse clip-clamps on all fuses which are mounted on mechanical equipment subject to vibration.
G. Install fuse reducers as required.
H. Install fuse cabinets on wall adjacent to fused equipment; coordinate location with all building trades. Stock all spare fuses in fuse cabinets in proportion to their use in that room.
I. Provide typewritten label on the inside of the door of each fused switch indicating replacement fuse type, class and ampere rating.

3.03 FIELD QUALITY CONTROL:

A. Prior to energization of fusible devices, test fuses and fused switches for continuity and for short-circuits. Replace malfunctioning units with new units, and then demonstrate compliance with requirements.

END OF SECTION 26 28 13

SECTION 262816 - CIRCUIT AND MOTOR DISCONNECT SWITCH

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:
A. This Section specifies circuit and motor disconnects.

1.03 RELATED REQUIREMENTS:
A. SECTION 26 05 53 - ELECTRICAL IDENTIFICATION.
B. SECTION 26 27 26 - WIRING DEVICES for manual switches used as motor disconnects.
C. SECTION 26 28 13 - FUSES.

1.04 REFERENCE STANDARDS:
A. National Electrical Manufacturers Association (NEMA):
1. 250 - Enclosures for Electrical Equipment (1,000V maximum).
2. KS 1 - Enclosed Switches.
B. National Fire Protection Association (NFPA):
1. 70 - National Electrical Code (NEC).
C. Underwriters Laboratories (UL):
1. 869 - Electrical Service Equipment.

1.05 SUBMITTALS:
A. Refer to DIVISION 01 and SECTION 26 05 10 - BASIC ELECTRICAL REQUIREMENTS for administrative and procedural requirements for submittals.
B. Includes, but not limited to, the following:
1. Product data for each type of product specified.
2. Ampere rating and fused switch short-circuit interrupting ratings.
3. Maintenance data for circuit and motor disconnects for inclusion in Operation and Maintenance Manual specified in DIVISION 01 and SECTION 26 05 10 - BASIC ELECTRICAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 MANUFACTURES:
A. Subject to compliance with requirements, provide products by one of the following:
1. Crouse-Hinds Co.
2. Cutler-Hammer Inc.
3. General Electric Co.
4. General Switch Corp.
5. Siemens Energy and Automation, Inc.
6. Square D Company.
7. Westinghouse Electric Corp.

2.02 CIRCUIT AND MOTOR DISCONNECT SWITCHES:
A. General: Provide 3-pole circuit and motor disconnect switches in types, sizes, duties, features, ampere ratings, short-circuit interrupting ratings, energy withstand ratings, and enclosures as indicated. Provide NEMA 1 enclosure for indoor dry locations. For outdoor disconnect

switches and other indicated wet locations, provide NEMA 3R enclosures with raintight hubs. Switch mechanism shall be interlocked with door mechanism to prevent door from opening when switch is closed and to prevent switch from being closed when door is. Switch mechanism shall have provisions for pad locking in the open or closed position. For motor and motor starter disconnect switches, provide units with horsepower ratings suitable for the loads. Provide 60-hertz, 600V (and 240V units as required by application). Provide terminals UL rated for 75ºC (minimum) conductors. Provide equipment ground conductor lug. Provide solid neutral assemblies when indicated, specified, or required. Provide only load-break rated motor disconnect switches.

B. Fusible Single-Throw Disconnect Switches: 240Vac General-duty switches, with fuses of classes, current ratings and interrupting ratings indicated. See SECTION 26 28 13 - FUSES for specifications. Where current limiting fuses are specified or indicated, provide switches with noninterchangeable rejection feature suitable only for current limiting type fuses.

C. Service Disconnect Switches: Heavy-duty fusible disconnect switches. UL listed for use as service equipment under UL 98 or 869.

D. Accessories:

1. Special Enclosure Material: Provide special enclosure material as follows for disconnect switches when indicated.
   a. Heavy cast steel.

PART 3 - EXECUTION

3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECTS:

A. General: Provide circuit and motor disconnect switches as indicated or required. Provide fused type disconnect switches on all packaged mechanical equipment such as HVAC units, condensing units, air-conditioning units, and other items., that require fuse protection as listed on the unit nameplate or as required for equipment short-circuit protection. Install fuse type and size as indicated on unit nameplate. Comply with NEC and disconnect switch manufacturers' printed installation instructions. Where practicable, install switch at an elevation such that the centerline of the switch operator is 5 feet-6 inches above the finished floor. Tighten connectors and terminals in accordance with manufacturer's instructions. All fuses in each disconnect switch shall be of the same type and from the same manufacturer. Where switches can be backfed provide a warning sign reading: "Warning: Load side of switch may be energized by backfeed" per SECTION 260553.

3.02 FIELD QUALITY CONTROL:

A. Testing: Inspect all contacts and clean, if required. Inspect all arc chutes if provided on switches. Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit deenergized. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation (if required on switch), and for verification of power on load side of fuse (fuse has not blown), fuse type and rating of fuses installed (if required on switch). Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION 262816

SECTION 26 41 13 – LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:
- A. Section includes lightning protection for structures.

1.03 REFERENCED STANDARDS:
- A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- B. NFPA
  1. NFPA 780-2017: Standard for the Installation of Lightning Protection Systems (ANSI)
- C. Underwriters Laboratories Inc.
  1. UL 96-2005: Lightning Protection Components (ANSI)
  2. UL 96A-2007: Installation Requirements for Lightning Protection Systems (ANSI)

1.04 SUBMITTALS:
- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For air terminals and mounting accessories.
  1. Layout of the lightning protection system, along with details of the components to be used in the installation.
  2. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
- C. Qualification Data: For qualified Installer and manufacturer. Include data on listing or certification by UL.
- D. Field quality-control reports.
- E. Comply with recommendations in NFPA 780, Annex D, "Inspection and Maintenance of Lightning Protection Systems," for maintenance of the lightning protection system.
- F. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features, including the following:
  1. Ground rods.
  2. Ground loop conductor.

1.05 QUALITY ASSURANCE:
- A. Installer Qualifications: Certified by UL or LPI as a Master Installer/Designer, trained and approved for installation of units required for this Project.
- B. System Certificate:
  1. UL Master Label.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

1.06 COORDINATION:
- A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.
C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

PART 2 - PRODUCTS

2.01 LIGHTNING PROTECTION SYSTEM COMPONENTS:

A. Comply with UL 96 and NFPA 780.
B. Roof-Mounted Air Terminals: NFPA 780, Class I, aluminum unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      (a) East Coast Lightning Equipment Inc.
      (b) ERICO International Corporation.
      (c) Harger.
      (d) Heary Bros. Lightning Protection Co. Inc.
      (e) Independent Protection Co.
      (f) Preferred Lightning Protection.
      (g) Robbins Lightning, Inc.
      (h) Thompson Lightning Protection, Inc.
C. Air Terminals More than 24 Inches (600 mm) Long: With brace attached to the terminal at not less than half the height of the terminal.
   1. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in DIVISION 07 roofing Sections.
D. Main and Bonding Conductors: Copper.
E. Ground Loop Conductor: The same size and type as the main conductor except tinned.
F. Ground Rods: Copper-clad steel, sectional type; 3/4 inch (19 mm) in diameter by 10 feet (3 m) long.
G. Heavy-Duty, Stack-Mounted, Lightning Protection Components: Stainless steel.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install lightning protection components and systems according to UL 96A and NFPA 780.
B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends.
C. Conceal the following conductors:
   1. Down conductors.
   2. Interior conductors.
D. Conductors within normal view of exterior locations at grade within 200 feet (60 m) of building.
E. Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.
   1. Exception: In single-ply membrane roofing, exothermic-welded connections may be used only below the roof level.
F. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.

G. Bury ground ring not less than 24 inches (600 mm) from building foundation.
   1. Bond ground terminals to the ground loop.
H. Bond grounded building systems to the ground loop conductor within 12 feet (3.6 m) of grade level.

3.02 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS:
A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in DIVISION 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.03 CORROSION PROTECTION:
A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.04 FIELD QUALITY CONTROL:
A. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
B. UL Inspection: Meet requirements to obtain a UL Master Label for system.
C. LPI System Inspection: Meet requirements to obtain an LPI System Certificate.

END OF SECTION 26 41 13

SECTION 26 50 00 – INTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies interior lighting fixture work as indicated on drawings and schedules.

B. Types of interior lighting fixtures in this Section include the following:

1. Light Emitting Diode (LED):

1.03 REFERENCE STANDARDS:

A. Applicable Standards: Comply with applicable requirements of the following standards.

1. American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE):
   a. IEEE C62.41-1991 - Recommended Practice for Surge Voltages in Low-Voltage A.C. Power Circuits.
2. National Electrical Manufacturers Association (NEMA):
3. National Fire Protection Association (NFPA):
   a. 70 - National Electrical Code (NEC). Comply with applicable local code requirements of the authority having jurisdiction and the NEC.
4. Underwriters Laboratories (UL): Provide interior lighting fixtures and components which are UL-listed and labeled.
   a. 57 - Electric Lighting Fixtures.
   b. 506 - Specialty Transformers.
   c. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   d. 542 - Lampholders, Starters, and Starter Holders for Fluorescent Lamps.

1.04 SUBMITTALS:

A. Refer to Division 01 and Section 26 00 00 – “Basic Electrical Requirements” for administrative and procedural requirements for submittals.

B. Includes, but not limited to, the following:

1. Product Data: Submit manufacturer's product data and installation instructions on each type of interior building lighting fixture, lamp, and component. Submit fluorescent lamp color in degrees Kelvin, color rendering index (CRI), and average lamp efficacy in lumens per watt
2. Shop Drawings: Submit fixture shop drawings in booklet form with a separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order, with proposed fixture, lamp type, and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system.
3. Wiring Diagrams: Submit wiring diagrams for interior lighting fixtures showing connections. Differentiate between portions of wiring which are manufacturer factory-installed and portions which are field-installed.
4. Illumination Data: Provide fixture efficiency and coefficients of utilization. Provide recommended maximum spacing-to-mounting ratio. Provide candlepower distribution curves (drawn to scale such that candlepower can be scaled at different angles) or provide candlepower data in tabular form at 10o increments. For recessed fluorescent lights provide visual comfort probability data for a 100 footcandle room with reflectances of 80% ceiling, 50% wall, and 20% floor in a 20 foot by 20 foot room with 10 foot ceiling and luminaries lengthwise.

5. Maintenance Data: Submit maintenance data and parts list for each interior lighting fixture and accessory; include "trouble-shooting" maintenance guide. Include in this data, product data and shop drawings in a maintenance manual, in accordance with general requirements of Division 01.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver interior lighting fixtures in factory-fabricated containers or wrappings that properly protect fixtures from damage.

B. Store interior lighting fixtures in original packaging. Store inside well-ventilated area, protected from weather, moisture, soiling, extreme temperatures, humidity. Lay flat and block off of floor.

C. Handle interior lighting fixtures carefully to prevent damaging, breaking, or scoring finishes. Do not install damaged units or components; replace with new.

1.06 SEQUENCING AND SCHEDULING:

A. Sequence interior lighting installation with other work to minimize possibility of interference with pipes, ductwork, and conduit. Protect light fixtures from damage and soiling during remainder of construction.

1.07 MAINTENANCE:

A. Extra stock:

1. Furnish stock or replacement lamps amounting to 15%, but not less than four lamps in each case, of each type and size lamp used in each type of fixture on the project. Deliver replacement stock, as directed, to Owner's storage space and obtain receipt.

PART 2 - PRODUCTS

PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide products as indicated on drawings or approved equal.

A. General: Provide lighting fixtures of sizes, types, and ratings indicated, complete with, but not limited to, housings, high power factor ballasts, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters, and wiring. Light fixture catalog numbers indicated in the light fixture schedule do not necessarily denote required mounting hardware, equipment or accessories. Provide mounting hardware, equipment and accessories as required. Ship fixtures factory-assembled, with those components required for a complete installation. Design fixtures with concealed hinges and catches, with metal parts grounded as common unit, and constructed to dampen ballast generated noise. All equipment and materials shall bear the UL label.

B. LED sources shall meet the following requirements:

1. Operating temperature rating shall be between -40 degrees F to 120 degrees F.
2. Correlated Color Temperature (CCT): 3500K.
3. Color Rendering Index (CRI): greater than or equal to 80.
4. The manufacturer shall have performed Joint Electron Devices Engineering Council (JEDEC) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK, Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

C. LED Drivers:
   1. LED drivers shall meet the following requirements:
      a. Drivers shall have a minimum efficiency of 85%
      b. Starting Temperature: -40 degrees F.
      c. Input Voltage: 120 to 277V (plus or minus 10%)
      d. Power supplies: Class I or II output.
      e. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 by 50 microsec, 10kA/8 by 20 microsec) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ANSI C62.41.2-2202, Scenario 1 Location Category C.
      f. Power Factor (PF): greater than or equal to 0.90.
      g. Total Harmonic Distortion (THD): Less than or equal to 20%.
      h. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
      i. Drivers shall be reduction of hazardous substances (ROHS) compliant.

D. Interior Lighting Fixture Types:
   1. General: Various fixture types required are listed on the fixture schedule on the drawings. Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to verify ceiling types, modules, suspension systems appropriate to installation.

E. Interior Lighting Fixture Types:
   1. General: Various fixture types required are listed on the fixture schedule on the drawings. Fixtures must comply with minimum requirements as stated herein. Review architectural drawings and specifications to verify ceiling types, modules, suspension systems appropriate to installation.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine the mounting surface for supporting lighting fixtures and the areas and conditions under which lighting fixtures are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF INTERIOR LIGHTING FIXTURES:

A. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers and method of fastening, other than that which is indicated or specified herein, for review by Engineer.
B. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface.
C. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.
D. Fasten fixtures securely to structural supports and ensure that pendant fixtures are plumb and level. Provide individually mounted fluorescent pendant fixtures with pendants longer than 2 feet with twin stem hangers. Provide all pendent stem hangers with ball aligners and provisions for minimum 1 inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than the number of fixtures in the row.
E. All recessed light fixtures supported by suspended ceilings shall be securely attached (from a minimum of 4 points) to the structural steel above by four diagonally opposite, adequately sized safety chains.
F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where

manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and the National Electrical Code.

G. Support surface mounted fixtures greater than 2 feet in length at a point in addition to the outlet box fixture stud.

3.03 FIELD QUALITY CONTROL:

A. At the Date of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed as judged by Engineer, after Contractor's use and testing.

B. Refer to Division 01 for the replacement/restoration of lamps in interior lighting fixtures where used for temporary lighting prior to Date of Substantial Completion.

3.04 ADJUSTING AND CLEANING:

A. Clean interior lighting fixtures of dust, dirt, and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.

B. Protect installed fixtures from damage during the remainder of the construction period.

C. All light fixtures which can be aimed (flood lights, etc.) shall be aimed as indicated and shall be reaimed as directed by the Engineer during nighttime lighting demonstrations. Redemonstrate lighting at night after all adjustments have been made.

3.05 GROUNDING:

A. Provide equipment grounding connections for interior lighting fixtures as indicated and specified. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.06 DEMONSTRATION:

A. Upon completion of the installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical power to demonstrate capability and compliance with requirements. All interior lighting shall be demonstrated during nighttime lighting demonstrations. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 50 00

SECTION 26 52 00 - EMERGENCY LIGHTING

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies emergency lighting as indicated by drawings and schedules.

B. Types of self-contained emergency lighting fixtures in this section include the following:

1. Unitized battery powered fixtures.
2. Illuminated exit sign fixtures.

1.02 REFERENCES:

A. Applicable Standards: Comply with applicable requirements of the following standards.

1. National Electrical Manufacturers' Association (NEMA):
   a. 1B 4 - Determination of Amperhour and Watthour Capacity of Lead-Acid Industrial Storage Batteries for Stationary Service.
   b. 1B 5 - Life Testing of Lead-Acid Industrial Storage Batteries for Stationary Service.
   c. 1B 7 - Testing Arrester Vents Used on Lead-Acid Industrial Storage Batteries for Stationary Service.
2. National Fire Protection Association (NFPA):
   a. 70 - National Electrical Code (NEC).
   b. 101 - Life Safety Code.
3. Underwriters Laboratories (UL) Compliance: Provide emergency lighting fixtures which are UL listed and labeled.
   a. 57 - Electric Lighting Fixtures.
   b. 924 - Emergency Lighting and Power Equipment

1.03 SUBMITTALS:

A. Refer to DIVISION 1 and SECTION 26 05 10 - BASIC ELECTRICAL REQUIREMENTS for administrative and procedural requirements for submittals.

B. Includes, but not limited to, the following:

1. Product Data: Submit manufacturer's technical product data on emergency lighting fixtures. Provide scaled candlepower distribution curves for light fixtures.
2. Shop Drawings: Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical or numerical order, with proposed fixture and accessories clearly indicated on each sheet.
3. Maintenance Data: Submit maintenance data and parts list for each emergency lighting fixture and accessory, including "troubleshooting" maintenance guide. Include this data, product data and shop drawings in maintenance manual, in accordance with requirements of DIVISION 1.

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Handle lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; replace with new.

B. Store lighting fixtures in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

EVALUATIONS: continued

A. Subject to compliance with requirements, provide products as indicated on drawings or approved equal.

2.02 EMERGENCY LIGHTING FIXTURES:

A. General: Provide lighting fixtures, of sizes, types, and ratings specified and indicated.

B. Unitized Battery Powered Fixtures:

1. Emergency Units: Battery powered, self-contained units with solid-state, fully automatic charger and transfer/brownout circuit and low-voltage battery disconnect. Provide enclosure constructed in accordance with NEMA 1 standards. Supply maintenance-free lead-calcium battery for 12V operation. Provide two unit mounted 12V, 25 watt sealed beam light fixtures.
   a. Battery: Provide 12V lead-calcium battery capable of supplying connected load for period of 1-1/2 hours to end voltage of 87-1/2% of nominal battery voltage.
   b. Charger: Provide automatic battery charger with full recharging capability within UL recharging standards, or less after full discharge.
   c. Unit shall have "Ready Light" and test switch.
   d. Accessories: Provide following accessories mounted on unit cabinet:
      (1) Voltmeter.
      (2) Ammeter.
      (3) AC "ON" pilot light.
      (4) Battery life expectancy alarm.
      (5) Wire guard.
      (6) Heavy-duty wall mounting bracket.
      (7) Three foot long cord with plug.
      (8) Fifteen minute retransfer time delay.
2. Illuminated Exit Sign Fixtures - Emergency Powered: Surface, wall, or ceiling mounted fixtures, as required. Provide 120Vac unit with extruded aluminum fixture with no external hardware, satin aluminum exterior finish and white baked enamel interior, with capability for adjusting face panel for: no arrow, left arrow and/or right arrow. Provide internal 6Vdc battery.
   a. Plastic Face Panels: White panels with permanent, red letters 6" high, 3/4" stroke. Provide single or double face as indicated.
   b. Furnish battery powered unit with 12-hour automatic charger, complete with nickel-cadmium battery which automatically connects 6V lamps to (1-1/2 hour) (20 hour) battery upon normal power loss and disconnects upon restoration of normal AC supply. Low voltage disconnect shall prevent damage to the battery.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which emergency lighting is to be installed and substrate which will support lighting fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF EMERGENCY LIGHTING FIXTURES:

A. Install emergency lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that the lighting fixtures fulfill requirements.

EVALUATIONS: continued

B. All emergency lighting conductors shall be routed in conduit separate from the normal power circuits.

3.03 ADJUSTING AND CLEANING:

A. Clean emergency lighting fixtures of dirt and debris upon completion of installation.
B. Protect installed fixtures from damage during remainder of construction period.
C. Aim adjustable lighting heads as directed by the Engineer in a night time test.

3.04 GROUNDING:

A. Provide equipment grounding connections for emergency lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.05 FIELD QUALITY CONTROL:

A. Upon completion of the installation of emergency lighting fixtures, and after building circuitry has been energized with the normal power source for a minimum of 12 hours, perform a night time test by turning off the normal power source for 90 minutes to demonstrate operation, capability, and compliance with requirements under emergency conditions. Reaim adjustable lighting heads as directed by the Engineer during a night-time demonstration. Redemonstrate again at night after the readjustments have been made. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 265200

SECTION 26 56 10 – EXTERIOR LIGHTING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section specifies exterior lighting fixture work as indicated by drawings, schedules, and as specified herein.

B. Types of exterior lighting fixtures in this Section include the following:

1. Light Emitting Diode (LED).

C. Applications of exterior lighting fixtures required for this Project include the following:

1. Outdoor area lighting.
2. Pole mounted lighting

1.03 REFERENCE STANDARDS:

A. Applicable Standards: Comply with applicable requirements of the following standards.

1. National Electrical Manufacturers' Association (NEMA): Comply with applicable requirements of NEMA Stds Pub/No. LE2 pertaining to lighting equipment.
2. National Fire Protection Association (NFPA):
   a. 70 - National Electrical Code (NEC). Comply with applicable local code requirements of the authority having jurisdiction and the NEC.
   b. 780 - Lightning Protection Code. Comply with applicable requirements pertaining to installation of exterior lighting fixtures.
3. Underwriters Laboratories (UL): Provide exterior lighting fixtures and components which are UL listed and labeled. Comply with applicable requirements of the following standards:
   a. 57 - Electric Lighting Fixtures.

1.04 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 – Basic Electrical Requirements for administrative and procedural requirements for Submittals.

B. Includes, but not limited to, the following:

1. Product Data: Submit manufacturer's product data and installation instructions on each type of exterior building lighting fixture.
2. Shop Drawings: Submit fixture Shop Drawings in booklet form with a separate sheet for each fixture, assembled in "luminaire type" alphabetical or numerical order with proposed fixture, lamp type, voltage, complete illumination data (as specified below), and accessories clearly indicated on each sheet.
3. Wiring Diagrams: Submit wiring diagrams for exterior lighting fixtures showing connections. Diagrams shall differentiate between portions of wiring which are manufacturer factory-installed and portions which are field installed.
4. Illumination Data: Provide fixture lumen efficiency. Provide recommended maximum spacing-to-mounting height. Provide isofootcandle (isolux) plot diagram of footcandles on horizontal pavement surface which shows composite values of illuminance projected from the arrangement of light sources from indicated fixture locations and heights. Show on the graphic plots the locations, spacings, and heights of luminaries. Provide

candlepower distribution curves (drawn to scale such that candlepower can be scaled at different angles) or provide candlepower data in tabular form at 10 degree increments. When the Contractor proposes a light fixture substitution other than the one the Engineer used for design, the Contractor shall also submit a computer printout of the area with horizontal and vertical maintained footcandles (and aiming criteria where applicable) indicated on a 10 foot x 10 foot grid for the exterior space being illuminated.

5. Maintenance Data: Submit maintenance data and parts list for each exterior lighting fixture and accessory, including "troubleshooting" maintenance guide. Include in this data, product data and shop drawings in a maintenance manual in accordance with requirements of Division 01.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver exterior lighting fixtures in factory-fabricated containers or wrappings which properly protect fixtures from construction debris and physical damage.
B. Store exterior fixtures in original wrappings in a clean dry space. Protect from weather, dirt, fumes, water, construction debris, and damage.
C. Handle exterior lighting fixtures carefully to prevent damage, breaking, and scoring. Do not install damaged fixtures or components; remove units from Site and replace with new.

1.06 SEQUENCING AND SCHEDULING:

A. Sequence exterior lighting installation with other work to reduce possibility of damage and soiling of fixtures during the remainder of construction period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide products as indicated on drawings or approved equal.

2.02 EXTERIOR LIGHTING FIXTURES:

A. General: Provide lighting fixtures of sizes, types, and ratings indicated; complete with, but not limited to, housings, high power factor ballasts, energy efficient ballasts, lamps, starters, and wiring. All equipment and materials shall bear the UL label.
B. LED sources shall meet the following requirements:
   1. Operating temperature rating shall be between -40 degrees F to 120 degrees F.
   2. Correlated Color Temperature (CCT): 3500K.
   3. Color Rendering Index (CRI): greater than or equal to 80.
   4. The manufacturer shall have performed Joint Electron Devices Engineering Council (JEDEC) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK, Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
C. LED Drivers:
   1. LED drivers shall meet the following requirements:
      a. Drivers shall have a minimum efficiency of 85%
      b. Starting Temperature: -40 degrees F.
      c. Input Voltage: 120 to 277V (plus or minus 10%)
      d. Power supplies: Class I or II output.

e. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 by 50 microsec, 10kA/8 by 20 microsec) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ANSI C62.41.2-2202, Scenario 1 Location Category C.
f. Power Factor (PF): greater than or equal to 0.90.
g. Total Harmonic Distortion (THD): Less than or equal to 20%.
h. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
i. Drivers shall be reduction of hazardous substances (ROHS) compliant.

D. Provide integral 2-50 footcandle adjustable photocell control when indicated. Photo control shall have internal 2-minute time delay.

2.03 EXTERIOR LIGHTING FIXTURE TYPES:

A. General: Various fixture types are indicated on the fixture schedule on the drawings. Fixtures shall comply with the minimum requirements as stated on the schedule.

2.04 LIGHTING POLES AND STANDARDS:

A. Metal Lighting Standards: Metal, raceway-type, lighting poles and standards, of sizes and types indicated, comprised of shafts and tenon joints. Equipment with grounding connections readily accessible from handhold or transformer base with vandal-resistant access doors; and constructed of the following materials and additional construction features.
1. Material:
a. Stainless steel.
2. Configuration:
a. Embedded-type base and reinforcing sleeve with hand and cable entrance holes (where indicated).
3. Metal Lighting Standard Accessories: Include anchor bolts, as recommended by the lighting standard manufacturer, of sizes and materials needed to meet erection and loading application requirements.

B. Metal Poles: Galvanized steel, tapered, tubular, seamless shaft poles, of sizes and types indicated, with 1/4-inch bearing plates and ground sleeves for direct embedment. (Provide removable step bolts 3/4 inch diameter and 6 inches long with threaded steel lugs welded to pole beginning 12 ft. above finished grade. Space step bolts at 15 inch intervals on alternating sides of the pole, continuing to the top.) Provide pole with adequately sized reinforced handhold complete with matching cover and located on climbing side of pole, 18 inches above grade level. Weld 1/2-inch grounding stud on shaft with accessibility from handhold. Design poles to withstand loads developed by 100 mph wind pressure, as adjusted for height above ground level, structural shapes loading and cable/wire loading. Construct poles whose total length is greater than 40 ft. in two sections for shipping purposes.

C. Metal Pole Accessories: Include crossarms, bolts, lifting eyes, and nuts as recommended by pole manufacturer, of sizes and materials needed to meet erection and loading application requirements

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which lighting fixtures are to be installed and the substrate which will support lighting fixtures. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF EXTERIOR LIGHTING FIXTURES:

A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and the National Electrical Code.

C. Fasten electrical lighting fixtures and brackets securely to structural supports, including poles/standards; ensure that installed fixtures are plumb and level.

D. All exterior lighting shall be demonstrated during night-time tests.

E. All light fixtures which can be aimed (floodlights, etc.) shall be aimed as indicated and shall be re-aimed as directed by Engineer during night time lighting demonstrations. Demonstrate lighting at night after all adjustments have been made.

3.03 GROUNDING:

A. Provide equipment grounding connections for exterior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.

3.04 FIELD QUALITY CONTROL:

A. At the Date of Substantial Completion, replace lamps in exterior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing as judged by Engineer.

B. Refer to Division 01 Sections for the replacement/restoration of lamps in exterior lighting fixtures where used for temporary lighting prior to Date of Substantial Completion.

3.05 ADJUSTING AND CLEANING:

A. Aim adjustable lighting fixtures and lamps in night test of system. Verify that measured illuminance values comply with submitted isolux plot diagram values.

B. Clean lighting fixtures of dirt and debris upon completion of installation.

C. Protect installed fixtures from damage during construction period.

D. Photoelectric Controls:

1. Aim "north."
2. Adjust to actuate "on" at 3.0 footcandles.
3. Provide FAA listed photoelectric controls for control of aviation obstruction lighting.

3.06 DEMONSTRATION:

A. Upon completion of installation of exterior lighting fixtures and associated electrical supply circuitry, apply electrical power to circuitry to demonstrate capability and compliance with requirements. All exterior lighting demonstrations shall be performed at night. Verify light fixture grouping (verify circuiting as indicated on Drawings) and controls. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 56 10

SECTION 48 14 13 – SOLAR ENERGY COLLECTORS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies Solar Energy Systems as indicated by Drawings and schedules, and is hereby defined to include, but not by way of limitation, photovoltaic modules, monitoring system, mounting equipment, and accessories. Installation of the Photovoltaic array involves mechanically mounting the modules, attaching the electrical interconnection, and checking performance.

1.02 REFERENCE STANDARDS:

A. NFPA 70 National Electrical Code.
B. Underwriters Laboratory (UL):
   1. UL 498 - Standard for Safety of Attachment Plugs and Receptacles.
   2. UL 746C - Polymeric Materials - Use in Electrical Equipment Evaluations.
   3. UL 854 - Service Entrance Cables.
   4. UL 1703 - Standard of Safety of Flat-Plate Photovoltaic Modules and Panels.
   5. UL 1977 - Standard for Safety of Component Connectors Used for Data, Signal, and Power Equipment Applications.
   6. UL 4703 - Photovoltaic Wire.
C. International Electrotechnical Commission (IEC):
   1. IEC 61215 - Crystalline Silicon Terrestrial Photovoltaic (PV) Modules.
   2. IEC 61646 - Thin-Film Terrestrial Photovoltaic (PV) Modules.

1.03 RELATED REQUIREMENTS.

A. Support Structure – 13 34 20.
B. Basic Electrical Requirements - Section 26 05 10.
C. Wiring – Section 26 05 19.
D. Electrical Identification - Section 26 05 33.
E. Raceways and Boxes - Section 26 05 33.
F. Commissioning of Electrical Systems - Section 26 08 00.
G. Static Inverter: Specified in Section 48 19 16.
H. Identification for Electrical Systems – Section 26 05 53

1.04 COORDINATION:

A. The Contractor shall coordinate the system requirements with other divisions and contractors as necessary to undertake the Work described.

1.05 ABBREVIATIONS:

A. kWh - Kilowatt Hour.
B. kWp - Kilowatt Peak.
C. STC - Standard Test Conditions.
D. Adc - Amps Direct Current.
E. Vdc - Volts Direct Current.

1.06 CONTRACTOR QUALIFICATIONS:

A. Contractor shall be trained and certified with manufacture components. Contractor shall submit personnel qualified to perform the Work based on overall electrical experience.
B. Contractor shall be NABCEP certified or demonstrate equal experience.

1.07 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 - Basic Electrical Requirements for administrative and procedural requirements for submittals.

B. Includes but not limited to, the following:

1. Product Data: Submit Manufacturer's data on Photovoltaic Modules and components. Include manufacturer's standard product warranty, for duration of not less than 20 years, for replacement of materials and equipment used in photovoltaic system.
2. Shop Drawings: Submit dimensioned Drawings of photovoltaic system and accessories including, but not limited to, cable tray, wiring, mounting hardware, data, and monitoring. Drawings shall list weights, clearances, disconnects for equipment isolation, field connection points, and nameplate data.
3. Wiring Diagrams: Submit wiring diagrams for Photovoltaic Modules, Data monitoring, and disconnects. Clearly differentiate between portions of wiring that are manufacturer factory installed and portions that are field installed.
4. Certifications: Provide photovoltaic array certified test record of the following final production tests.
    a. Total Array Output.
    b. Inverter Commissioning.
    c. Voltage and Array Output at STC.
        (1) Test shall extrapolate from no less than 600 W/m² day of insulation.
5. Operation and maintenance manuals.
6. Factory and all field test data.
7. Contractor qualifications and certificates.
8. Interconnection agreement with utility.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. All photovoltaics shall be stored in a protected area and handled with care.

B. Upon delivery, modules shall be inspected and tested for output voltage, cracks, defects, and discoloration.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide photovoltaic modules and products of one of the following (for each type and rating of module):

1. Mono-crystalline:
    a. Sanyo.
    b. Sun Power.
    c. Suntech.
    d. Or approved equal.
2. Poly-crystalline:
    a. Kyocera.
    b. Schott.
    c. Suntech.
    d. Or approved equal.
3. Thinfilm:
    a. Q-Cell.
    b. Suntech.
    c. Sharp.
    d. Or approved equal.

2.02 PHOTOVOLTAIC MODULES:

A. General: Except as otherwise indicated. Provide modules, racking equipment, and ancillary components of types, sizes, and ratings indicated which comply with manufacturer's standard materials and with the design and construction in accordance with published product information. Where types, sizes, and ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.
B. Modules shall have minimum one bypass diode per two rows of cells, with minimum of two diodes.
C. Provide surge protectors with at least 5 kA peak current rating for inverter protection.
D. Array shall be configured as shown on Drawings unless approved by Engineer, or Ameren.
E. Strings shall have an open circuit voltage as determined in NEC 690.7 at STC, and a short circuit current of no more than 10 Adc at STC as determined in NEC 690.8. Strings shall be sized to operate within inverter operating voltage.
F. Photovoltaic module wiring, connections, and terminations:
    1. Modules shall be equipped with 12 AWG, single core, XLP USE-2 cables with lockable MC-4 quick-connect terminations for module string connections.
    2. Connectors shall comply with UL 498 and UL 1977.
G. Modules shall be UL 1703 and CEC listed and comply with IEC 61215 or 61646 as appropriate.
H. Module junction box shall comply with UL 746C.

PART 3 - EXECUTION

3.01 GROUNDING:

A. Provide grounding conductor for all modules. Equipment grounding conductors shall comply with manufacturer's recommendations and all applicable codes.
B. Non-current carrying conductive parts (e.g., metal supports/framework, etc.) should be earthed with a suitable bonding conductor in accordance with NEC before PV modules are mounted.
C. All equipment within Array must have same equipment ground conductor and comply to NEC.

3.02 INSTALLATION OF PHOTOVOLTAIC ARRAY:

A. Modules shall be mounted using UNI RAC heavy-duty SolarMount rail, or approved equal and coordinated with the parking canopy structure as referenced in specification 13 34 20. Rack system must be certified by manufacturer and guaranteed for performance on Site. Manufacturer shall provide 3-year warranty for parts and maintenance.
B. Install photovoltaic modules as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that modules fulfill requirements.
C. Coordinate with other work, including raceways, electrical boxes, fittings, and accessories, as necessary to interface installation of photovoltaic array with other Work.
D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in applicable codes.
E. Connect conduit, combiners, disconnects, and inverter as indicated on Drawings and comply with the manufacturer's installation instructions.
F. Open circuiting, or opaque covering shall be used to disable an array for installation or service.

3.03 IDENTIFICATION: PROVIDE PROPER IDENTIFICATION OF SYSTEM COMPONENTS:

A. All junction boxes for strings shall indicate name of string, combiner, and building location, to which the modules are connected.

B. All junction boxes shall be labeled with the following words or equivalent:

THIS BOX CONTAINS LIVE PARTS WHICH CANNOT BE DEACTIVATED.

C. All disconnects shall be labeled with string or equipment it isolates.

D. Combiners and disconnects shall be labeled with the following words or equivalent:

WARNING
ELECTRIC SHOCK HAZARD
DO NOT TOUCH TERMINALS.
TERMINALS ON BOTH THE LINE AND LOAD SIDE
MAY BE ENERGIZED IN THE OPEN POSITION.

E. All test points shall be clearly labeled with their expected readings given.

3.04 ACCESSORIES:

A. Provide one set of opaque mats with capability of covering one string of modules.

3.05 FACTORY TESTING:

A. Modules shall be rated and tested to STC.

B. Quality tests on glass impact/shatter quality.

C. Test all panels for shorts and earth faults.

3.06 FIELD QUALITY CONTROL:

A. Start-Up Testing:

1. Check all equipment and grounding to ensure continuity of connection. Notify Engineer of excessive resistance.
2. Find and remove all ground faults. Provide one year of ground fault repair service.
3. Upon completion of installation, demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at Site, then retest to demonstrate compliance; otherwise remove and replace with new units and proceed with retesting. Initial testing and retesting to be at no cost to Owner.

3.07 COMMISSIONING:

A. System shall be tested and commissioned in the normal manner in accordance with NEC and industry standards.

B. A minimum irradiation level of 600 Wm^2 shall be used to ensure accurate extrapolation to STC.

C. Test that must be performed:

1. Electrical performance test on PV array.
2. Test on inverter efficiency and power quality.
3. Long-term output monitoring.

D. Contracting Representative must be present for the following tests:

1. Synchronization with the grid.
2. Safety interlocks.
3. Warning labels check.
4. Protection to isolate the inverter from supply network when:

a. Operating voltage falls outside acceptable range.
b. Operating frequency falls outside acceptable range.
c. Mains supply is lost.

3.08 AGREEMENT TO MAINTAIN:

A. Prior to time of final acceptance, the Installer shall submit four copies of an agreement for continued service and maintenance of PV Modules for Owner. Furnish ports and provide continued testing and servicing, including replacement of materials and equipment for a three-year period after Substantial Completion. Maintenance in Contract shall be provided by a local contractor. Provide an option for renewal of the agreement by Owner.

END OF SECTION 48 14 13

SECTION 48 19 16 – GRID-TIE UTILITY INTERACTIVE INVERTERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies the grid-tie utility interactive inverters and accessories to be provided as specified herein and where shown on the associated Drawings and manuals.

1.02 REFERENCE STANDARDS:

A. Underwriters Laboratory (UL):
   1. UL 1741 - Inverters, converters, controllers, and interconnection system equipment for use with distributed energy resources.

B. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE 519 - IEEE recommended practices and requirements for harmonic control in electrical power systems.
   2. IEEE 1547 - IEEE standard for interconnecting distributed resources with electric power systems.

C. FCC Part 15 - Radio frequency devices.

D. CSA C22.2 No. 107.01 - General-use power supplies.

1.03 RELATED REQUIREMENTS:

A. Basic Electrical Requirements - Section 26 05 10.

B. Wiring – Section 26 05 19.

C. Electrical Identification - Section 26 05 53.

D. Raceways - Section 26 05 33.

E. Electrical Systems Commissioning - Section 26 08 00.

F. Solar Energy Collectors - Section 48 14 13.

1.04 COORDINATION:

A. The Contractor shall coordinate the system requirements with other Divisions and contractors as necessary to undertake the Work described.

1.05 SUBMITTALS:

A. Submit wiring diagrams showing connections to ac system and dc system. Differentiate between portions of wiring that are manufacturer installed and portions that are field installed.

B. Submit manufacturer's Planning and Installation Manual which includes outline dimensions, connection and support points, weight, cooling air requirements, and specified ratings.

C. Submit manufacturer's Operations and Maintenance Manual.

D. Submit manufacturer's test record of specific inverter.

E. Refer to Division 01 and Section 26 00 00 - Basic Electrical Requirements for administrative and procedural requirements for submittals.

F. Product Data: Submit manufacturer's data on grid-tie utility interactive inverter and components. Include manufacturer's standard product warranty, for duration of not less than seven years, for replacement of materials and equipment used in inverter systems.

G. Shop Drawings: Submit dimensioned drawings of grid-tie utility interactive inverters and accessories including, but not limited to, AC Disconnects, control panel, DC disconnects, and instrumentation. Drawings shall list weights, cooling air requirements, noise criteria, field connection points, and nameplate data. Show adequate clearance space for removal of inverter elements for maintenance purposes. Provide center-of-gravity information for seismic-rated equipment.

H. Wiring Diagrams: Submit wiring diagrams for Utility Interactive inverter units, control panel, and power monitoring showing connections to electrical power system, automatic transfer switches, and ancillary equipment. Clearly differentiate between portions of wiring that are manufacturer factory installed and portions that are field installed.

I. Agreement to Maintain: Prior to time of final acceptance, the Installer shall submit four copies of an Agreement for continued service and maintenance of utility interactive inverter for Owner. Furnish parts and provide continued testing and servicing, including replacement of materials and equipment for a three-year period after Substantial Completion. Provide an option for renewal of the Agreement by Owner.

J. Certifications: Provide Grid-tie utility interactive inverter set certified test record of the following final production tests.
   1. Provide efficiency testing.
   2. Transient and steady-state governing.
   3. Safety shutdown device testing.
   4. Voltage regulation.
   5. Rated power.
   6. Maximum power.
   7. Provide certified test record prior to inverter being shipped from factory to Project location.

K. Operation and Maintenance Manuals.

L. Factory and all field test data.

1.06 DELIVERY STORAGE AND HANDLING:

A. Deliver grid-tie inverters properly packaged and mounted on pallets to facilitate handling. Utilize factory-fabricated wrappings and protective caps to protect equipment from damage.

B. Store grid-tie inverters in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade in manufacturer's wrappings.

C. Handle grid-tie inverters carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from Site and replace damaged equipment with new.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements provided grid-tie utility interactive inverters of one of the following manufacturers:
   1. Advanced Energy.
   2. SMA.
   3. Or approved equal.

2.02 GRID-TIE UTILITY INTERACTIVE INVERTERS:

A. General: Except as otherwise indicated. Provide inverters, disconnects, and ancillary components of types, sizes, and ratings indicated, which comply with manufacturer's standard materials and with the design and construction in accordance with published product information. Where types, sizes, and ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.

B. Provide grid-tie utility interactive inverters listed to UL 1741 and IEEE 1547.

C. Provide inverters rated with an ac output as indicated on Contract Drawings, ac line voltage at 120V, 60 Hz, greater than 0.99 power factor. DC input voltage shall be 250Vdc to 1500Vdc or less and output tracking voltage shall be 250Vdc to 1500Vdc or less.

D. Provide inverter configured for monopolar arrays. Array shall be grounded inside the inverter enclosure using a Ground Fault Detection and Interruption (GFDI) system. The inverter shall be configured for negative or positive ground coordinate with manufacturer of photovoltaic modules.
E. Maximum back feed current shall be 0 Adc to prevent additional over current protection requirements in the dc system.
F. Inverter shall be supplied with a night-time disconnect to reduce tare loss to below 100 W and a soft-start circuit to reduce inrush currents.
G. Enclosure shall be NEMA 3R and suitable for indoor or outdoor use. Provide stainless-steel hardware.
H. Inverter shall be supplied with an integrated isolation transformer, integrated dc disconnect and output ac circuit breaker.
I. Inverter shall be provided with a front panel display. The display will provide read capability for all parameters and password protected write capability.
J. Inverters shall meet FCC Part 15 for harmonic content.
K. Inverter shall have ground fault protection with capability of:
    1. Detects an earth fault.
    2. Indicates that a ground fault has occurred.
    3. Automatically disconnects all conductors or causes the inverter to automatically cease serving power to output circuits.
L. Inverter shall be capable of interface and control through BMS.
M. Inverter shall be compliant with CSA C22.2 No. 107.01.
N. Invertor shall have Short Circuit Withstand Rating (SSCR) indicated on Drawings.

2.03 ACCESSORIES:

A. Provide a remote communications interface that allows for RS485/Modbus communication and is required for owner/third party monitoring.
B. Provide an array sub-combiner to be integrated in the inverter enclosure. Fuse ratings and quantities shall be coordinated with photovoltaic module manufacturer and NEC.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which grid-tie inverters are to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF GRID-TIE INVERTER:

A. Install the grid-tie inverter in accordance to the manufacturer's Planning and Installation Manual and applicable NFPA Standards.
B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in applicable codes.

3.03 GROUNDING:

A. Provide grounding conductor for grid-tie inverter units as indicated. Tighten connections to comply with tightening torques specified in NEC and IEEE to ensure permanent and effective grounding.

3.04 FIELD QUALITY CONTROL:

A. Visual Inspection of Mechanical Connections.
   1. Ensure that the ac and dc disconnect switches, as well as any utility interconnect circuit breakers or main disconnect switches, are opened.
   2. Ensure all anchor bolts and any required seismic bracing is properly tightened and in place.
   3. Remove the latches and open the doors of the ac and dc interface and inspect.
   4. Verify all wire conduit fittings and connections are properly tightened.

B. Visual Inspection of Electrical Connections.
   1. Ensure that the ac disconnect and dc disconnect switches, as well as any utility interconnect circuit breakers or main disconnect switches, are opened.
   2. Ensure all conductors and wiring connections interfacing with the inverter are tightened to the correct torque value. For specific torque values, see the manufacturer's Planning and Installation Manual.
   3. Verify the ac power conductors terminated at the inverter within the ac interface are terminated correctly and properly sequenced.
   4. Verify the dc power conductors terminated at the inverter within the dc interface are terminated correctly and properly polarized.

C. Commissioning Procedure.
   1. Begin the inverter commissioning procedure as described in detail further in the Operations and Maintenance Manual. The steps are summarized below.
      a. Record the serial number.
      b. Inspect the inverter enclosure.
      c. Verify ac and dc voltages.
      d. Apply grid voltage.
      e. Check the front panel display.
      f. Confirm operational parameters (ac, dc and power tracker).
      g. Apply dc voltage.
      h. Perform the matrix test.
      i. Operate inverter.

END OF SECTION 48 19 16

ADMINISTRATIVE INSTRUCTIONS

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1.00 VALUE ENGINEERING

A Value Engineering Proposal ("VEP") is a creative proposal initiated by the Contractor to amend the Contract to use an alternate method, design, material, or similar element, to reduce the project's cost or improve its outcome for both the City of Cheyenne's (the "City's") and the Contractor's benefit.

The Contractor may submit a VEP for consideration by the City and the City Engineer (the "Engineer") after the City awards the contract. The Contractor shall submit a VEP in accordance with the procedure outlined in the current edition of the Wyoming Department of Transportation Standard Specifications for Road and Bridge Construction ("WYDOT Standard Specifications for Road and Bridge Construction"), Subsection 104.3.4, "Submitting a VECP".

The City will not consider VEPs that are cost reductions resulting from corrections to design errors; that are inconsistent with the City's design policies and criteria for the project; or that may require excessive time or cost for review.

If the City and the Engineer accept a VEP which results in a net reduction in the contract price, the Contractor will share proportionally with the City in the net savings (City 50%; Contractor 50%), less the cost of the Engineer's time required to evaluate the VEP. Net savings are defined as savings available after deducting VEP evaluation costs.

2.00 REFERENCES

2.01 **Coordination of Contract Documents.** Revise City of Cheyenne & Board of Public Utilities Standard Construction Specifications and Standard Drawings, 2014 Edition ("City Standard Specifications and Drawings" or separately as "Standard Specifications" or "Standard Drawings") Section 01090, REFERENCES, item 1.01.A. as follows, by deleting the hierarchy list included (items 1 thru 4), and replace with the following in order of precedence:

1. Permits from other agencies as required by law;
2. Successive change orders and contract modifications in order of issuance, most recent first;
3. Addenda;
4. Contract;
5. City-obtained agreements;
6. Special Provisions;
7. General Conditions;
8. Project Plans;
9. Standard Drawings;

10. Standard Specifications;
11. Electronic CADD Files; and
12. Reference Specifications.

Detailed plans shall have precedence over general plans.

2.02 **Reference Specifications.** The City Standard Specifications and Drawings, and all revisions through the advertisement date, constitute the current Standard Specifications and Standard Drawings for this project. They are an integral part of the Contract and are incorporated herein by reference. The Contractor shall adhere to all requirements and provisions of said City Standard Specifications and Standard Drawings in the performance of this Contract, except where otherwise provided herein or otherwise shown on the Contract Drawings.

Contract references to standard test methods or specifications such as those from the American Association of State Highway and Transportation Officials ("AASHTO"), the American Society for Testing and Materials ("ASTM"), or similar professional organizations, refer to the methods and specifications in effect on the advertised date of the public bid opening. If a later change to a cited document affects successful completion of the project, the City will incorporate the new reference with a contract modification.

All work shown on the Contract Drawings and Standard Specifications which refer to the Wyoming Department of Transportation ("WYDOT") shall be constructed in accordance with the current editions of the WYDOT Standard Specifications for Road and Bridge Construction and WYDOT Standard Plans and all revisions through the date of advertisement.

It is the bidder's responsibility to acquire the latest editions of all the Specifications, Standard Drawings, and Manuals.

3.00 TRAFFIC CONTROL

3.01 **Construction Phasing.** When a construction phasing or traffic control plan is included in the project plans, this plan shall govern unless an alternate plan, acceptable to the City, is submitted to the Engineer by the Contractor. If no traffic control plan is provided or if the Contractor desires to deviate from the provisions for maintaining traffic as described in the contract documents, the Contractor shall submit to the Engineer for approval a proposed sequence of operations and a compatible method of maintaining vehicle, pedestrian, and bicycle traffic. The Contractor shall submit the proposal for review and approval at least ten (10) Working Days prior to its intended implementation. The City reserves the right, in its sole discretion, to reject any construction phasing or traffic control proposal for any reason whatsoever.

3.02 **Traffic Control Requirements.** The Contractor shall provide adequate signs, barricades, lights, flares, flaggers, take all necessary precautions to prevent accident or injury, and minimize the public's inconvenience while the work is in progress. Any traffic control or construction phasing drawings shown in the project plans are conceptual only. The Contractor shall submit a detailed traffic control diagram to the City for prior approval before work begins. The diagram shall indicate location and type of signs, cones, flashers, flagging, reflective barricades, and all other devices the Contractor deems necessary for the proper protection of the work area. The Contractor shall install and maintain all traffic control and protective devices in accordance with the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways ("MUTCD").

3.03 **Notifying Affected Parties.** The Contractor shall notify all homeowners and businesses it anticipates will be affected by any work no less than two (2) Working Days, as defined by section 7.04, "Working Days and Time", before work is scheduled to commence. All written notifications shall be approved by the City prior to distribution. The Contractor shall notify all homeowners and businesses again if the work does not begin on the specified day, as anticipated. The notice shall be a written posting, hand delivered to the property, stating the anticipated start-date and duration of such work containing parking restriction information, and a phone number for the Superintendent or Project Manager. The Contractor shall not place notices in mailboxes.

3.04 **Parking Restrictions.** If work requires parking restrictions, the Contractor shall place "No Parking" signs along the affected area a minimum of forty-eight (48) hours prior to the beginning of work. The Contractor shall place "No Parking" signs a maximum of seventy-five (75) feet apart, but at no time fewer than two per block, per side. The City will only tow vehicles from the work area if they remain parked on the street after the Contractor provided proper written notice and placed "No Parking" signs. If the Contractor provides insufficient notice to affected parties, the Engineer must approve towing vehicles parked on the street, and such towing shall be at the Contractor's expense.

3.05 **Traffic Disruption and Obstructions.** The Contractor shall minimize obstructions to vehicle, pedestrian, and bicycle traffic; minimize disruption to transit routes; and give consideration to the location of detours and provisions for handling traffic. The Contractor shall provide for the safety and convenience of both the general public and residents near the work. The Contractor's travel rights do not supersede the public's travel rights.

Whenever, in the Engineer's opinion, the Contractor has not provided sufficient or proper safety precautions, the Contractor shall do so immediately and to whatever extent the Engineer requires. This provision shall not be construed as creating any duty on the part of the Engineer for traffic safety.

Fire hydrants on or near the site of the work shall be accessible at all times.

The Contractor shall not close any streets, driveways, access points, or any transit stops without prior consent of the City, Engineer, and proper governmental authorities affected by the closure or having authority over such area. The Contractor is required to request approval from the Engineer at least five (5) Working Days prior to the planned date of physical closure of any street or transit stop. Submittal or approval of a traffic control plan alone does not constitute notice or approval of the date of start of closure.

3.06 **Property Access.** The Contractor shall provide temporary approaches to businesses and residences adjacent to the roadway, intersections, detours, crossings, or similar features or facilities to safely accommodate customary vehicular or pedestrian traffic affected by the work.

3.07 **Emergency Access.** The Contractor shall be prepared at all times to provide immediate access for emergency vehicles to any buildings or other areas adjacent to the project and shall, upon emergency personnel request, construct temporary ramps and other facilities required for such emergency access. The City will make no additional payment to the Contractor for any delays or cost incurred by the Contractor in providing such emergency access.

4.00 CONTROL OF WORK

4.01 **Construction Stakes, Lines, and Grades.** The Contractor shall provide all construction surveying and stakeout required to accurately build and complete the project. The Engineer will establish primary project control only, but if the Engineer determines that additional project control is needed, the Engineer may direct the Contractor to establish additional project control under the direct supervision of a licensed Wyoming Professional Land Surveyor. The Engineer may provide an electronic point file or CADD files to the Contractor for use in construction staking.

The Contractor shall preserve all survey stakes and marks. If any of the primary project control survey marks are destroyed or disturbed due to the Contractor's construction activities or negligence, the Contractor shall be charged at the Engineer's established hourly crew rate for replacing them, with payment for this extra work made directly to the City's Consultant by deduction from the monthly periodic estimate payments to the Contractor. The Contractor shall also be responsible for any mistakes or damage resulting from the unnecessary loss or disturbances of control points, offset line points, and stakes.

The Contractor is responsible for scheduling all surveying and shall consider all phasing, sequencing, and construction limits required by all specifications. The Contractor shall review the survey stakes to ensure there is no discrepancy between the drawings and the survey stakes. If there is a discrepancy, the Contractor shall stop work immediately and notify the Engineer without delay.

The Contractor shall provide the survey data to the Engineer to verify elevations, resolve grade issues, and to otherwise use as the Engineer deems necessary or appropriate. The Engineer has the right to review the project stakeout prior to staking. The Contractor shall arrange work to allow forty-eight (48) hours advance notice for the Engineer to review the lines and grades of those stakes set for the next step of the Contractor's work. The Engineer shall have the right to make reasonable changes in the grades as shown on the drawings. The Engineer will be available for consultation and interpretations for staking operations.

The Contractor shall call to the Engineer's attention any reference lines, points, or bench marks, which may have been disturbed or appear off line or grade.

A licensed Wyoming Professional Land Surveyor shall directly supervise all construction surveys. The costs for providing all construction surveying and staking shall be considered included in the cost of contract items.

4.02 **Land Provided by the City.** The City or Engineer will obtain all easements and franchises required for the work. The Contractor shall limit operations to the area obtained and shall not trespass on private property. The City may provide access to certain lands, as indicated in connection with the work under the contract. The Contractor shall not conduct any activity on any land which may result in the imposition of any lien or encumbrance. The Contractor shall use said land in accordance with conditions established by the City.

4.03 **Land Provided by the Contractor.** If the Contractor requires additional area required for temporary construction facilities or storage of materials, the Contractor shall obtain written consent and agreement from the landowner on whose land the Contractor seeks to expand the Contractor's operation. The Contractor must provide a copy of this agreement to the Engineer, who may grant or deny permission to expand to additional land. The agreement, if accepted by the Engineer, must describe the activity for which the land will be used and how the Contractor will restore the land.

The Contractor shall construct all access roads, detour roads, or other temporary works, as required by the operations. The Contractor shall confine its equipment, materials storage, and worker operations to those areas shown and described, and such additional areas as the Contractor may provide. The Contractor shall provide such land, and access thereto, without liability to the City.

Prior to final payment, the Contractor shall furnish the Engineer with a written statement of clearance from the landowner for those properties on which work, equipment, or material staging took place.

4.04 Protection and Restoration of Property, Markers, and Landscape.

General: All construction work under this contract on rights-of-way, easements, or franchise, shall be confined to the limits of such rights-of-way, easements, or franchise. The Contractor shall accomplish all work so as to cause the least amount of disturbance and a minimum amount of damage. The Contractor shall take all necessary precautions to preserve and protect adjacent roadways, public and private properties and improvements, and underground facilities during work on the project. The Contractor shall take responsibility for any damage or injury resulting from:

1. Any act, omission, negligence, or misconduct in the execution of the work;
2. Defective work or materials; and
3. The work of a Subcontractor.

Except for damage due to unforeseeable causes beyond the control of, and without fault of negligence of the Contractor, the Contractor shall rebuild, repair, restore, and make good damages to any portion of the project or real property injured in the course of the work, from any cause before final acceptance, and without additional cost to the City.

The Contractor shall coordinate such repairs, replacements, or both, of real property with the affected property owner, and obtain the property owner's written approval when the final work is complete. A copy of the property owner's approval shall be submitted to the City. If the Contractor fails to perform such restoration within a reasonable time, the City may do so and deduct the cost from monies due the Contractor or bill the Contractor, as appropriate.

The Contractor's responsibility for the work lasts until final written acceptance of the project by the City, in accordance with General Conditions regarding Completion and Warranty.

Site security: The Contractor shall provide site security in accordance with Special Provisions Section 01231, SAFETY. Suspension of work does not relieve the Contractor of responsibility for the project, except in accordance with General Conditions provisions on Suspension of Work**.**

Vehicle Damage Claims: If a vehicle owner makes a vehicle damage claim, the Contractor shall send a written response to the claimant addressing the claim and the actions the Contractor has taken or intends to take. The Contractor shall send a copy of the response letter to the following address:

City of Cheyenne Risk Management
Attn: Risk Manager
2101 O'Neil Ave
Cheyenne, WY 82001

Trenches: The Contractor shall not leave trenches open across travel ways for more than twenty-four (24) hours or over weekends or holidays. Trenches that present a danger to vehicular or pedestrian traffic shall be backfilled or barricaded at the end of each day's work.

Structures: The Contractor shall remove such existing structures as may be necessary for the performance of the work and, if required, shall rebuild the structures thus removed in as good a condition as found with minimum requirements as herein specified. The Contractor shall also repair all existing structures damaged as a result of the work under this contract.

Cultivated Areas and Other Surface Improvements: All cultivated areas, either agricultural or lawns, and other surface improvements damaged by Contractor's actions shall be restored as nearly as possible to their original condition and in accordance with Standard Specification, Section 02900, Landscaping. Prior to excavation on an easement or private right-of-way, the Contractor shall strip topsoil from the trench or construction area and stockpile it in such a manner that it may be replaced by the Contractor upon completion of construction. Ornamental trees and shrubbery shall be carefully removed, with the earth surrounding their roots, wrapped in burlap and replanted in their original positions within twenty-four (24) hours. The Contractor shall replace all shrubbery or trees destroyed or damaged with material of equal quality at no additional cost to the City or property owner.

In the event that it is necessary to trench through any lawn areas, the sod shall be carefully cut, rolled, and replaced after the trenches are backfilled. The Contractor shall then clean the lawn area of debris by raking or other means. All fences, markers, mail boxes, or other temporary structures shall be removed by the Contractor and immediately replaced after the trench has been backfilled, in their original positions. The Contractor shall notify the Engineer and property owner at least twenty-four (24) hours in advance of any work done on easements or private rights-of-way.

Streets: The Contractor shall assume all responsibility for restoration of the surface of all streets (travel ways) used by the Contractor and damaged.

4.05 **Cooperation by the Contractor.** Contact and Emergency Response: The Contractor shall maintain a telephone for the duration of the contract, at the Contractor's own expense, where the Contractor or the Contractor's authorized representative may be reached directly or by message at all times, including weekends and holidays. The Contractor shall cooperate with the Engineer and inspectors at all times and shall respond to requests for emergency repairs to the contract work no later than two (2) hours of the request.

If the Contractor does not respond to requests for emergency repairs within the time allotted, the City reserves the right to enter the work area and conduct repairs with

City forces or City-hired forces. The Contractor will be responsible for all costs incurred by the City in responding to the emergency repairs and will also be responsible for restoring all work back to the required contract conditions. The City will not be responsible for any damages to the Contractor's work or equipment that results from the City responding to the emergency repair.

Superintendence: When work is underway, including work by a Subcontractor, the Contractor shall ensure the presence of a competent project superintendent, who is an employee of the Contractor, at the worksite at all times, unless otherwise agreed to by the City. The project superintendent shall have the ability to communicate clearly; to read, interpret, and implement the relevant contract documents; have experience in the work included in the project; have authority to represent and act for the Contractor, including authority to execute the Engineer's directions; and authority to obtain and provide sufficient materials, equipment, tools, labor, and incidentals to complete the project as specified.

4.06 **Cooperation between Contractors**. The City may contract with separate Contractors for additional work on or near the worksite. When separate contracts are let, the City requires each Contractor to cooperate with and work without hindering each other.

Each Contractor assumes liability, financial or otherwise, for its own errors, acts, or omissions and holds the City harmless, in accordance with the General Conditions of the Contract, from damages or disputes arising from inconvenience, delay, or loss due to the presence and operations of other persons, contractors or public entities on or near the worksite.

4.07 **Maintenance during Construction.** The following shall be added to Standard Specification Section 01054.1.09:

The Contractor is responsible for snow removal within all barricaded areas of the project. The Contractor will be responsible for snow removal within the travel way of the project area unless a minimum of a 16' lane is provided for the City plows.

5.00 CONTROL OF MATERIAL

5.01 **Inspection and Testing for Quality Control.** Requirements: All materials and work shall be tested and inspected in accordance with the specifications. The Contractor shall provide testing and inspection services to verify compliance with requirements specified or indicated. The Contractor shall be responsible for scheduling inspections and tests and notifying the laboratory.

The Contractor shall provide advance notification to the Engineer of any testing or sampling to be conducted. The Engineer may provide Quality Assurance testing to prevent against defects and deficiencies in the Contractor's work by verifying that

the Contractor's Quality Control testing is accurate and adequate. However, furnishing such Quality Assurance testing shall not relieve the Contractor of responsibility for providing Quality Control testing or responsibility for the Contractor's failure to perform the work in accordance with the contract documents.

Laboratory Requirements: The Contractor shall retain the services of an Independent AASHTO-accredited testing laboratory to inspect, sample and test the related work. The testing laboratory shall cooperate with the Engineer and the Contractor in performing its duties and shall provide qualified and/or certified personnel to perform inspections and tests.

Tests shall be performed in accordance with the most recent cited standard methods of AASHTO or ASTM, approved AASHTO Interim Specifications, or ASTM Tentative Specifications in effect on the advertised date of the public bid opening or more stringent Quality Control requirements where specified in the Special Provisions.

The testing laboratory shall promptly notify the Engineer and the Contractor of deficiencies in the work observed during the performance of its duties. The testing laboratory shall not approve or accept any portion of the work nor shall it perform any duties of the Contractor.

Submittals: The testing laboratory shall submit a certified written report of each inspection and test to the Engineer, Contractor, and any other entities designated by the City. Copies of all test results shall be provided to the City within twenty-four (24) hours of the availability of the test results with written report to follow within seven (7) Working Days. Reports of each inspection, test, or similar service shall include the following:

1. Name, address, and telephone number of testing laboratory.
2. Project title and project number.
3. Date of report and designation (number).
4. Dates of testing and maps with sufficient detail to accurately identify locations where samples were taken or inspections and field tests made.
5. Ambient conditions at the time of sample taking and inspecting, or field testing.
6. Names of individuals taking the sample or making the inspection or test.
7. Product and test method.
8. Inspection or test data including interpretation of test results and comments or professional opinion on whether inspected or tested work complies with requirements.
9. Recommendations on retesting or re-inspections.
10. Name and signature of laboratory inspector.

5.02 **Unacceptable Materials.** The Contractor shall not undertake any work in which untested or non-conforming materials are used without prior, written, express approval from the Engineer. Any such work undertaken using untested or non-

conforming materials without the prior, written, express approval of the Engineer may be considered in material breach of this contract and, if directed by the City, shall be removed at no additional cost to the City.

5.03 **Storage of Materials.** Materials shall be stored, in accordance with manufacturer's recommendations, and handled in a manner that facilitates inspections and preserves the materials' quality and suitability for use. Material shall be transported in vehicles built to prevent loss, contamination, or segregation after loading and measuring. The Engineer may re-inspect stored, previously inspected materials before approving their use in the work.

As approved by the City, that portion of the right-of-way within the project limits not required for public travel may be used for storage purposes and for placing of the Contractor's plant and equipment. Material stored on or adjacent to public streets shall not create a safety hazard, obstruct, or inconvenience the traveling public. Any additional space required must be provided by the Contractor at the Contractor's expense. Private or public property shall not be used for storage purposes without written permission of the owner or lessee. All storage sites shall be restored to their original condition by the Contractor at the Contractor's sole expense. Construction materials may not be stored in streets, roads, or highways for more than five (5) days after unloading. All materials or equipment not installed or used in the construction within five (5) days after unloading shall be stored elsewhere by the Contractor at the Contractor's expense, unless the Engineer authorizes additional storage time.

Excavated material, except that which is to be used as backfill in the adjacent trench, may not be stored in public streets, roads, or highways unless the Engineer authorizes such storage. Erosion control shall be provided around all excavated or backfill material. After placing backfill, all excess material shall be removed immediately from the site.

5.04 **City-Furnished Material**. If specified in the Special Provisions, the City will provide material for incorporation into the project. Materials furnished by the City will be delivered, or made available to the Contractor, at the locations specified in the Special Provisions.

The cost of handling and placing all materials supplied by the City shall be considered as included in the contract price for the item in connection with which they are used.

The Contractor shall be held responsible for all material delivered to him, and deductions shall be made from any money due to make good any shortages or deficiencies, from any cause whatsoever and for any damage which may occur after such delivery and for any demurrage charges.

5.05 **Rights In and Use of Material Found in the Work.** The City may authorize the

use of aggregate or other material found in excavation for use in another pay item. The City will pay the established contract unit price for excavation of such material and for the pay item for which it was used. If the excavated material is used for another pay item but was otherwise needed for embankments, backfills, approaches, or other purposes, the Contractor shall provide an acceptable replacement at no additional cost to the City.

The Contractor shall not excavate or take material outside the slope stake limits without the City's prior written approval. The right to use and process material found within the project limits excludes use and processing for noncontract work. If the Contractor produces or processes more material from the project than is required for the contract, without additional compensation to the Contractor, the City may take possession of the excess material and direct its use; or require removal of the material and restoration of the land to a satisfactory condition.

5.06 **Removal and Salvage of Materials**. Any equipment, hardware, structures, inlet grates, valve boxes, manhole rings, covers and lids, traffic control standards, signs and posts, fence and any other miscellaneous items designated for removal from the site and salvage to the City shall be removed from the site and taken to a location designated by the City. All such materials shall be the property of the City unless otherwise specified. Diligent care shall be taken during the removal of all materials to prevent damage.

Manhole covers and manhole rings designated for salvage shall be both plainly marked with a durable, exterior paint for easy identification as individual pairs.

5.07 **Material Spoil Area/Waste Site.** The Contractor shall notify the Engineer at the preconstruction conference as to the location selected to dispose of the excess, waste and unsuitable materials and a map indicating the haul route for the removal from the project.

Lost and spilled materials onto the route taken by the Contractor shall be promptly removed. The route shall be maintained as deemed necessary by the Engineer by the use of water trucks, motor grader, hand labor and related equipment to alleviate the problem of lost spills, tracked mud, and dust control. Prompt restoration of the route is required.

No extra compensation shall be allowed for the disposal of the waste and surplus material; including but not exclusively; dump fees, extra haul distances and time, changed haul routes, and haul road maintenance.

5.08 **Load Restrictions.** The Contractor shall be responsible for all damage to the work caused by the Contractor's hauling equipment. The Contractor shall comply with legal load restrictions when moving equipment or hauling materials on public roads that remains in service. A permit to operate an overweight, oversized, or over-width vehicle does not relieve the Contractor of liability for damage to public roads due

to the moving of equipment or materials.

The Contractor shall not allow loads on concrete pavement, base, or structures before the strength or time requirements for the concrete have been met. In case of pipes, the Contractor shall not allow loads before placing the specified cover fill.

6.00 RESPONSIBILBILTY FOR UTILITY PROCEDURES AND SERVICES

6.01 **Location.** Where underground main distribution conduits such as water, gas, sewer, electric power, telephone or cable are shown on the plans, the Contractor, for the purpose of preparing the Contractor's bid, shall assume that every property parcel is served by a service connection for each type of utility. Failure by the Engineer to show the location of any utility on the plans shall not relieve the Contractor from the responsibilities below.

Before proceeding with the work, the Contractor shall confirm the final grade and locations of such facilities in accordance with the "Wyoming Underground Facilities Notification Act" and the "Wyoming High Voltage Power Lines and Safety Restrictions Act."

The Contractor shall notify utility and pipeline companies of the proposed construction schedule at least two (2) Working Days before the start of work. The Contractor shall ask for the nature, location, and depth of pipes and cables and areas where they may conflict with the work. If a company cannot or will not provide this information, the Contractor shall obtain it by alternate means. Where conflicts may exist, the Contractor shall locate the relevant pipes or cables in three dimensions.

The Contractor shall not begin excavation until all such features have been located, their owners notified, and the Engineer has approved. The Contractor shall not interrupt the service function or disturb the supporting base of any utility without authority from the utility owner or an order from the City. Where protection is required to ensure support of utilities, the Contractor shall, unless otherwise provided, furnish and place the necessary protection at no cost to the City.

6.02. **Utility Line Conflicts and Damage.** If utility lines are determined to be in conflict with or are damaged during the work, the Contractor shall stop work in the immediate area, notify the Engineer and the utility owner, and cooperate with the owner to move or repair the utility. The Contractor shall be solely responsible for any damage done to such utilities due to failure to preserve original locate marks or to properly protect the utilities when their location is known.

7.00 WORK SCHEDULE AND CONDITIONS

7.01 **Pre-Construction Conference.** The Contractor will schedule and convene, at a mutually convenient time before the start of work, a Preconstruction Conference with, all Subcontractors, Design Engineer and/or City's Representative, Board of Public Utilities, Power Company, Telephone Company, Gas Company, Cable Television, and other interested parties. Before or at the meeting, the Contractor shall provide the following, if applicable:

1. A letter providing the names, phone numbers and addresses, of material suppliers and Subcontractors;
2. Project Schedule in accordance with the item **7.05 Schedule** below;
3. Spill contingency and storm water pollution prevention plans in accordance with Standard Specification Section 01563 Erosion Control and Storm Water Management;
4. A traffic control plan in accordance with Section 01050 Traffic Control;
5. A list with names and phone numbers of key personnel, including the project superintendent and subordinates, authorized to sign contract documents and project records;
6. A list of phone numbers for the Contractor's personnel the Engineer should call in case of emergency in accordance with item **4.05 Cooperation by the Contractor** above; and
7. Other items the Engineer may request.

7.02 **Weekly Conference**. Subsequently a representative of the Contractor and the Contractor's Subcontractors (if requested) shall attend a weekly conference at a mutually convenient time and at a place designated by the City to review progress and discuss any problems that may arise or have incurred.

7.03 **Work Progress.** The Contractor shall make every effort to complete work in a manner and fashion that minimizes roadway closures and inconveniences to the traveling public and adjacent property owners. Progress will be continuously prosecuted on all roadways and drive approaches that have been closed for construction in accordance with Section 01041.1.01.I. of the Standard Specifications.

The Contractor shall not open up work to the prejudice or detriment of work already started. The City may require the Contractor to finish a section on which the work is in progress before work is started on any additional sections if the opening of such section is essential to public convenience.

7.04 **Working Days and Time.** Normal working hours shall be 7:00 am to 6:00 pm. No work shall be allowed on Saturdays without the City's prior written permission. For the purposes of time limitations specified in these instructions, a Saturday shall count as a "Working Day" if the City has approved work on that Saturday. No work, except for City-approved emergency repairs, shall be allowed on Sundays or

Holidays. For the purposes of the time limitations in these instructions, neither a Sunday nor a Holiday will count as a "Working Day" even if the City has authorized emergency repairs to be performed on that Sunday or Holiday. If the Contractor desires to perform work beyond the City's normal working hours, the Contractor must obtain the City's written approval forty-eight (48) hours in advance of scheduled work. In an emergency situation, verbal approval will suffice until the next working day at which time written approval shall be obtained before further inspection work beyond normal working hours will be provided.

Holidays. Normal City holidays are as follows:

HOLIDAY	DATE
New Year's Day	January 1st
Martin Year's Day	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday of May
Independence Day	July 4th
Labor Day	First Monday in September
Veteran's Day	November 11th
Thanksgiving Day	Fourth Thursday in November
Day after Thanksgiving	Day after Thanksgiving
Christmas Day	December 25th

With the Engineer's prior written approval, no work shall be permitted the day before, during, and the day after said holidays. The Engineer may require the Contractor to cease construction operations at any other time if the Contractor's operations are of such nature, the project is so located, or the traffic is of such volume that the Engineer deems it expedient to do so.

Frontier Days. During Cheyenne Frontier Days (CFD), typically the last full week in July, and the week immediately preceding, special rules shall apply in the following designated areas:

1. All roadways contained in the area bounded by 15th St. on the south, Snyder Ave. on the west, Pershing Blvd. on the north, and Van Lennen Ave. on the east, including the roadways making up the boundaries.

2. All roadways contained in the area bounded by Pershing Blvd. on the south, Interstate 25 on the west, the extensions of Manewal Dr. on the north, and Warren Ave./Yellowstone Rd. on the east, including the roadways making up the boundaries.

3. All roadways designated on the functional classification map as "Principal Arterial" or "Minor Arterial".

4. All roadways located north of the Union Pacific Railroad tracks designated on the functional classification map as "Major Collector" or "Minor Collector".

Functional classification maps are available from the Engineer's Office or the Cheyenne Metropolitan Planning Organization's website at www.plancheyenne.org.

During the week immediately preceding CFD, the special rules are as follows:

1. Work in the designated areas shall be in a state whereby all facilities are available to the public no later than 5 pm Wednesday of the week immediately preceding CFD;

2. After Wednesday of the week immediately preceding CFD, the only work allowed in designated areas are emergency repairs and operations having a duration of less than one (1) hour (including moving operations, such as striping or street sweeping).

3. All equipment, materials, traffic control devices, and other construction items shall be removed from the designated areas prior to 5 pm Wednesday of the week immediately preceding CFD.

4. All roadways and pedestrian ways shall be in such a condition that there shall be no interference with parades or other CFD event operations.

During CFD:

1. No work will be allowed in the designated areas with the exception of City-approved emergency repairs and moving operations, such as striping or street sweeping.

2. All moving operations must be approved in writing, in advance by the Engineer.

3. Work and traffic control operations can recommence during normal working hours on the Monday morning following the end of CFD.

Exceptions to the above will be made at the Engineer's sole discretion.

7.05 **Schedule.** The Contractor shall submit a project schedule to the Engineer for review and discussion at the Pre-Construction meeting. This schedule shall be sufficiently detailed to show the following:

1. The activities needed to perform and complete the work, activities that might delay contract completion, and critical activities such as street closures or major traffic restrictions.

2. Sequence of each activity required to complete the project within the contract time allotted and in the manner specified. Interrelationships among activities shall be shown without lead or lag time.

3. The planned start and completion dates for each activity, the duration of each activity with activities of more than fifteen (15) Working Days in duration broken into two or more activities distinguished by location or some other feature.

4. Interim, milestone, and project completion dates specified in the contract.

5. An indication of how the schedule accommodates adverse weather days for each month.

6. Dates related to the procurement of materials, equipment, articles of special manufacture, etc.

7. Dates related to the submission of working drawings, plans, and other data specified for review or approval by the Engineer.

8. Dates related to required special inspections of structural steel fabrications and other specified activities by the City or third parties.

The Contractor shall submit monthly updates to the Project Schedule at the time of the submittal of the monthly Pay Estimate. The schedule update shall include any revised planned start and finish dates for each activity shown on the most recent accepted schedule. For newly started or finished activities, the Contractor shall include the actual start or finish date. For activities previously started and still ongoing, the Contractor shall show the remaining duration and planned finish dates. The City may withhold processing the monthly Pay Estimate until the Contractor submits the monthly update to the Project Schedule.

The Engineer may request a schedule revision at any time for any reason. Circumstances leading to such a request include, but are not limited to, the following:

1. A delay (actual or projected) of partial or contract completion dates by fourteen (14) calendar days or more;

2. A difference between the actual rate of progress and that depicted in the schedule; and

3. Issuance of a contract modification that, by adding, deleting, or revising activities, changes the planned sequence of work or the method and manner of its performance.

7.06 **Requirements for Workers, Methods, and Equipment.** The Contractor shall at all times provide enough qualified labor and enough capable equipment to complete the project in accordance with the contract.

The Contractor shall provide workers that are sufficiently skilled to perform the work assigned to them. In writing, the City may direct removal from the project of any person, regardless of employer, who is unsafe, incompetent, intemperate, disorderly, or insubordinate. Through written notice, the City may suspend the work for failure of the Contractor to comply with such a directive or for failure to provide enough qualified workers.

All equipment proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the project shall be such that no injury to the roadway, adjacent property, or other improvement will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the construction are not prescribed in the contract, the Contractor is free to use any methods or equipment that the Contractor demonstrates to the satisfaction of the Engineer will accomplish the contract work in conformity with the requirements of the contract. When the contract specifies that the construction be performed by the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer.

If the Contractor desires to use methods or types of equipment other than those specified in the contract, the Contractor may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed to be used and an explanation of the reasons for desiring to make the change. Approval does not relieve the Contractor from the requirement to produce work in accordance with the contract documents. The use of alternative methods or equipment resulting in work that fails to meet contract requirements may lead the Engineer to, in writing:

1. Direct a stop in their use;

2. Order the completion of remaining work using the original specified methods or equipment; or

3. Require the removal, at no additional cost to the City, of the unsatisfactory work and its replacement using the original specified methods and equipment.

7.07 **Suspension of Work.** The City shall have the authority to suspend the work wholly or in part, for such period as may be deemed necessary due to unsuitable weather, due to such other conditions as are considered unfavorable for the suitable prosecution of the work, for failure of the Contractor to correct unsafe conditions,

for failure of the Contractor to carry out orders given, or for failure of the Contractor to perform any provision of the contract.

If the City suspends the work for more than ninety (90) days, through no fault of the Contractor, the Contractor may apply, in writing, for a price adjustment to compensate for reasonable expenses caused by the suspension. Any application for price adjustment or contract time extension will be submitted to the governing body of the City for its consideration in the form of a Contract Modification. It will be the responsibility of the Contractor to provide sufficient documentation to substantiate any claim.

The City will not grant or consider contract modifications based upon City-ordered suspension:

1. Without timely written notice from the Contractor;

2. To the extent that the suspension is overlapped or falls within a suspension or delay due to any other cause, including delays caused by the Contractor; or

3. That includes profit.

The Contractor may ask the City to suspend the project in writing due to unsuitable weather or due to such other conditions as are considered unfavorable for the suitable prosecution of the work. The Contractor shall not suspend operations or remove necessary equipment or materials without approval from the City.

During delays or suspensions, if the traveling surface is a leveling course or non-paved surface, the Contractor shall maintain the roadway for traffic use (including snow removal and placing of sand) and the quality of the surface course until the placement of additional course or temporary surfacing, at no additional cost to the City. If placement of concrete pavement or a full lift of plant mix pavement is not completed before delays or suspension of work, the Contractor shall provide, place, and maintain the temporary plant mix pavement and then remove it at the end of the suspension.

During suspensions, the Contractor shall store materials and equipment, at no additional cost to the City as far from the travel way as possible; at a location that will not cause maintenance or safety problems for the roadway; and at a location where they will be protected from damage. The Contractor shall maintain all living material in new plantings, seeding, and sods in an acceptable growing condition and protect from injury, at no additional cost to the City.

During suspensions, the Contractor shall provide roadway drainage, temporary structures needed for public travel throughout the project, any required temporary traffic control, along with removal of such temporary structures, traffic control, and surfacing, at the end of the suspension at no additional cost to the City. Before

suspension, the Contractor shall protect slopes without vegetation in accordance with Section 01563 Erosion Control and Storm Water Management.

If during a suspension the Contractor fails to accommodate traffic or maintain the project, including temporary traffic control devices, the Engineer may direct other organizations to do so. The City shall deduct the cost from monies due the Contractor or bill the Contractor, as appropriate.

During suspensions, the Contractor shall complete necessary measures to protect the work and the roadway during the suspension. The Contractor shall repair or replace materials lost or damaged during the suspension at no additional cost to the City.

The Contractor shall resume work when conditions are favorable or when approved by the Engineer.

7.08 **Extension of Contract Completion Date.** The contract time for completion shall be fixed by the City and stated in the Contract Agreement, either as a calendar date or as a specified number of calendar days.

The Contractor shall perform the work in an acceptable manner within the time stated in the contract except that the contract time for completion may be adjusted as follows:

1. If the satisfactory completion of the contract shall require performance of work in greater quantities than those set forth in the proposal, the time allowed for performance shall be increased in the same ratio as the final estimate bears to the original contract amount, except that the final monetary amount of any contract modification for which an extension of contract time was previously allowed shall be deducted from the final estimate prior to making the pro-rata time adjustment.

2. If delays beyond the Contractor's control are caused solely by action or inaction by the City, or are for unforeseen causes beyond the control and without fault or negligence of the Contractor, such delays will entitle the Contractor to an extension of time which will be based upon the effect of delays to the project as a whole and will not be granted for non- controlling delays to minor included portions of work, unless it can be shown that such delays did, in fact, delay the progress of the project as a whole. Written request for such extension of time must be made by the Contractor within ten (10) calendar days after the beginning of such delay.

No allowance shall be made for delay or suspension of the work due to fault of the Contractor. Nor will the City grant an extension based on pleas that the contract specified insufficient time for completion of the project.

7.09 **Concurrent Delays.** Concurrent delays are delays occurring at the same time to separate critical activities. When concurrent delays occur, the City will use only the

longer delay, and/or the excusable delay, to determine extensions to the contract completion date. Non-excusable delays will not be considered for extensions.

7.10 **Weather Days.** The Adverse Weather Table shows the number of working days included in the contract time in anticipation of weather that may preclude work. If the Contractor believes that it is entitled to additional time for adverse weather, the Contractor must submit written documentation to the Engineer and City within five (5) working days of the end of month that adverse weather was experienced. The Engineer may extend the completion date if the actual number of adverse weather days exceeds the expected number and the Contractor has pursued the work diligently during the month. The determination as to whether a day is to be considered an adverse weather day shall be at the discretion of the Engineer for when work on critical path items cannot be accomplished. The Engineer shall not count or treat Sundays or holidays as adverse weather days. Any weather days not used during any month are invalid and cannot be considered cumulative. For partial months, the Engineer shall prorate the number of expected lost workdays due to adverse weather.

ADVERSE WEATHER TABLE

MONTH	DAYS	MONTH	DAYS	MONTH	DAYS
January	8	May	4	September	2
February	8	June	3	October	4
March	7	July	2	November	5
April	6	August	2	December	7

8.00 MEASUREMENT AND PAYMENT

8.01 **Measurement of Quantities.** The Engineer shall measure pay items in the units of measure specified in the contract using methods of measurement and computation that meet generally recognized good engineering practice. The Engineer shall measure pay items when in place and complete. The actual work performed shall be measured, excluding work outside the construction limits unless adjusted by the City. The Engineer shall measure pay item quantities using the following methods, unless otherwise provided elsewhere in the contract documents:

1. Area. Computed from linear distances measured horizontally. Individual fixtures occupying areas equal to or less than 9 sq. ft. shall not be deducted from the computation.

2. Linear. Items measured by the foot shall be measured parallel to the surface on which the items are installed.

3. Lump Sum. Although actual quantities of the components in a lump sum pay item used in the work may differ from the estimated quantities specified, the City will not change the amount of payment.

4. Volumes of Excavation, Embankment, and Similar Pay Items. The average end area method shall be used unless otherwise specified or agreed to.

5. Asphalt Materials. Measured by the gallon or short ton, subject to correction for foaming, shipping loss, or other reasons for nonuse.

6. Delivery Tickets. All delivery tickets that are required for the purpose of calculating quantities for payment must be received by the Engineer at the time of delivery. Payment shall not be made for delivery tickets which do not show type of material, gross weight, tare weight, truck number, and date. Delivery tickets shall utilize automatic printer systems. Scale certification shall be submitted before their use. In no case shall materials weighed on non-certified scales be accepted for payment.

8.02 **Compensation for Altered Quantities.** Unless otherwise provided, payments to the Contractor shall be made for the actual quantities of contract items performed in accordance with the plans and specifications, and if, upon completion of the construction, these actual quantities show either an increase or decrease from quantities given in the bid schedule, the contract unit prices shall still prevail. Except as provided otherwise, the City shall not allow for increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor from any cause, including directly from alterations or indirectly from unbalanced allocation by the bidder of overhead expense among the pay items.

8.03 **Monthly Progress Payment.** The City shall make payments at least once each month in accordance with Article 4. Compensation and Method of Payment of the Contract Agreement as work progresses. The Contractor shall supply supporting billing documentation, including as a minimum, a spreadsheet (form to be approved by the Engineer) which lists each item of work included in the Bid Proposal form and shows quantities and amounts currently being invoiced and previously invoiced. Payments shall be based on the Engineer's approval of the estimate of the value of work performed and materials complete-in-place, in accordance with the contract, and for materials delivered, in accordance with item **8.04 Payment for Material on Hand** below.

8.04 **Payment for Material on Hand.** The City may pay for materials stockpiled or stored for later use on the project and for which the Contractor provides acceptable documentation indicating the materials meet contract requirements. Stockpiled or stored materials may be located on the project or at facilities approved by the City, which the City reserves the right to inspect. Materials shall be stored in accordance with manufacturer's recommendations. The City shall not make such payment without a written request received at least ten (10) calendar days before the date of the next scheduled progress payment, and in no case will it pay more than fifty (50) percent of the item's original bid extension. The Contractor shall include with the written request documentation, such as copies of invoices, freight bills, or other information required by the Engineer, that supports material and shipping costs.

9.00 MOBILIZATION

Payment shall be made for mobilization to cover the costs of preparatory work and operations including but not limited to those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all field offices, storage buildings, and other facilities necessary for the work on the project, and for all other work and operations which must be performed, or costs incurred, prior to beginning work on the various items on the project.

Mobilization shall be measured on a lump sum basis and payment shall be made with the monthly estimate based on the percentage of the original contract amount earned in accordance with the following:

1. On the first estimate following award, 10 percent of the Mobilization pay item or 1 percent of the original contract amount, whichever is less will be paid.

2. When 5 percent of the original contract amount is earned, 25 percent of the amount bid for Mobilization or 2 percent of the original contract amount, whichever is less will be paid.

3. When 10 percent of the original contract amount is earned, 50 percent of the amount bid for Mobilization or 5 percent of the original contract amount, whichever is less will be paid.

4. When 25 percent of the original contract amount is earned, 60 percent of the amount bid for Mobilization or 6 percent of the original contract amount, whichever is less will be paid.

5. When 50 percent of the original contract amount is earned, 70 percent of the amount bid for Mobilization or 7 percent of the original contract amount, whichever is less will be paid.

6. When 70 percent of the original contract amount is earned, 100 percent of the amount bid for Mobilization or 10 percent of the original contract amount, whichever is less will be paid.

7. Upon completion of all work on the project, payment on any amount bid for Mobilization in excess of 10 percent of the original contract amount will be paid.

The total sum of all payments will not exceed the original contract amount bid for Mobilization, regardless of the fact that the contractor may have shut down work on the project or moved equipment away from the project and then back again.

Mobilization is subject to the retainage that shall be withheld for final payment.

The payment schedule for mobilization shall be utilized for construction staking, contractor materials testing, and similar items, when the method of measurement and basis of payment is not otherwise specified in the contract documents.